Exploring and Evaluating Modular Approaches to Multi-State Compliance with EPA's Clean Power Plan in the West

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Glossary

Term	Definition
111(d) Attribute	An eligibility marker that determines if the REC or EEC is eligible for use towards 111(d) compliance.
Affected Electric Generating Unit (EGU)	An EGU with emissions impacted by the 111(d) rule.
Best System of Emission Reduction (BSER)	Refers to the provision in Section 111(d)(1) that emissions standards "reflect the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any non-air quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated."
Building Blocks	Refers to four options the EPA identified that states may choose for reducing emissions. States may also choose to use options outside of the building blocks to meet their overall state goal. There is no goal or target at the building block level. The building blocks are intended to offer states a flexible range of options from which to draw in achieving their state goal. The building blocks identified include: (1) heat rate improvement, (2) re-dispatch, (3) renewable energy, and (4) energy efficiency.
Bundled Renewable Energy Certificate (REC)	A bundled REC includes all associated energy and environmental attributes.
Clean Power Plan (CPP)	Draft regulation proposed by the EPA under Section 111(d)* of the Clean Air Act that requires states to meet specific CO2 emissions reduction goals.
Demand Side Management (DSM)**	Generally refers to activities designed to reduce energy at the end-user or "demand side" of the energy meter by encouraging consumers to modify the level and pattern of electricity usage. Common DSM programs include efficient appliance rebate programs and upstream (discounted) lighting programs.
Evaluation, Measurement & Verification (EM&V)	The process of verifying and measuring claimed energy efficiency savings captured through DSM activities.
Energy Efficiency Certificate (EEC)	For the purpose of this report, an EEC is a tradable commodity representing the benefits of an EE activity or action, measured as 1 MWh avoided and bundled with the related environmental benefits and eligible 111(d) attributes.
Energy Efficiency Resource Standard (EERS)***	Specific energy-savings targets established by legislation or through regulatory mandates.
Environmental Attribute	The non-energy attributes associated with RECs or EECs, such as NOx, SOx, and CO2.

Term	Definition
Free Ridership	Represents energy savings that would have occurred in the absence of a DSM program. The free ridership value is removed from the gross savings estimate to calculate net energy savings resulting from the program.
Mass-Based Goal	Measuring a state's emissions reduction goal as the amount of CO_2 emissions reduction at the affected EGUs.
Measure	In energy efficiency, a measure refers to the product that was installed or replaced, such as an efficient HVAC unit replacing an older, inefficient model.
Net-to-Gross (NTG) Ratio	Represents the net effects of a DSM program that accounts for the impacts of free ridership and spillover on program-generated energy savings. The NTG ratio is used to adjust the evaluated gross energy savings accruing from a DSM program.
Rate-based goal	Measuring a state's goal as the rate of CO_2 emissions per MWh of electricity generated (lbs CO_2/MWh).
Renewable Energy Certificate (REC)	For the purpose of this study, a REC is a tradable commodity representing clean energy generated from renewable resources and measured as 1 MWh of generated renewable energy plus associated environmental benefits and 111(d) eligible attributes. The definition of a REC in each Western Interconnection state is provided in Appendix D.
Renewable Portfolio Standard (RPS)	Regulation requiring that a minimum percentage of electricity be provided by renewable sources.
Spillover	Energy savings attributable to a DSM program when no rebates or incentives were paid. The spillover value is added to the gross savings estimate to calculate net energy savings resulting from the program.

* 42 U.S. Code §7411 – Standards of performance for new stationary sources. http://www.law.cornell.edu/uscode/text/42/7411

** Definition provided by the U.S. Energy Information Administration.

*** Definition provided by American Council for an Energy-Efficient Economy.

1 Executive Summary

In December 2014, the Western Interstate Energy Board (WIEB) commissioned The Cadmus Group (Cadmus) to explore modular approaches to multi-state compliance with the Environmental Protection Agency's (EPA's) Clean Power Plan (CPP), a regulation proposed under Section 111(d) of the Clean Air Act. WIEB specifically sought to understand the essential tracking, trading, and reporting of renewable energy (RE) and energy efficiency (EE) compliance activities needed by states in the Western Interconnection, and to determine whether an existing Renewable Energy Certificate (REC) tracking system could be expanded or modified to accommodate such activities.

Under 111(d), the EPA establishes numeric greenhouse gas (GHG) emissions reduction goals for every state and requires each state to develop and submit a compliance plan outlining how it will achieve and enforce the goals. States will be allowed to submit single-state or multi-state compliance plans. The draft 111(d) does not explicitly define multi-state compliance options, but does not rule out the option of allowing states to work together to develop multi-state compliance plans or to collaborate on particular elements of their plans.

A modular approach, as defined by WIEB, is one in which "states develop their own [111(d)] compliance plans for meeting their individual targets, but with portions of those state plans—or 'modules'—developed in voluntary collaboration with other states."[1] WIEB identified three strategic options to compliance:

1. A single-state approach, whereby each state develops an individual compliance plan and executes compliance activities independently, but may engage in informal collaboration with other states to develop modules that facilitate compliance (e.g., regional EM&V protocols).
2. A partial multi-state approach, where two or more states develop their own compliance plans but collaborate formally on certain components of their state plans such as RE or EE.
3. A full multi-state approach, where two or more states develop compliance plans to meet joint goals.

The objectives of this study were three-fold:

1. Determine, to the extent possible, what features and capabilities would be required of a tracking, trading, and reporting system for RE and EE 111(d) activities.
2. Review and evaluate the adequacy of existing RE and EE tracking and reporting systems, with an emphasis on the Western Renewable Energy Generation Information System (WREGIS).
3. Identify gaps in the available systems where enhancements are necessary in order for these systems to fulfill the 111(d) compliance needs.

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[1] Similar, multi-state collaborative frameworks are being explored in other regions, such as the Southeast's common elements approach. For examples, see Policy Brief NI PB 15-01 from the Nicholas Institute for Environmental Policy Solutions: http://www.eenews.net/assets/2015/03/17/document_cw_01.pdf

For this study, Cadmus relied primarily on a thorough review of the available literature and technical documents related to the proposed rule, including comments submitted by key stakeholders; interviews with stakeholders and research groups in the 11 Western Interconnection states; a review of existing tracking systems; and a detailed gap analysis focused on the tracking system features and capabilities needed for 111(d) compliance.

As part of this study, Cadmus explored a range of policy questions that might pose a challenge to adopting a modular approach. To the extent possible, this report outlines and recommends ways to address these challenges, with the caveat that the EPA may address them in final 111(d) rules.

The principal finding of the study is that the modular approach is a valid strategy for compliance with the requirements of 111(d). The approach offers tangible and quantifiable benefits, including:

- It is conducive to multi-state solutions without requiring one or more states that would like to cooperate to engage in complex interstate negotiations and agreements on all plan elements. However, these negotiations would be necessary to develop a full joint emissions goal and a joint compliance plan.
- It offers the opportunity to lower overall compliance costs by allowing states to share certain costs for developing the plan and meeting tracking and reporting requirements.
- Importantly, it allows greater compliance flexibility by enabling the trade of RE and EE in cases where collaborating states offer comparative advantages.

A modular approach can be structured in a single-, partial- or full multi-state compliance form. The findings of this study reveal that, given the unique policy and regulatory environments of the states in the Western Interconnection, the partial multi-state approach would likely provide the most practical option. It offers states greater control over their plan while enabling formal collaboration on one or more elements of the plan. Such an approach encourages multi-state collaboration in the development of common protocols, tools, or trading parameters, but does not bind states to develop joint compliance plans.

To investigate the potential benefits of multi-state approaches that involve trade, Cadmus used a resource portfolio modeling method to analyze and compare the costs and potential benefits of a two-state collaborative scheme whereby states with complementary resource mixes engage in trade for the re-dispatch of coal generation to natural gas. The results of the analysis indicated that the multi-state approach offers tangible economies for compliance in the context of re-dispatch. The analysis also indicated that expanding the scope of compliance options to encompass additional building blocks would likely provide a more comprehensive solution, as well as an additional perspective on multi-state compliance options. The portfolio modeling approach also proved effective as a means of quantifying emissions reductions and costs at the state and multi-state levels.

1.1 Tracking and Reporting

Cadmus identified two categories of features and capabilities needed for 111(d) tracking, trading, and reporting of RE and EE activities: essential and beneficial. Essential features, including account details, reporting functions, and eligibility markers, represent the minimum requirements a tracking system must offer to support 111(d) RE and EE activities. Beneficial features, including functions to calculate avoided emissions, track power transactions, identify EE indicators, and track progress, are features that are not required to meet basic tracking and trading of 111(d) certificates. These features would be beneficial to offer within one tracking system to efficiently provide both consistency and transparency while facilitating trade.

There are 10 REC tracking systems operating in different regions of the country, some of which were implemented as early as 2001. These systems cover geographic areas of different sizes ranging from one state (e.g., those operating in Michigan, Nevada, North Carolina, and Texas), to regional systems (like the New England Power Pool Generation Information System (NEPOOL GIS) and the Midwest Registry), to very large, multi-state systems (such as those covering the PJM service area, WREGIS, and the North American Renewables Registry (NAR) that covers all other areas).

There are no comparable systems or infrastructures for creating and tracking Energy Efficiency Certificates (EECs). The existing EE tracking systems are generally limited to one utility or program administrator, and have capabilities that tend to be limited to tracking program activity and/or transactions at the program administrator level.

WREGIS offers a technologically robust and flexible platform for tracking and reporting state RE and EE 111(d) activities. It provides the essential capabilities and the necessary functionalities to track, establish transfer of ownership, retire, and generate compliance reports for 111(d)-eligible RE and EE activities. States in the Western Interconnection already use WREGIS for creating, tracking, and trading RECs. Currently, WREGIS does not offer the features necessary for creating and tracking EECs, but it has the capability to accommodate such functionalities.

There are a number of additional features that would enhance the usability of WREGIS for 111(d) compliance tracking and reporting, particularly for EE. These features include a module for calculating avoided emissions; a feature for tracking interstate transactions, the amount (kWh saved) and type (net versus gross) of EE savings; functionality to calculate progress towards the level of RE or EE specified in a state's plan; and an indicator of the certificate's eligibility for 111(d) compliance.

1.1.1 Policy Considerations

Aside from the tracking and reporting requirements, implementing a modular approach (or any compliance strategy) hinges on the satisfactory resolution of a number of concerns and policy questions. The results of this study revealed that there is considerable uncertainty about how EPA will rule on a number of fundamental policy matters that remain open in 111(d), and about how the resolution of these matters would affect state plans for modular compliance. These fundamental policy considerations consist primarily of those outlined below.

1.1.1.1 *Definition of Certificates*

It is important to establish uniform definitions of RECs and EECs to ensure they represent the same value for the same activities, and that these values are determined using reliable and replicable methods. WREGIS currently defines a REC as 1 MWh of eligible renewable generation bundled with all environmental attributes. If RECs eligible for 111(d) are defined in the same way, then there is no challenge for RE from this policy consideration. If states want to unbundle some of the attributes from the associated energy to allow for disaggregated trading under 111(d), then the system must minimally include transparency around what constitutes a REC in each state.

For EE, this consideration does constitute a challenge. Specifically, it is thought that state regulatory protocols entailing vastly different methods and rigor levels to calculate savings from energy efficiency activities will present a significant challenge for multi-state collaboration on EE activities. In other words, when two states calculate energy savings using different methods, the same activity could result in very different energy savings impacts.

Equity is another major concern. States with existing Renewable Portfolio Standard (RPS) and Energy Efficiency Resource Standard (EERS) policies would want to claim credit for those activities, and not be held to a higher standard than states who are further behind in RE and EE.

These challenges can be addressed by adopting more harmonized and consistent methods for measuring and verifying savings, such as those being developed under the Uniform Methods Project, sponsored by the U.S. DOE.[2]

1.1.1.2 *Ownership of Certificates*

Policy makers need to address the lack of clarity in the ownership of RECs and EECs eligible for 111(d). Specifically, there is uncertainty if ownership lies with the state generating the power or savings (in the cases of RE and EE) or with the consuming state, when RE and EE cross state lines. EPA will likely rule to authorize crediting emissions reductions to the state that sponsors the RE generation or EE program, regardless of the location of lowered output. In the absence of an EPA ruling, regardless of whether states engage in RE or EE trading, they will need to negotiate ownership through bi-lateral or multi-lateral agreements to avoid double counting the associated savings.

1.1.1.3 *Choice of Compliance Measurement Approach*

The choice of rate- or mass-based compliance measurement approaches is another policy matter with potentially significant ramifications for a modular approach that involves trade. States that choose a mass-based approach adopt a cap on their overall tonnage of CO2 emissions, and monitor compliance by directly measuring emissions at the electric generating unit (EGU) stack. The rate-based approach entails measuring emissions reductions as the quantity of CO2 per MWh of electricity generated for affected EGUs (lbs CO2/MWh). While rate-based goals can accommodate increases in generation due to

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2 U.S. Department of Energy. *The Uniform Methods Project*. Available online: http://energy.gov/eere/about-us/ump-home

increased demand, mass-based goals are simpler to measure. REC trading between states that have adopted different types of measurement approaches (rate- versus mass-based) is complicated and introduces challenges. In particular, when states with differing measurement approaches want to trade, the potential for double counting is especially high.

2 Introduction

On June 2, 2014, the EPA issued draft regulations known as the CPP that require states to meet CO2 emissions reduction goals under Section 111(d)[3] of the Clean Air Act. The CPP sets state-specific carbon reduction goals, expressed in pounds of CO2 per MWh, and based on each state's energy use and generation mix in 2012.[4] By 2030, EPA anticipates that the combined impact of each state's compliance activities will achieve federal carbon emissions reductions 30% below 2005 levels.[5]

The EPA expects states to develop compliance plans that articulate how they will meet their carbon reduction goals using some combination of activities consistent with the best system of emission reduction (BSER) building blocks proposed in 111(d). States can develop individual plans or collaborate with other states in a multi-state approach. States have broad discretion in how to meet their emissions reduction goals; compliance strategies available to them extend beyond the four building blocks. While the draft rule requires that state plans be submitted by June 30, 2016, the final rule is likely to extend that deadline to within one year of when it is issued. The rule also includes provisions allowing states to request extensions, if needed, to accommodate additional planning and multi-state coordination.

In December 2014, WIEB hired Cadmus to explore modular approaches to multi-state compliance with 111(d). WIEB sought to understand whether an existing REC tracking system could be expanded and modified to support state compliance with 111(d). Cadmus specifically assessed how states in the Western Interconnection could use such a system to facilitate certificate tracking, trading, and reporting of RE and EE. This report presents Cadmus' research findings, including an analysis of tracking system capabilities and policy challenges regarding the implementation of a tracking system to support 111(d) compliance.

2.1 Overview of Clean Power Plan and Building Blocks

The proposed 111(d) regulations set the nation's first federal limits on carbon emissions from existing power plants. EPA is currently reviewing public comments on the proposed regulations, and has stated that it will promulgate final regulations in summer 2015. The EPA proposed two basic approaches that states can use to assign responsibility for compliance: direct CO2 emissions limits on EGUs and portfolio

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3 42 U.S. Code §7411 – Standards of performance for new stationary sources. Available online: http://www.law.cornell.edu/uscode/text/42/7411

4 U.S. Environmental Protection Agency. "Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units." 40 CFR Part 60, Page 133. June 2, 2014. Available online: https://www.federalregister.gov/articles/2014/06/18/2014-13726/carbon-pollution-emission-guidelines-for-existing-stationary-sources-electric-utility-generating

5 U.S. Environmental Protection Agency. EPA Fact Sheet: Clean Power Plan. "Overview of the Clean Power Plan: Cutting Carbon Pollution from Power Plants." Available online: http://www2.epa.gov/sites/production/files/2014-05/documents/20140602fs-overview.pdf

approaches that include both direct emissions limits on EGUs and emissions reductions from a number of programs and measures. A portfolio approach includes two pathways—: a utility driven portfolio approach and a state driven approach. Both allow for the inclusion of emissions reductions attributed to RE and EE.

The EPA has proposed to allow states two different ways to measure progress towards their state goals: a mass-based or rate-based measurement approach. The draft 111(d) rule proposes rate-based state goals (e.g., quantity of CO2 per MWh of electricity generated for affected EGUs); however, the EPA also proposed that states could translate the rate-based goal to a mass-based goal (e.g., a cap on the tonnage of CO2 emissions).[6] Rate-based goals consider carbon intensity in pounds of CO2 per MWh (lbs CO2/MWh). These goals are measured using total MWh and emissions generated from affected EGUs, then applying compliance activities to either the denominator or numerator through adjustments to the MWh or pounds of CO2 based on the state compliance plan as shown in Figure 1.

Figure 1. Rate-based Goal Adjustments from RE and EE Activities

Option 1. Adjust numerator:

$$\frac{\text{lbs of CO2} - \text{lbs CO2 from RE and EE activities}}{\text{MWh}}$$

Option 2. Adjust denominator:

$$\frac{\text{lbs of CO2}}{\text{MWh generated} + \text{MWh from RE and EE activities}}$$

Therefore, a rate-based approach can accommodate growth in generation as long as the emissions generated grow at a slower rate than the MWh generated. Mass-based goals are more simple to account for, as they have an absolute cap on emissions generated and are measured directly at the affected stacks, rather than calculated based on carbon intensity.

In accordance with the 111(d) guidelines, state plans must establish performance standards that reflect the degree of emission limitations achievable by applying BSER. BSER refers to the provision in Section 111(d)(1) that emissions standards “reflect the degree of emission limitation achievable through the

6 Federal Register. *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Proposed Rule*. Vol. 79, No. 117, Part II. EPA 40 CFR Part 60. Pages 34,892-34,894. June 18, 2014. Available online: https://www.federalregister.gov/articles/2014/06/18/2014-13726/carbon-pollution-emission-guidelines-for-existing-stationary-sources-electric-utility-generating

application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any non-air quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated."[7] The EPA BSER options include four primary building blocks that serve as flexible mechanisms for states to use for compliance:

1. Block 1: Reducing the carbon intensity of existing EGUs through an improved plant heat rate.
2. Block 2: Substituting generation from affected lower-emitting EGUs for more carbon-intensive EGUs.
3. Block 3: Substituting zero- and low-carbon generation (e.g., RE, nuclear) for affected EGUs.
4. Block 4: Reducing the amount of generation (and thus emissions) required through demand-side EE initiatives.[8]

States are not limited to these four mechanisms.

2.2 Approach

Cadmus conducted a detailed review of 111(d), the comments submitted to the EPA about the proposed rule, and existing tracking systems to understand the systems' technological capabilities for tracking, trading, and reporting. We also explored a range of policy questions with implications for modular compliance tracking and certificate trading under 111(d). This section provides a high-level summary of Cadmus' data collection and analysis activities for this project. A detailed description of our approach is provided in Appendix A.

2.2.1 Project Purpose and Objectives

The objectives of this project were to provide insights regarding the following research questions:

1. What data and functionalities are required of an RE and EE tracking system to enable tracking, trading, and reporting of 111(d) compliance activities?
2. What data, analysis, and tracking functions are currently available through the WREGIS and other REC tracking systems and/or through existing EE tracking systems?
3. How could Western Interconnection states use a system to track RE and EE activities against the RE and EE components of their individual state compliance plans?
4. Specifically for EE, what commonalities and differences exist between utility and state-specific energy-savings calculation methods and evaluation, measurement, and verification (EM&V) protocols?

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7 Ibid. Page 34,834.

8 U.S. Environmental Protection Agency. "National Framework for States: Setting State goals to Cut Carbon Pollution." EPA Fact Sheet: Clean Power Plan. Available online: http://www2.epa.gov/sites/production/files/2014-05/documents/20140602fs-setting- goals.pdf

2.2.2 Data Collection and Analysis

To address these research questions, Cadmus reviewed several of the existing tracking systems that have the potential to serve the anticipated 111(d) tracking and reporting requirements for RE and EE activities. For this analysis, we assumed that states would be interested in using a tracking system for calculating, documenting, and tracking emissions reductions against the RE and EE components of their state plans and, critically, for trading compliance certificates.

Cadmus examined the technological feasibility of using a modified version of an existing system to facilitate a modular approach to 111(d) compliance and the various policy considerations that have implications for such a system's technical feasibility, capabilities, structure and development, and operating costs. Cadmus considered three modular compliance paths: single-state, partial multi-state, and full multi-state.

To assess WREGIS' capability to serve state compliance needs, Cadmus conducted four primary data collection activities:

1. A literature review of relevant state and federal policies, analyses of these policies by key stakeholders, and a review of current EM&V protocols and procedures used to measure the impacts of EE activities.
2. Structured interviews with stakeholders in the 11 Western Interconnection states and with research groups focused on energy issues.
3. A review of existing environmental certificate tracking systems, the attributes they track, and their operations.
4. A detailed gap analysis focused on the tracking system features needed for 111(d) compliance tracking.

To further support Western Interconnection states, Cadmus used an integrated planning model to investigate EPA's proposed re-dispatch compliance approach for reducing emissions from coal facilities and the feasibility of achieving the EPA targeted emissions rates for natural gas power plants. This analysis demonstrated the opportunity for states to re-dispatch coal and natural gas units using a two-state approach based on publicly available data. Details of this work are provided in section 5, Appendix B, and Appendix C.

2.2.3 Tracking System Review

Cadmus conducted a detailed review of WREGIS, the renewable energy registry and tracking system used in the Western Interconnection. We specifically focused on the system's analytical and reporting features and on its capabilities in light of anticipated quantification and tracking requirements for 111(d) compliance. Cadmus also reviewed all but one[9] of the existing REC tracking systems currently used in

[9] Cadmus did not review Electric Reliability Council of Texas (ERCOT), as it is the most basic tracking system currently used in the United States.

other areas of the United States, representing seven systems. Table 1 presents the REC tracking systems we reviewed.

For each relevant system, Cadmus carefully reviewed operating procedures and rules, then documented each data field and its function, examining their similarities and differences and assessing their capabilities. We looked at systems enabling both RE and EE tracking and/or trading, and considered the features required to track each resource separately. Cadmus then deeply explored specific issues and information gaps through interviews with tracking system operators.

Table 1. Reviewed Tracking Systems

Tracking System	RE	EE
Michigan Renewable Energy Certification System (MIRECS)	■	
Midwest Renewable Energy Tracking System (M-RETS)	■	
New England Power Pool Generation Information System (NEPOOL GIS)	■	■
North American Renewables Registry (NAR)	■	■
North Carolina Renewable Energy Tracking System (NC-RETS)	■	■
PJM Environmental Information Services Generation Attribute Tracking System (PJM-GATS)	■	
Western Renewable Energy Generation Information System (WREGIS)	■	

WIEB, the project sponsor, identified WREGIS as a key focus for this study. Therefore, Cadmus dedicated greater resources to conducting more detailed and extensive research and analysis of WREGIS than of the other six systems. In addition, many Western Interconnection states currently use and are comfortable trading certificates through the system, and have invested considerable resources in the software, subscription services, and system training and management. If WREGIS offers a technically feasible option, since it is already used by many of the Western Interconnection states, this would likely be the most cost-effective option for use as a 111(d) tracking system platform for these states.

Section 3.3 discusses existing tracking systems' functionality and capabilities for RE; section 4.3 discusses the same for EE.

2.2.4 Gap Analysis

To assess whether WREGIS is suitable for 111(d) purposes, or would require enhancements for states to use to track, trade, and report RE or EE 111(d) activities, Cadmus conducted an in-depth gap analysis. Specifically, we identified the data, analysis, and reporting functions likely needed within a tracking system for states to calculate emissions, track RE and EE activities, trade and retire compliance certificates, and report to EPA.

Cadmus categorized each tracking feature as either essential to enable minimum tracking and trading functionality or beneficial to facilitate a more sophisticated calculation of impacts and tracking of 111(d) RE and EE activities. We then identified data, analysis, and tracking functions currently available through WREGIS and other tracking systems. Cadmus examined the majority of industry recognized tracking systems (as listed in Table 1) that are currently used by multiple entities or states to track and/or trade RECs or EECs.

Cadmus then compared findings from each of these steps to identify data and functionality gaps. Sections 3.4 and 4.4 provide the findings from this analysis for RE and EE, respectively.

2.3 The Modular Approach

A modular approach entails two or more states working together to conduct joint compliance activities. Under a modular approach, states develop their own individual compliance plans, but also voluntarily develop portions of those state plans—or modules—with other states. This approach allows states to propose one of three strategic options: a single-state approach, a partial multi-state approach, or a full multi-state approach. Sections 2.3.1, 2.3.2, and 2.3.3 present brief descriptions of each option along with example scenarios of how each option could be structured and how states might use a regional tracking system to facilitate modular compliance under each option.

2.3.1 Single-State Autonomous Compliance: Ad Hoc Modular Collaboration

Under a single-state approach, states would develop their own plans for compliance, but two or more states may use jointly developed modules to streamline compliance tracking (while maintaining full autonomy over their individual state compliance plans). Single states may use a tracking system to track compliance activities and manage progress against their individual 111(d) RE and EE plan components, but would not engage in any formal collaboration in their compliance plans. Under this approach, although an individual state takes a solo approach to compliance, their use of a regional tracking system to track RECs for 111(d) (and their RPS if desired) leaves the possibility of collaborating with other states on other elements of their plans (which are not formally agreed to in each state's plan).

- Single-state example: two or more states could agree to develop joint EM&V protocols as the basis for creating EECs. This might make EM&V more consistent, easier for EPA to approve, and potentially reduce the cost of EM&V if evaluators work across state lines and use identical protocols. However, in the single-state approach, this collaboration would be informal and the states would not trade EECs. Compliance in each state would be based entirely on its own activities, with neither state dependent on the other.

2.3.2 Partial Multi-State Compliance: Formal Modular Collaboration

Under a partial multi-state approach, two or more states would develop their own compliance plans, but portions (or modules) of those plans would include formal collaboration with other states. Under this approach, states would agree to undertake some compliance actions jointly, file these actions in their individual state plans, and take credit for their portion of the action based on a predefined attribution of the resulting emission reductions. Hence, the proposed tracking system is an important tool for collaborating states to use to manage and track their progress toward compliance. Under this approach, each state participating in a modular activity must then agree on the underlying attributes associated with that activity.

- Partial multi-state example: Two or more states interested in EE share the costs of developing joint measurement and verification protocols, which becomes the basis of the attribute definition for EECs. Each state's plan includes EE activities with anticipated energy savings based on the shared, defined EM&V approach. The collaborating states then trade EECs using a regional tracking system to facilitate the trade. Each state would file its own plan with EPA and not necessarily collaborate on other aspects of the plan.

2.3.3 Full Multi-State Compliance: Formal Collaboration

Under a full multi-state approach, two or more states would develop a joint plan and implement all compliance activities jointly. Under this approach, states would agree to a single, shared goal, then file a joint/multi-state plan with the EPA and pursue compliance jointly, sharing the cost, deployment responsibility, and resulting impacts of compliance activities.

- Full multi-state example: Two or more states interested in collaborating on a full multi-state approach combine their state emissions goals and submit a compliance plan to the EPA as one entity. In this scenario, the collaborating states may use a tracking system to track compliance activities and their overall progress toward the joint goals. Although trading among these states is not necessary since all RE and EE impacts are applied to the multi-state goal as a whole, the collaborative states may wish to trade RECs or EECs with other states or other multi-state groups to facilitate their compliance overall, and could use the tracking system to facilitate those transactions.

2.3.3.1 Benefits of a Modular Approach

The modular approach offers the following primary benefits:

- It is conducive to multi-state solutions without requiring one or more states that would like to cooperate to engage in complex interstate negotiations and agreements on all plan elements (which would be necessary to develop a full joint emissions goal and a joint compliance plan).
- It offers the opportunity to lower overall compliance costs by allowing states to share certain costs for developing the plan and meeting tracking and reporting requirements.
- Importantly, it allows greater compliance flexibility by enabling the trade of RE and EE in cases where collaborating states offer comparative advantages.

2.4 Report Organization

The report is organized into the following sections. The Executive Summary and this Introduction summarize the project and approach. Then sections 3 and 4 provide the tracking system gap analysis and policy considerations for RE and EE, respectively. Section 5 provides discussion and findings for a resource portfolio modeling approach to investigate the potential benefits of trade between two hypothetical states, with a focus on re-dispatch as one of the four compliance options. Finally, section 6 contains conclusions. Supplemental materials are presented in the report appendices.

3 Renewable Energy Tracking Module

3.1 Introduction

RE is the third of four BSER building blocks EPA used to establish state goals outlined in 111(d), and is a key compliance mechanism states may use to demonstrate progress towards achieving their proposed overall state emissions reduction goals. Choosing to increase renewable generation will require states to maintain a reliable registry and tracking system for RECs and for emissions reductions. By enhancing the existing registry and tracking capabilities already used to facilitate interstate trading of RECs, states would lower compliance costs by avoiding development of a tracking system solely for 111(d) purposes). This could increase states' flexibility to engage in a modular approach to compliance activities.

Cadmus assessed the sufficiency of WREGIS or an alternative REC tracking system to meet states' needs for tracking, trading, and reporting RE activities under 111(d). As a secondary task, we assessed potential policy challenges with implications for adapting WREGIS or another existing REC tracking system.

3.2 RE Policy Background

Since the late 1990s, RPSs have been important to bringing more RE generation online. Of the 11 Western Interconnection states, eight have binding RE targets and one has a voluntary goal, with just two currently having no RPS in place. However, each state with an existing RPS has very different requirements as to which RE technologies (i.e., wind, solar, biomass) are eligible. Table 2 lists the RE technologies eligible for each Western Interconnection states' RPS, along with the existing RPS in each state and the amount of existing renewable generation. Appendix D provides details on how RECs are defined in each Western Interconnection state.

Table 2. State RPS and Eligible Technologies (as of October 2014)

State	RPS	Existing RE Generation*	Eligible RE
AZ	20% by 2025	294 GWh	Solar water heat, solar space heat, solar thermal electric, solar thermal process heat, photovoltaics, landfill gas, wind, biomass, hydroelectric, geothermal electric, geothermal heat pumps, combined heat and power (CHP)/cogeneration (CHP only counts when the source fuel is an eligible RE resource), solar pool heating (commercial only), daylighting (nonresidential only), solar space cooling, solar HVAC, anaerobic digester, small hydroelectric, fuel cells using renewable fuels, geothermal direct-use, additional technologies upon approval*
CA	20% by 12/31/13; 25% by 12/31/16; 33% by 2020; 50% by 2030 (proposed)	3,350 GWh	Solar thermal electric, photovoltaics, landfill gas, wind, biomass, geothermal electric, municipal solid waste, energy storage, anaerobic digestion, small hydroelectric, tidal energy, wave energy, ocean thermal, biodiesel, and fuel cells using renewable fuels

State	RPS	Existing RE Generation*	Eligible RE
CO	Investor-owned utilities (IOUs): 30% by 2020; Co-ops serving >100,000 meters: 20% by 2020; Co-ops serving <100,000 meters: 10% by 2020; Municipal utilities serving >40,000 customers: 10% by 2020	666 GWh	Solar thermal electric, photovoltaics, landfill gas, wind, biomass, hydroelectric, geothermal electric, recycled energy, coal mine methane (if the Colorado Public Utilities Commission determines it is a GHG-neutral technology), pyrolysis of municipal solid waste (if the Commission determines it is a GHG-neutral technology), anaerobic digester, and fuel cells using renewable fuels
ID	None	287 GWh	N/A
MT	15% by 2015	197 GWh	Solar thermal electric, photovoltaics, landfill gas, wind, biomass, hydroelectric, geothermal electric, compressed air energy storage, battery storage, flywheel storage, pumped hydro (from eligible renewables), anaerobic digester, and fuel cells using renewable fuels
NM	IOUs: 20% by 2020; Rural electric cooperatives: 10% by 2020	203 GWh	Solar thermal electric, photovoltaics, landfill gas, wind, biomass, hydroelectric, geothermal electric, zero emission technology with substantial long-term production potential, anaerobic digester, and fuel cells using renewable fuels
NV	25% by 2025	357 GWh	Solar water heat, solar space heat, solar thermal electric, solar thermal process heat, photovoltaics, landfill gas, wind, biomass, hydroelectric, geothermal electric, municipal solid waste, waste tires (using microwave reduction), energy recovery processes, solar pool heating, anaerobic digestion, biodiesel, and geothermal direct use
OR	Large utilities: 25% by 2025; Small utilities: 10% by 2025; Smallest utilities: 5% by 2025	499 GWh	Solar thermal electric, photovoltaics, landfill gas, wind, biomass, hydroelectric, geothermal electric, municipal solid waste, hydrogen, anaerobic digestion, tidal energy, wave energy, and ocean thermal
UT	Voluntary goal: 20% by 2025	90 GWh	N/A

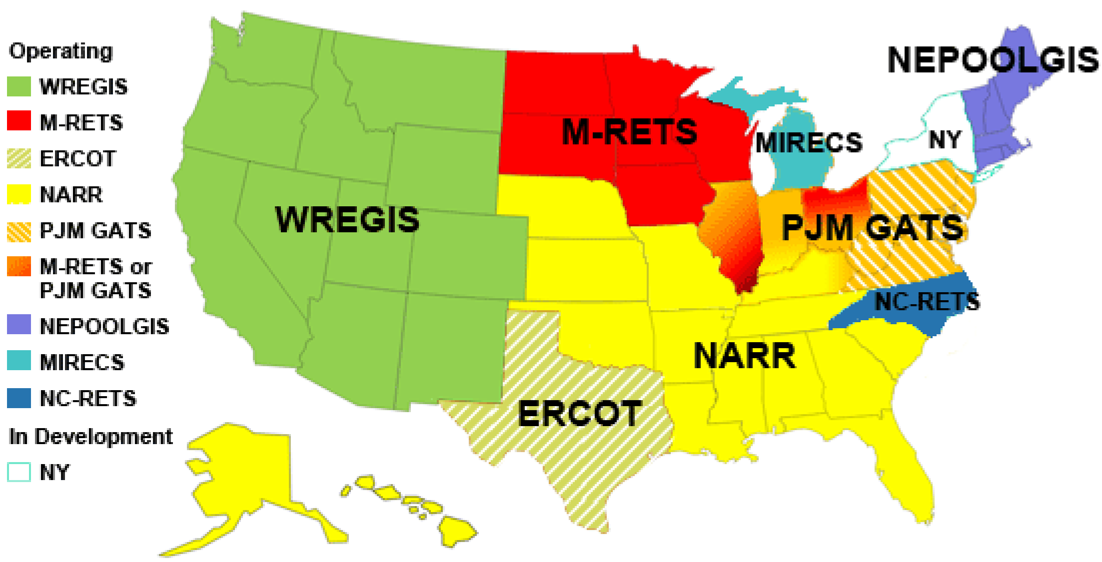
State	RPS	Existing RE Generation*	Eligible RE
WA	15% by 2020 and all cost-effective conservation	631 GWh	Solar thermal electric, photovoltaics, landfill gas, wind, biomass, hydroelectric, geothermal electric, anaerobic digestion, tidal energy, wave energy, ocean thermal, and biodiesel
WY	None	357 GWh	N/A

* Approved technologies are generated in the state (excluding hydro generation). In many cases, generation in one state is used for RPS compliance in a different state.

3.3 Overview of Existing REC Tracking Systems

Figure 2 displays all the REC tracking systems currently in use in the United States.[10] A centralized, national REC-tracking system does not yet exist. APX, a private developer of tracking system infrastructure, develops the software and hosts all of the systems, with the exception of PJM-GATS and ERCOT. Though the systems have slightly different features and functionalities, all are based on similar software systems and infrastructure, and all could be used for 111(d) compliance with similar modifications.

Figure 2. REC Tracking Systems in the United States



Source: U.S. Environmental Protection Agency. *REC Tracking*. Available online: http://www.epa.gov/greenpower/gpmarket/tracking.htm

[10] U.S. Environmental Protection Agency. *REC Tracking*. Available online: http://www.epa.gov/greenpower/gpmarket/tracking.htm

Cadmus reviewed the existing data fields, features, and capabilities of WREGIS, PJM-GATS, NEPOOL GIS, NC-RETS, NAR, M-RETS, and MIRECS to determine what each system does and what enhancements might be needed for tracking and trading certificates under 111(d). Section 3.3.1 is focused on WREGIS, while Appendix E provides a brief overview of PJM-GATS, NEPOOL GIS, NC-RETS, NAR, M-RETS, and MIRECS.

3.3.1 Structure, Key Features, and Uses

3.3.1.1 WREGIS

The Western Electricity Coordination Council (WECC)[11] administers WREGIS, taking responsibility for all day-to-day operations, user registration, data control, and payments. APX serves as the software provider and maintains the system. Under contract with WECC, APX makes system modifications as needed and develops new functionality.

The WREGIS workflow consists of several user types, account types, and transaction types. Each month, users registered as either Qualified Reporting Entities or Self-Reporting Account Holders submit the number of MWh produced by each EGU or aggregation of EGUs for which they are registered as the reporting agent. WREGIS generates certificates on a 90-day creation cycle: they deposit one certificate for each MWh reported into the EGU owner's (or their designee's) active sub-account 90 days after reporting occurs. WREGIS carries any remaining fractional MWhs forward to the next certificate issuance. From the active sub-account, the owner (or designee) may take the following actions:

- Transfer a certificate to another WREGIS user's active sub-account;
- Accept a certificate transferred to them from another WREGIS user's active sub-account;
- Move the certificate to the retirement sub-account to indicate compliance with a program; or
- Move the certificate to the reserve sub-account to indicate having sold or transferred the certificate to an entity that uses a different tracking system or an entity that has not registered for WREGIS.

3.3.1.2 Users

WREGIS staff reported that the current WREGIS users include those who generate energy, load serving entities, retail sellers, marketers, and brokers. WREGIS requires those who register EGUs to own a REC or show contractual rights to a REC (e.g., through a Power Purchase Agreement or Commission order). RECs in WREGIS show the state of origin as part of the serial number. WREGIS also tracks where retirement takes place and can be partitioned to show whether a resource is in the state at the time of REC retirement.

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[11] One of the eight NERC regional entities; its mission is to assure the reliability of the Bulk Electric System in the Western Interconnection. Available online: https://www.wecc.biz/Pages/Careers.aspx

WREGIS staff reported that the system can also track interstate certificate transfers. Currently, the only limit WREGIS imposes on the interstate transfer of RECs occurs when transferring RECs into California. These RECs must indicate the status of its matching e-Tag[12] to indicate delivery of energy into the state (this is used to meet the requirements of California's RPS). This does not pose a problem for using RECs for 111(d) compliance, since it is likely that 111(d) compliance will be demonstrated by the retirement of eligible certificates (which has little to no effect on the trading of certificates). Entities who buy or sell certificates arrange the conditions of the transfer (purchase price, quantity of certificates, etc.) outside of the tracking system and only use the tracking system to transfer certificates from the seller to the buyer.

3.3.1.3 Fields and Features

Table 3 shows the current WREGIS fields and features.

Table 3. WREGIS Certificate Fields

Static Fields	Dynamic Fields
• WREGIS EGU ID • Generating unit name • Primary facility name • Facility county • Facility state or province • Facility country • Multifuel generator indicator • Generation technology/prime mover • Fuel type/energy source • Fuel source • Date when EGU first commenced operation • Nameplate capacity • Facility operator information • Customer site distributed generation • Reporting entity (balancing authority operator, qualified reporting entity, or WREGIS account holder) • Reporting entity contact company or organization name • EGU in WECC region declaration indicator (Y/N) • Utility to which EGU is interconnected • Qualifying facility indicator (Y/N) • Facility ownership type (e.g., IOU, municipal utility, joint power authority) • Receipt of California supplemental payment (Y/N)	• Generation period start date • Generation period end date • Certificate serial number • Total certificates • Certificate creation date • Vintage month/year

12 An e-Tag is a document containing bulk electric interchange system requests. Source: Joint Electric Scheduling Subcommittee. *Electronic Tagging Functional Specification.* Version 1.8.1. March 12, 2009. Available online: http://www.naesb.org/pdf4/weq_jiswg031909reqcom_a2_etag_spec.doc

Static Fields	Dynamic Fields
• Receipt of facility state/provincial public benefit fund support (Y/N) • Most recent FERC hydro license date, or • One of the following valid values: non-jurisdictional, application pending, or not applicable • Repowered indicator (Y/N) • Repower date (required if repowered indicator=Y) • State/provincial/voluntary RPS selections: eligibility and certification number (AB, AZ, BC, CA, CO, MT, NM, NV, OR, TX, UT, WA) • California SEP eligibility • California facility qualified to claim non-renewable • Green-e energy eligibility certification number • Ecologo certification number • Low-impact hydro certification number • Sacramento Municipal Utility District eligibility certification number	

Appendix F provides a sample WREGIS certificate and the current reporting fields, along with definitions of their purpose.

Table 4 lists the generation types currently tracked in WREGIS.[13]

Table 4. WREGIS Generation Types

Generation Type	
• Biomass combustion • Biomass liquefaction • Biomass gasification • Industrial digestion of biomass • Reverse polymerization of biomass • Hydrogen fuel cell • Geothermal: dry steam • Geothermal: flash steam • Geothermal: binary cycle • Hydroelectric water • Municipal solid waste combustion • Municipal solid waste conversion	• Conduit hydroelectric • Ocean thermal • Ocean tidal current • Ocean wave • Solar thermal • Solar photovoltaic • Wind • Co-generation • Conversion of fuel from natural gas pipeline • Multifuel

[13] Western Electricity Coordinating Council. *WREGIS Operating Rules*. July 15, 2013. Available online: https://www.wecc.biz/Corporate/WREGIS%20Operating%20Rules%20072013%20Final.pdf

3.3.1.4 Current Costs of WREGIS

WREGIS users currently pay a fee to use the system. The WREGIS director indicated that if enhancements are made to the system for 111(d) RE compliance, the associated costs may result in changes to the fee schedule and number of users.[14] The WREGIS director reported: "WREGIS fees are pretty reasonable and recently the rates went down as there was an excess in funding. The majority is associated with fixed costs of having software and it does not go up or down based on users or uses."

Figure 3 provides the current WREGIS fee structure.

Figure 3. WREGIS Fee Matrix*

WREGIS Fee Matrix

	Annual Fee	Issuance Vol Fee	Transfer Vol Fee	Retire, Reserve or Export Vol Fee
GU Micro	$75	NO	NO	NO
GU Small	$100	NO	NO	NO
GU Medium	$350	NO	NO	NO
GU Large	$675	$0.005/Certificate	$0.005/Certificate	$0.005/Certificate
Load Serving Entities	$675	$0.005/Certificate	$0.005/Certificate	$0.005/Certificate
Retail Marketers	$675	$0.005/Certificate	$0.005/Certificate	$0.005/Certificate
Wholesale Marketers	$675	$0.005/Certificate	$0.005/Certificate	$0.005/Certificate
Utility Aggregators	$675	$0.005/Certificate	$0.005/Certificate	$0.005/Certificate
Generator Aggregators	$675	$0.005/Certificate	$0.005/Certificate	$0.005/Certificate
Account Holder: Other	$675	$0.005/Certificate	$0.005/Certificate	$0.005/Certificate

WESTERN ELECTRICITY COORDINATING COUNCIL

Source: Western Electricity Coordinating Council. *WREGIS Fee Matrix*. January 2015. Available online: https://www.wecc.biz/Administrative/WREGIS%20Fee%20Matrix%20and%20Definitions%20012015.pdf

* GU = generating unit

As shown in Figure 4, WECC reported that WREGIS had a surplus of $4.6 million in 2014.

14 WREGIS staff indicated that they remain in contact with most Western Interconnection states and have administrators from 10 of these states. Eight of the 11 Western Interconnection states have an RPS, one state (Utah) has a voluntary standard, and two states have no standard (ID and WY). See Table 2.

Figure 4. WREGIS 2014 Budget Surplus

WREGIS
Year-to-Date (YTD) Budget vs. Actual Report
October 31, 2014

Expenses	ANNUAL BUDGET	YTD ACTUAL	YTD BUDGET	YTD VARIANCE ($)
Labor: Salaries, Benefits	$464,095	$296,801	$386,745.83	$89,945
Computer Systems: Software, Contracting, Hardware, Communications, and Licenses & Services	$551,500	$306,478	$459,583.33	$153,105
Overhead Allocation	$541,111	$307,540	$405,833.25	$98,293
OTHER	$102,275	$12,429	$85,229.17	$72,800
Total Expenses	$1,658,981	$923,248	$1,337,392	$414,144
Total Reserves		$4,604,995		

COLLECTED YTD	BILLED YTD
$2,731,713	$2,610,915

Source: Western Electricity Coordinating Council. *WREGIS Year-to-Date (YTD) Budget vs Actual Report*. October 31, 2014. Available online: https://www.wecc.biz/Administrative/WREGIS%20Budget%20vs%20Actuals%20Report%20102014.pdf

3.3.1.5 Source of Data and Process

WREGIS receives generation data from two types of account holders: Qualified Reporting Entities and Self-Reporting Account Holders. Qualified Reporting Entities are both balancing authorities and approved non-balancing authorities. Self-Reporting Account Holders most often have small or aggregated generators, such as those with a nameplate capacity less than 360 kW. Qualified Reporting Entities typically load monthly generation data into WREGIS via bulk uploads, while Self-Reporting Account Holders and those with smaller or aggregated generation units use the WREGIS *Self-Reporting Interface* web page to input data.

Account holders with distributed generation units, such as rooftop solar, participate in one of two ways: (1) they register as a standalone unit in the 1 kW to 360 kW range, or (2) they register as a Small Scale

Aggregation. Small Scale Aggregations typically have small distributed generation projects that they initially registered as a single unit in WREGIS at about 250 kW capacity or less. The Small Scale Aggregation must at least submit annual updates to WREGIS administrators regarding facilities in the aggregation. The capacity of these small projects may grow over time, up to 360 kW. All EGUs, regardless of scale, must currently be metered and interconnected to receive approval for tracking in WREGIS.

The WREGIS *Qualified Reporting Entity Interface Control Document* defines the file layout for uploading generation data into WREGIS in detail, and consists of the following information in a comma-separated file, with one row for each EGU:

- Identifier for the unit assigned by the Balancing Authority or Qualified Reporting Entity.
- Most recent month and year of generation in the current reporting period.
- First and last dates of generation output for the current reporting period.
- Total MWh for the reporting month as a floating point decimal value.

When uploading generation data, the WREGIS system performs the following data validations:

- Verify that the reporting entity is designated to report output for each EGU included.
- Verify that the amount of generation reported for each unit is feasible, per an engineering calculation of the duration, nameplate capacity, and capacity factor of the unit.
- Verify that the period given does not overlap with previous reporting periods.
- If the unit shares a meter with multiple units, proportionally allocates all generation to units sharing the meter.
- If data were previously loaded for units and time periods in the file, adheres to the following rules:
  - If the previously loaded data status is “Account Holder Accepted,” rejects the new data and notifies the reporting entity that data for this unit was already accepted.
  - If the previously loaded data status is “WREGIS ACCEPTED” or “Account Holder Disputed,” overwrites the previously loaded data with the new data.
  - If the previously loaded data status is “WREGIS Administrator Accepted,” “WREGIS Administrator Disputed,” or “WREGIS Admin Adjusted,” rejects the new data and notifies the reporting entity of the status of data for this unit.
  - If the WREGIS administrator loads the new data file, they overwrite all previously loaded data for this unit the new data, regardless of status.

Data that pass all of these validations are committed to the database and become available for account holders to review, then either accept or dispute. If accepted, certificates are generated; if disputed, the account holder**s** may follow dispute procedures.

3.3.1.6 *Modification Process*

As EPA finalizes the proposed 111(d) rule, states may wish to use WREGIS to track, trade, and/or report RE activities. If so, WREGIS system modifications will be necessary. The magnitude of such modifications will hinge on multiple issues, such as the final rule specifications and the ways states approach compliance. WREGIS staff said they would implement any system modifications by integrating with existing functionalities to maintain the current WREGIS functions.

WREGIS refers to the modification process as the Change Control Process. Per the WREGIS *Change Control Processes*: "Program Change Requests (PCR) and Program Issues Requests (PIR) are the official methods for reporting, assessing, tracking, evaluating, resolving, and approving, or rejecting a proposed change to the program's schedule, scope, resources, or issue."[15]

Appendix G outlines the process for modifying the WREGIS software.

WREGIS staff reported operating the system as needed, ensuring they meet the greatest good by prioritizing requests that benefit all or multiple account holders. WREGIS staff established a process for proposed system changes, and vet such changes at stakeholder meetings where they determine priorities and actions. WREGIS staff reported that they will try hard to make it possible for states to comply with 111(d), and can prioritize state requests.

WREGIS staff said, if they received a request from a state regarding a certain compliance approach, they would "put out a public notice and would develop a working group of states and it would be up to those states to show that they want to use it. If there is a state that currently does not have an administrator in the system, they would need to show interest."[16]

WREGIS staff reported that if the EPA releases minimum compliance guidelines (with the definition of a REC and other compliance items), and WREGIS users express interest in adopting this standard, it will go before the WREGIS Committee. If some states adopt the guidelines and others want exceptions, WREGIS will publish all exceptions on its website for public review.

3.4 *Technical Feasibility: REC Tracking System Gap Analysis*

Cadmus evaluated the existing tracking systems indicated in Table 1 above to determine whether they include the necessary functionality to support 111(d) modular compliance tracking. The following sections outline the tracking system data fields and features that are essential or beneficial to enable states to track 111(d) RE activities and resulting impacts, trade 111(d) eligible RECs with other states, and manage progress against their 111(d) RE plan component.[17] Cadmus compared each data field and

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[15] Western Electricity Coordinating Council. *WREGIS Change Control Processes.* Page 5. February 15, 2013. Available online: https://www.wecc.biz/Administrative/WREGIS%20Change%20Control%20Process.pdf

[16] Arizona is the only U.S. Western Interconnection state that does not currently have a WREGIS administrator.

[17] States do not have to comply at the building block level, only the overall state level.

feature to the current tracking systems' capabilities to assess the technical feasibility of using each of these systems to build a 111(d) tracking system.

To determine whether it is technically feasible to use WREGIS for 111(d) tracking, trading, and reporting needs, Cadmus identified the data fields and functions that are most likely to be required for tracking 111(d) RE activities. We reviewed the proposed rule and supporting documents, as well as recommendations submitted to the EPA through state and relevant stakeholder public comments.

3.4.1 Anticipated Features for Tracking RE Compliance with 111(d)

Cadmus identified two categories of data fields and functions that support tracking 111(d) RE compliance activities:

1. **Essential features**: the minimum requirements to enable states to track, trade, and report RECs for 111(d) purposes.
2. **Beneficial features**: tracking system features and/or functionality that are not required for basic tracking, but would enhance the system usability for states trading RECs for 111(d) purposes and/or managing compliance against the level of RE projected in the state plan.

3.4.1.1 Essential Features for 111(d) Compliance

Cadmus anticipates that the following data fields and functions will be essential (or the minimum criteria) of tracking RE activities for 111(d). With the exception of the last feature listed, WREGIS currently includes similar features that would enable REC trading (discussed in detail in section 3.3.1.3):

- **Account details**: Data fields such as account holder, location, EGU characteristics, retirement status, and a unique certificate serial number are essential for 111(d) RE tracking, as they identify ownership, help avoid double counting, and allow for tracking a certificate from generation to potential trading to retirement.
- **Fuel type**: This data field is essential to ensure that the generation source remains eligible for compliance under the EPA final rule or plan approval of eligible RE sources (e.g., wind, solar).
- **Vintage**: This data field is essential to ensure that RE was generated during the claimed 111(d) compliance time period.
- **Public reporting**: The reporting function is essential for having transparency of certificates retired for 111(d), which helps avoid double counting and streamlines RE accounting for annual compliance reporting to the EPA.
- **Transfer of ownership**: This function, authenticating the transfer of ownership from one account holder to another, is essential to enable certificate trading between states or between entities that have a compliance obligation (e.g., between two utilities).
- **111(d) eligibility**: This field would indicate whether a certificate was created due to generation from a 111(d)-eligible RE EGU. This field is essential because some resources may be eligible for RPS compliance in one or more states but not be eligible for use in state 111(d) compliance plans.

The additional features summarized in section 3.4.1.2 may prove beneficial for facilitating 111(d) RE activity tracking, trading, and reporting.

3.4.1.2 Beneficial Features for 111(d) Compliance

The beneficial data fields and features Cadmus identified are strictly related to creating a single tracking system with more comprehensive information for states. In other words, if all essential and beneficial features are incorporated into the tracking system, states can track RE activities and transactions, calculate the resulting emissions reductions, and compare the results of each activity to the expected reductions stated in their plan.

Without these beneficial features, outlined below, states would have to perform some of these functions outside the system, making the process more cumbersome. For example, it could be beneficial to have states use the same emissions quantification assumptions in the tracking system, which could be built into WREGIS or used externally through other resources and tools (such as the EPA's Emissions and Generation Resource Integrated Database [eGRID] and the AVoided Emissions and geneRation Tool [AVERT]).[18]

Summaries follow of the specific data fields and functions identified as beneficial.

Calculating Avoided Emissions

One beneficial function for the 111(d) tracking system is avoided emissions quantification that provides a consistent methodology for each eligible REC, which would facilitate trade. This function could also occur externally, such as through AVERT. Appendix H contains a detailed description of AVERT.

The following approaches to quantifying avoided emissions could be included in a tracking system, depending on the final 111(d) required accuracy or the accuracy preferred by states that trade RECs:

- **Average emissions approach**: This approach would be to use a regional emissions factor that consists of historical emissions and generation data (such as those compiled by EPA in eGRID) to derive a grid-average emissions factor that assumes emissions reductions at all EGUs proportionally regardless of fuel type (e.g., coal, wind) on the margin. This factor could be applied uniformly to all RE activities within a region to determine avoided emissions (by multiplying a selected average avoided emissions factor by the quantity of RE generated). This function could be integrated into a tracking system at a minimal cost.

  The policy decisions required to use this approach include determining the sources for appropriate regional average emissions factors and setting timelines for the frequency of updating the emissions factors to accommodate regional changes in the mix of emissions-

[18] More details about AVERT are available online: http://www.epa.gov/avert/

producing generation sources. This approach also could be applied at the state level if stakeholders determine that the regional averages are too variable.

- **Marginal emissions approach**: This approach would provide a more accurate estimate of emissions reductions resulting from each MWh of avoided generation. It would entail calculating the avoided emissions based on the EGUs that are most likely to be displaced from the RE activity, or based on the EGUs that are estimated to be on the margin at the time of RE generation. This approach would be to use a marginal emissions rate that was either estimated based on historical data or calculated using dispatch modeling of the actual generation of EGUs in the region. Dispatch modeling calculations are considerably more complex to implement, and would require a tracking system to track all generation from each EGU within a given region along with the emissions associated with every MWh generated. This is currently implemented in the NEPOOL GIS system. However, NEPOOL GIS does not currently use these generation and emissions data to model avoided emissions.

EPA included electricity sector modeling in its State Plan Considerations Technical Support Document as an approach to emissions quantification; however, Cadmus did not identify this modeling approach as beneficial since it is likely too complex to incorporate into a tracking system.

Tracking Certificate Imports and Exports

Though not essential, the following beneficial feature could help alleviate the possibilities for double counting if states want to trade outside of the Western Interconnection. This beneficial feature will ensure that certificates are identified and claimed:

- **Track certificate imports from and exports to other registries**: States choosing to trade 111(d) eligible RECs with states in other regions or that use other registries may double count the certificate by registering it in two different locations. This function would help states avoid double counting certificates traded outside of the WREGIS system. For example, when a certificate is left one system, it could be placed in that user's reserve sub-account and flagged to illustrate the user no longer owns that certificate.

Tracking Progress Against the RE Component of the State Plan

The purpose of this beneficial feature is to allow WREGIS users to monitor the impacts of RE activities against the RE component outlined in their state plan. This feature would allow a state to calculate its progress towards the level of RE projected in its plan, and would require the following features:

- **Calculate total RE impacts:** This function would display the state's anticipated RE contribution level identified in its state compliance plan, and would sum energy savings and/or emissions reduction impacts resulting from all RE activities registered in the system. Total RE savings could then be subtracted from anticipated RE savings to indicate a running tally of the state's progress.
- **Accounting adjustments**: As RECs are not counted towards a state RPS until retired, RECs for 111(d) would function the same way. This accounting adjustment function would apply retired

RECs eligible for 111(d) to the state's progress against the level of RE projected in their compliance plans.

3.4.2 Comparison of Reviewed Systems to 111(d) Features

After identifying the essential and beneficial data fields and functions required for a viable 111(d) tracking system for RE activities, Cadmus developed a gap analysis to determine if each of these essential and beneficial fields and functions are present in existing systems. As Cadmus assumed 111(d) REC tracking, trading, and reporting could function similarly to REC tracking, trading, and reporting within these existing systems, we compared the anticipated essential and beneficial data fields and functions to the fields and functionalities of WREGIS, PJM-GATS, NEPOOL GIS, NC-RETS, NAR, M-RETS, and MIRECS.

Table 5 lists the data fields and functions that currently exist, fields or functions that are technically feasible but would require operational enhancements, and gaps.

Table 5. 111(d) and REC Tracking System Gap Analysis*

111(d) Anticipated Features	WREGIS	PJM-GATS	NEPOOL GIS	NC-RETS	NAR	M-RETS	MIRECS
Territory	Multi-state	Multi-state	Multi-state	One State Systems	Multi-state	Multi-state Registry	One State Systems
Essential 111(d) Fields and Functions							
Account holder	x	x	x	x	x	x	x
Retirement status	x	x	x	x	x	x	x
Generating facility	x	x	x	x	x	x	x
Unique serial number	x	x	x	x	x	x	x
Fuel type	x	x	x	x	x	x	x
Vintage	x	x	x	x	x	x	x
Public reports	x	x	x	x	x	x	x
Transfer of ownership	x	x	x	x	x	x	x
111(d) eligibility	TF	TF	TF	TF	TF	TF	TF
Beneficial 111(d) Fields and Functions							
Calculate emissions avoided	TF	TF	TF	TF	x	TF	TF
Allow for certificate importing	TF	x	x	x	x	x	x
Allow for certificate exporting	x	x	x	x	x	x	x
Calculate RE impacts	GAP	GAP	GAP	GAP	GAP	GAP	GAP
Make 111(d) accounting adjustments	GAP	GAP	GAP	GAP	GAP	GAP	GAP

* In table, x indicates that the field or feature currently exists in the system; TF indicates that the identified system is technically feasible, but is not currently a system function (either comparable functions are offered in sister systems, or the system itself has a comparable feature); and GAP indicates that the feature is not currently part of the system.

3.4.2.1 RE Gap Analysis Findings

The gap analysis shown in Table 5 reveals that all systems would require enhancements of essential and beneficial features for use in tracking, trading, and reporting 111(d) RE activities.

While only minimal WREGIS enhancements would be required for essential 111(d) features, more substantial modifications would be needed to incorporate the identified beneficial features. This finding is supported by conversations with key stakeholders, including WREGIS and APX staff.

At the project outset, Cadmus and WIEB theorized that WREGIS could serve as a starting point to develop a system for 111(d) tracking, trading, and reporting since most Western Interconnection states already use it. Although the gap analysis indicates that NEPOOL GIS and PJM-GATS already contain many of the identified beneficial features for 111(d) tracking that would need to be added to WREGIS, it is likely more cost-effective for Western Interconnection states if the WREGIS were modified to include the beneficial features (replicated from NEPOOL GIS or PJM-GATS) than purchasing and using a new system. Cadmus did not identify prohibitive challenges to using WREGIS for this purpose. Therefore, the findings discussed in the sections below are focused on WREGIS.

Essential Features

WREGIS currently offers all but one of the identified essential features needed for RE tracking, trading, and reporting under 111(d). The only essential 111(d) feature that WREGIS does not currently offer is an indicator to show 111(d) eligibility. As discussed, this essential data field would provide verification that certificates generated can be counted toward 111(d) compliance. Table 5 illustrates that WREGIS does currently offer the remaining essential features of account details, such as retirement status, generating facility details, certificate serial numbers, and vintage. In addition, WREGIS already includes fields and functions to generate public reports and track certificate transactions and ownership details. As these fields and functions already exist in the WREGIS system, only minor modifications would be required to enable 111(d) compliance activity tracking and trading.

Though WREGIS does not currently offer an indicator to show 111(d) eligibility, the system already includes indicators for similar qualifications, such as California RPS, so has the technical capability to incorporate this feature with only slight modifications. This indicator appears on certificates created by eligible generators, and is used in California to confirm eligibility towards the state RPS. A 111(d) indicator would function similarly by illustrating a REC's eligibility for 111(d) compliance.

The easiest method for incorporating a 111(d) compliance eligibility indicator is to (1) apply the indicator to the profile of each eligible EGU within WREGIS and (2) design evaluation processes for determining whether new EGUs registering with the system are eligible for the indicator. The corresponding certificates of 111(d) eligibility would show this indicator. Whenever such a certificate is retired due to RPS compliance or another reason, it could be tracked to demonstrate compliance with 111(d).

During discussions, APX and WREGIS staff indicated that this enhancement would require minimal effort and cost.

Gaps in Essential Features

There are no technological gaps in the WREGIS tracking system that would prevent it from being used to track and potentially trade RECs for 111(d) purposes, as the one outstanding essential feature (111(d) attribute) is technical feasible within WREGIS.

Beneficial Features

Of the beneficial features identified, one currently exists in WREGIS: the ability to track certificate exports to other tracking systems.

There are two beneficial features identified as technically feasible that are not currently included in WREGIS: calculating avoided emissions and tracking certificate imports (detailed in bullets below). While WREGIS does not currently have these beneficial features, comparable functions exist in WREGIS or sister systems and would therefore require minimal system enhancements.

- **Calculating Avoided Emissions:** This beneficial feature does not currently exist in WREGIS, but NAR offers this feature for generators eligible for specific programs. Including this feature in WREGIS increases the consistency of emissions calculations. Adding this feature would require a calculation function (using the average emissions or marginal emissions quantification approach) and selecting avoided emissions factors. NAR calculates avoided emissions using emissions inputs provided by the EPA for generators eligible for the Green-e Climate Protocol and EPA's Climate Leader's Protocol.
- **Tracking Certificate Imports:** WREGIS currently permits and tracks certificate exports and has the capability to permit certificate imports, but administrative decisions have excluded this option. As discussed, this beneficial feature would mitigate double counting from states that trade 111(d) eligible RECs with states in other regions or using other registries. Sister systems, including NEPOOL GIS, currently contain this functionality, and receive imported RECs to the recipient's active account. The sender must perform the corresponding tracking system operation to indicate trading a REC out of their system. In most systems, the corresponding operation is to move the REC to a sub-account specified for such operations. WREGIS staff reported that this feature could be easily replicated.

Gaps in Beneficial Features

Cadmus identified one gap between WREGIS and the beneficial feature of enabling a state to track their RE activities (e.g. buying and selling RECs for 111(d)) against the level of RE projected in their state plan.

- **Tracking Progress Against RE Component of the State Plan:** None of the reviewed systems include the features to display, calculate, and adjust RE impacts against the RE level outlined in a state compliance plan. The effort to incorporate the fields and functions needed to offer these features could be minimal; however, the policy implications associated with various accounting adjustments could be significant and would require prior resolution.

3.4.2.2 Potential Costs of WREGIS Enhancements

WREGIS will require minimal enhancements, focused primarily on programming updates, to offer the essential feature of a 111(d) eligibility marker. WREGIS will require more substantial enhancements to offer the beneficial features of calculating avoided emissions and tracking certificate imports and RE activity progress. To implement these enhancements, WECC and the WREGIS Committee would need to modify and customize fee schedules or adopt a new fee. Both APX and WREGIS staff reported that the cost to enhance software to facilitate 111(d) tracking would likely not present a significant challenge, should states pursue using WREGIS as a tracking, reporting, and trading mechanism for 111(d). WREGIS and APX would dictate the time and cost necessary for this work.

The WREGIS Committee would have to approve a fee increase or new fees for system modifications to accommodate 111(d) RE activities. This Committee, according to the director: "…works similar to state commissions. If new services are causing costs, then the Committee would look to account holders using that service to cover the bill. For 111(d) compliance we would anticipate a new fee rather than an increase." The majority of stakeholders noted that cost did not present a significant concern, as WREGIS fees have historically been very reasonable.

In addition to the technological requirements to enhance WREGIS to offer the essential (and, if requested, beneficial) features, there remain several policy considerations. Given that 111(d) is a draft and the EPA is processing upwards of 3 million public comments, the timing and specific compliance requirements remain unknown. Section 3.5 outlines the policy considerations in greater detail.

3.5 RE Policy Considerations

As mentioned, Cadmus identified multiple policy considerations that states must address in order to establish a tracking and trading system for 111(d) RE activities. Though not an exhaustive list of policy considerations relevant to 111(d) RE activities (nor do the descriptions present an exhaustive list of their permutations), states must consider these primary policy issues before trading under 111(d). In a partial multi-state modular approach, two or more states could agree on one or more aspects of a policy consideration and agree to work together in that area (but not have to agree on every aspect of all policy considerations). If states are looking to develop a full multi-state or even regional plan, then broad stakeholder agreements on these issues would likely be a complex and lengthy process, involving multiple state policy entities. In more extreme cases, policy considerations may have broader implications and require EPA guidance or agreements across every state in a region to establish features necessary for equitable tracking and trading. The first two policy considerations listed below are largely resolvable in WREGIS. However, the third policy consideration listed below presents a more complex issue that is not completely resolvable in WREGIS.

The primary policy considerations include:

1. Trading between states with inconsistent REC definitions
   - This relates to the essential features outlined in section 3.4.1.1. The only essential feature not currently in WREGIS relevant to this policy consideration is a marker indicating that a REC is eligible for 111(d).
2. States using varying methods to quantify emissions reductions from RE activities
   - This consideration is relevant to the beneficial feature of calculating avoided emissions. Emissions can be calculated in WREGIS or an external tool. In addition, emissions calculations are only necessary if a state chooses a rate-based approach and wants to apply emissions to the numerator to measure progress.
3. Mitigating the risk of double counting
   - For tracking *only* (not trading), this relates to the essential features of account details. If RECs eligible for 111(d) are defined the same way WREGIS defines them now (including all attributes), then WREGIS already has the features to address this consideration. If states decide to define RECs differently (such as by using attributes separately), then WREGIS staff would need to be consulted to determine how to make this modification in the system, which is technically feasible.
   - For tracking *and* trading, this consideration is the most complex of the proposed rule and it relates to the identified beneficial features of tracking REC certificate imports and exports and accounting adjustments. It is the most complex because the potential for double counting is especially high among states that trade RECs for 111(d) purposes and choose different measurement approaches (mass-based versus rate-based). WREGIS can mitigate double counting except in the case of rate-based states wanting to trade RECs with mass-based states. In this case, additional policy discussions would need to take place to ensure double counting is prevented.

Section 3.5 provides context around each policy consideration, relevant comments on the draft rule and from interviews, and analysis and proposed solutions (where possible or the issue is not already resolved in WREGIS). As the proposed rule has not been finalized, these considerations, discussion, and proposed solutions should be considered a snapshot of current thinking on 111(d) issues. Proposed solutions involving EPA decisions may reflect the possible evolution of an issue upon the EPA releasing a final rule: they should not be considered recommendations to the EPA. The majority of interviewed stakeholders asked that their opinions remain anonymous, as they did not represent their state's official stance; therefore, comments are not attributed to specific people.

3.5.1 Policy Consideration 1: Trading Between States with Inconsistent REC Definitions

3.5.1.1 Lack of Consistent REC Definitions

REC definitions provide transparency regarding elements included in the REC, specifically whether the REC includes some or all environmental attributes. Variation occurs, however, in not just what REC stands for in each state, but what it includes.

According to the Clean Energy States Alliance: "different states use different names for RECs including alternative energy certificates, certificates and credits."[19] Generally, 'credit' refers to RECs used for RPS compliance purposes, while 'certificate' serves as a more generic term. States with formal RPS programs using RECs most commonly define a REC as follows (or use a variation of this language):

> *A tradable certificate of proof of one megawatt hour of electricity generated by an eligible renewable resource that is issued and tracked by a tracking system and includes all of the environmental attributes associated with that megawatt hour unit of electricity production.*

The Clean Energy States Alliance also notes: "two states, Arizona and Nevada, denominate their RECs in kWh."

The Western Interconnection states' definitions of RECs range. One state explicitly includes all environmental attributes (in California, the definition of a 'renewable energy credit' includes all renewable and environmental attributes associated with producing electricity from the eligible renewable energy resource),[20] while other states generally include environmental attributes (in Oregon, a 'renewable energy certificate' is a unique representation of the environmental, economic, and social benefits associated with generating electricity from renewable energy sources.[21] The states' definitions also vary in terms of eligibility. For example, some states require energy bundling with the REC to meet compliance requirements and others do not. Appendix D provides REC definitions for each Western Interconnection state.

Nearly all Western Interconnection states have experience tracking and trading RECs, having done so to meet RPS compliance. When 1 MWh of RE is generated, one REC is created in WREGIS. Neither the variations in REC definitions nor the differing technologies eligible (listed in Table 2) have presented challenges for trading RECs to date. RECs in WREGIS are bundled with all environmental attributes (i.e., NOx, SOx, and CO2), so there is consistency and transparency in what is being traded.

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[19] Clean Energy States Alliance. *REC Definitions and Tracking Mechanisms Used by State PRS Programs.* June 2014. Available online: http://www.cesa.org/assets/2014-Files/RECs-Attribute-Definitions-Hamrin-June-2014.pdf

[20] California Public Utility Commission. *Renewable Energy Credits.* Last modified February 1, 2012. Online at: http://www.cpuc.ca.gov/PUC/energy/Renewables/FAQs/05REcertificates.htm

[21] Oregon Department of Energy. Renewable Energy Certificates. Online at: http://www.oregon.gov/energy/RENEW/RPS/Pages/RPS-RECs.aspx

However, such variations in REC definitions could present implications for trading RECs used for 111(d) between states that include different attributes and are not transparent about which attributes are included. For example, State A defines a REC as RE plus all environmental attributes, that REC could be eligible for 111(d) compliance and could be traded and retired for both RPS and 111(d) compliance. Then if State B defines a REC only as RE and does not include environmental attributes, that REC would not be eligible for 111(d) compliance in State A, and could not be traded for this purpose.

3.5.1.2 Approved RE Technologies

States have also historically held differing RPS requirements, specifically around the RE technologies that are eligible for RPS compliance. As such, some states (specifically Oregon and Idaho) requested clarification from the EPA regarding the definition of RE for 111(d) compliance purposes and a list of the types of renewables allowed. For example, the EPA excluded existing hydroelectric power from its RE calculations, but stated that incremental hydropower could be included as a compliance option. In the rule, EPA did not explicitly state types of RE allowed for compliance. Idaho requested acknowledgement of biomass as an eligible compliance RE source.[22] Oregon stated it "recognizes that EPA likely intends to allow states to certify the full range of RE generation, but EPA should clarify all emission reductions resulting from a range of RE technologies, such as biomass, incremental hydro, and marine RE, are acceptable in state compliance plans."[23]

To trade with each other and to include others states' resources in their own compliance plan, states will first want to know what qualifies for 111(d) compliance, whether defined by EPA or agreed to by trading parties. Further, as many RE technologies currently exist in WREGIS (see section 3.3.1.3), any qualifying RE source and associated RECs could be marked as 111(d) eligible in the system. Additionally, technologies could be added to WREGIS if states (or the EPA) determined that additional RE technologies are 111(d) eligible.

3.5.1.3 Potential Solution

Though not all states must agree on common definitions of RECs or eligible RE technologies, transparency will prove vital to enabling states to evaluate elements traded and whether they are eligible for RPS and 111(d) compliance.

Currently, WREGIS defines a certificate as including all environmental attributes. As Cadmus focused this project on assessing whether existing tracking systems could serve as a potential tracking, trading, and reporting mechanism for 111(d), we used the WREGIS definition of a REC. If a 111(d) eligible REC were defined the same way, WREGIS could be used to track the certificate and its attributes as one entity.

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22 Idaho Governor's Office of Energy Resources. *State of Idaho's coordinated comments on the EPA's proposed Clear Air Act 111(d) guideline; Docket ID No. EPA-HQ-OAR-2013-0602.* Page 18. November 26, 2014. Available online: http://energy.idaho.gov/informationresources/d/idaho_clean_power_plan_111(d)_comments.pdf

23 Oregon Department of Environmental Quality. *Docket ID: EPA-HQ-OAR-2013-0602*. October 16, 2014. Available online: http://www.deq.state.or.us/aq/climate/docs/epaLcomment.pdf

WREGIS users could attribute a 111(d) eligibility marker to a REC as a flag that is tracked with all existing attributes.

Should states want to define RECs differently than the current WREGIS definition, the WREGIS software would need to be modified to allow for separate tracking and retiring of RE and 111(d) attributes. One potential solution would be for states to determine what is eligible for their RPS and 111(d) compliance. Another potential solution could be for states to specify in their compliance plans to EPA whether their definition of a REC for 111(d) purposes is fully bundled or otherwise.

Additionally, some states, such as Washington, would need to change their state RPS requirements to be able to use RECs for dual compliance (towards both the state RPS and 111(d)).

3.5.2 Policy Consideration 2: States use Varying Methods to Quantify Emissions Reductions

As the state goals under 111(d) are expressed as tons of emissions for mass-based states and as pounds of emissions/MWh for rate-based states, the way states calculate emissions reductions resulting from RE activities has significant policy implications. This challenge stems from multiple approaches to quantifying emissions. The EPA may dictate an acceptable uniform quantification method, but has not indicated an intention to do so. In the proposed rule, the EPA references several potential emissions quantification methods, but does not indicate that states must use one of these methods nor specify which method they should use.

The EPA identifies emissions quantification approaches[24] that range in complexity and include:

- An average emissions rate approach, which uses average emissions rates from sources such as eGRID to estimate avoided emissions for a region or sub-region. This is the easiest and least cost method for calculating avoided emissions and can be readily incorporated as a beneficial feature in WREGIS.
- A marginal emissions rate approach, which is supported by tools such as AVERT. This approach represents the specific emissions rate of EGUs that are most likely to be affected by the emissions reductions in a given state or region. It offers a more accurate method for calculating avoided emissions using either estimated marginal emissions rates or modeled emissions rates, though at a greater cost than the average emissions rate approach.
- An electricity sector modeling approach, which is more complex and entails quantifying avoided emissions through retrospective modeling. In this approach, actual realized EGU emissions generated are compared to projected emissions that would have occurred without the RE activities. The model can be set to different look-back periods—long term or short term—and to simulate changes to the "build margin," such as whether new generating capacity will be added in the future. This is the most accurate, but also the most difficult, approach to implement.

24 U.S. Environmental Protection Agency. *TSD: State Plan Considerations*. Pages 24-31. June 2014.

Cadmus did not identify this approach as a beneficial function in the gap analysis because it is not likely to be feasible within a tracking system due to its complexity.

If states are allowed to use different emissions quantification methods, the chosen method will affect the volume of emissions reductions resulting from the same RE activity. In other words, if two states implement the exact same RE generation project, under identical conditions, but measure the emissions impacts differently, the resulting emissions that each state could claim toward compliance could be vastly different.

In interviews, stakeholders generally did not express strong opinions regarding which of these approaches states should use; however, several cited the related consistency as a significant concern. One air regulator said, while he did not have an opinion favoring a method, consistency would be important so “you know a ton is a ton is a ton.” If the EPA does not dictate a specific quantification method, states that plan to use a rate-based approach and apply emissions reductions from RE activities to the numerator will need to propose a method in their state plans for EPA approval. To ensure a level playing field, at a minimum, it will be important that states maintain transparency in these calculations.

Although this represents a significant policy question for the EPA and states as they consider compliance and reporting options under 111(d), the method or methods used to quantify emissions do not represent a significant challenge to tracking system functionality.

3.5.2.1 Potential Solution

As was noted in section 3.4, including emissions quantification functionality in the tracking and reporting system is a beneficial feature that would enable states to track RE emissions impacts against the level of RE projected in their state plan, rather than simply tracking RE savings. From a technological perspective, programming emissions quantification functionality into WREGIS or another tracking system can entail varying levels of complexity (depending on the approach chosen), but remains within the systems’ capabilities. Furthermore, using a centralized system such as WREGIS would not necessarily require users to agree upon a common GHG quantification approach. Alternative methods could be programmed into a system, allowing states to select the relevant approach and claim the resulting emissions reduction against the RE component outlined in their state plan.

While it will be important for states to identify an equitable approach to quantifying emissions for tracking compliance against their 111(d) goals, such considerations are outside the scope of this study. If stakeholders agree that adding emissions quantification functionality to a tracking system is desirable, and they choose an average emissions approach, then users will need to agree on a common source of emissions factors. For example, eGRID provides average, regional emissions factors. If states opt to use the marginal emissions rate calculation approach, they must agree on appropriate parameter values based on EGUs affected and their marginal emissions rates.

The benefits and costs of incorporating this function will vary based on the emissions calculation approach selected, and states must determine whether the cost of these system modifications represents a worthwhile investment.

Alternatively, these calculations can take place outside a tracking, trading, and reporting system using a tracking system such as eGRID or AVERT. The EPA's AVERT tool offers peer-reviewed and accepted calculation parameters that balance simplicity and precision. States that want to convert their RE impacts into emissions can use AVERT as a centralized module. See Appendix H.

3.5.3 Policy Consideration 3: Mitigating the Risk of Double Counting

Double counting is a critical policy consideration for implementing 111(d). It occurs when energy savings impacts are claimed by more than one entity or claimed for more than one purpose. Double counting in the context of 111(d) can arise from the following primary factors:

1. **Ownership of environmental attributes**: In situations in which RE is generated in one state and consumed in a different state, there is potential for both states to claim ownership of the RE.
2. **Trading RECs between states with mass-based versus rate-based compliance approaches**: When one state has opted for a mass-based measurement approach and another uses a rate-based approach, the potential for double counting is high. Additionally, trading becomes highly complex.
3. **Dual Compliance**: In states with an existing RPS in place, energy savings resulting from RE programs and initiatives will likely be counted toward compliance in both regulations.

Sections 3.5.3.1 through 3.5.3.3 explore these issues in greater detail.

3.5.3.1 RE Ownership

Identifying ownership of RE impacts poses a potential challenge, particularly when qualifying RE that is exported across state boundaries. The EPA has proposed having importing states claim RE generation impacts toward compliance, but has requested comments on this proposal. States offered differing recommendations regarding RE-generating or RE-consuming states' ownership of RE emissions reductions.

In part because REC trading was developed as a market-based compliance mechanism to support state RPS, policy leaders and commercial market actors have determined workable approaches for avoiding double counting resulting from ownership claims and interstate effects. Specifically, they set systems to use attribute markers that describe each uniquely identified REC, including ownership status and transactional details, from origination to retirement. Thus, if RECs for 111(d) purposes are used similarly to existing RECs, there is no challenge of double counting; however, if states define and use RECs differently, and if ownership does not follow the REC for 111(d), then there is potential for double counting.

3.5.3.2 Trading RECs Between Mass-Based and Rate-Based States

The EPA has proposed to allow states two different ways to measure progress towards their state goal: a mass-based or a rate-based approach. States that choose a mass-based approach adopt a cap on their overall tonnage of CO2 emissions, and monitor compliance by directly measuring emissions at the EGU stack. States that choose a rate-based approach measure emissions reductions as the quantity of CO2 per MWh of electricity generated for affected EGUs. While rate-based goals can accommodate increases in generation due to increased demand, mass-based goals are more simple to measure. REC trading between states that have adopted differing measurement approaches is complicated and introduces a high potential for double counting.

For example, RE generation can reduce the generation and emissions from affected fossil fuel sources. If any of the affected sources operate in a state with a mass-based limit, the RE generation reduces emissions in that state and helps it comply with that mass-based limit. However, if the REC from that RE generation is sold to a state with a rate-based limit and used to adjust the emissions rate, it is now counting towards the goals of two states and creates the problem of double counting.

If every state in the Western Interconnection chooses to use a mass-based approach, there would be no need to track RECs for 111(d) purposes, since all compliance measurement would take place at the EGU. If every state in the Western Interconnection chooses to use a rate-based approach, double counting could be avoided by ensuring that the 111(d) attributes of each REC are only used in one state, by one entity, and could be tracked in a regional system such as WREGIS. The challenge arises when states that choose different measurement approaches wish to trade RECs for 111(d).

Trading between mass-based and rate-based states poses a challenge beyond the capabilities of a tracking system to resolve. Therefore, states that select differing measurement approaches and want to trade RECs under 111(d) will need to engage in policy discussions to mitigate double counting.

3.5.3.3 Dual Compliance: State RPS and 111(d) RE Compliance

The draft rule suggests that RE activities implemented to comply with RPS may also qualify as 111(d) compliance activities. Should states want to trade RECs, it would be prudent to make sure that trading partners are transparent about what attributes are included in a REC and how it is used for compliance with various regulatory requirements. Additionally, some state RPS rules include provisions that RECs created to comply with the RPS cannot be used for other regulatory compliance purposes. Therefore, policy makers in states with these limits in place may need to re-evaluate their state-level policies to enable dual compliance with 111(d) to avoid being burdened with significantly higher compliance requirements than other states.

3.5.3.4 Potential Solutions

In the draft rule, the EPA proposed several ways to avoid double counting and requested stakeholder comments on this issue, but fell short of issuing definitive guidelines. It is expected that EPA will ask states to identify how they will avoid double counting in their state plans, then will approve or reject states' proposed approaches based on their consistency with the rule. As discussed above, a regional tracking system, such as WREGIS, can be used to assign clear ownership rights from generation to retirement by applying a marker to each REC that documents its ownership rights, regulatory eligibility (e.g., for RPS, 111(d), or other compliance needs), and retirement status. WREGIS currently includes this type of functionality. To ensure accountability and accuracy, these markers would need to entail transparent documentation and access to the data each state used to make these determinations.

States should carefully consider the potential impacts of interstate effects when selecting a mass-based or rate-based measurement approach and, as suggested by EPA in the proposed rule, develop a method to mitigate double counting in their state plans. The simplest way to address the interstate effect challenge would be for all states within an interconnected power grid to agree on a consistent measurement approach. However, the flexibility built into the 111(d) rules makes this approach unlikely.

This issue is paramount for states wishing to trade RECs for 111(d) purposes. In order to ensure equitable valuation of RECs and accounting of impacts against the level of RE projected in a state's plan, trading states with differing measurement approaches must collaborate to ensure the prevention of double counting. For more information on the complexities of rate- and mass-based measurement approaches see the literature review sources in Appendix A.

4 Energy Efficiency Tracking Module

4.1 Introduction

Broadly considered a least-cost energy resource, EE is included among the EPA's proposed BSER building blocks that states can use toward their state 111(d) goals. While emissions reductions can originate from many different types of EE activities, it remains unknown which types of EE programs or measures the EPA will accept as approved compliance strategies under 111(d).

The most common, proven strategies include adopting new building codes or equipment standards (at the local, state, or federal level) and deploying consumer demand-side management (DSM)[25] programs. DSM programs can include efforts to save energy, reduce peak demand, or encourage market transformation for specific equipment or technologies (e.g., to normalize EE purchasing decisions). Through these programs, the sponsor (state agencies, non-governmental organizations (NGOs), regional collaboratives, or utilities administrators) typically offer financing, incentives (e.g., rebates for the purchase of EE equipment or equipment that reduces demand), technical services/support (e.g., energy audits), education (e.g., behavior modification), or other mechanisms that encourage consumers to conserve energy. States also may take additional supply-side actions that improve the efficiency of transmission and distribution systems, for example, by installing upgrades or repairs (e.g., poles and wires) to the transmission infrastructure.

Regardless of the EE strategies the EPA approves and states adopt, the same basic functionality needs and challenges apply with regard to tracking the resulting EE savings.

In developing each states' overall 111(d) compliance goal, the EPA assumed each state could eventually achieve annual incremental energy savings equal to 1.5% of retail energy sales. For states not already achieving 1.5% annual savings, the EPA proposed a ramp-up rate of 0.2% per year until achieving 1.5% no later than 2025, and assumed that states could maintain that level through 2029. The EPA also proposed a more accelerated alternative goal, where states would need to achieve a lower 1.0% annual incremental savings rate over a shorter timeline, ramping up by 0.15% per year until achieving and maintaining 1.0% energy savings through 2024.

Table 6 lists the amount of EE the EPA assumed would be achievable for each Western Interconnection state in the proposed and alternative scenarios.

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[25] DSM refers to programs or initiatives that reduce energy consumption at the end-use level and, in turn, reduces generation at the EGU level.

Table 6. EPA Proposed and Alternative Block 4 Contributions

	Arizona	California	Colorado	Idaho	Montana	Nevada	New Mexico	Oregon	Utah	Washington	Wyoming
Cumulative Savings as a Percentage of Retail Sales											
Proposed (2029)	11.42%	11.56%	11.01%	11.10%	10.90%	10.69%	10.60%	11.41%	11.03%	11.26%	9.73%
Alternative (2024)	5.98%	6.08%	5.87%	5.88%	5.69%	5.45%	5.50%	6.06%	5.82%	6.00%	4.19%

Source: U.S. Environmental Protection Agency. *TSD: GHG Abatement Measures.* Page 5-46. June 10, 2014.

Currently, EE is a common practice across most Western Interconnection states. While some states have made EE part of their overall resource mix by adopting regulated energy savings targets, others have engaged in little or no formal EE (see section 4.2). Cadmus explored existing tracking systems that allow states to track EE activities and/or trade EECs, their suitability for tracking EE compliance activities under 111(d), and how such a system might be modified—or if a new system would need to be developed—to track EECs.

After analyzing the technical feasibility of tracking and trading EECs, Cadmus identified and analyzed important policy issues that require consideration for EE trading to become a viable compliance option that can be managed using an existing or new tracking system. Some of these policy issues will likely evolve, and some may be resolved when the EPA issues its final rule.

This section presents an overview of current tracking systems, their ability to track EE activities, and policy challenges associated with trading EECs to facilitate a modular approach to 111(d) compliance.

4.2 EE Policy Background

Figure 5. Western Interconnection States with Current EERS

Source: http://aceee.org

For more than two decades, various states have adopted policies to capture available EE resource potential. Energy Efficiency Resource Standards (EERS) or similar policies provide a key way for state regulators, operating through electric and natural gas utilities, to derive meaningful energy savings that contribute to a state's overall resource or environmental goals. Seven of the 11 Western Interconnection states have enacted an EERS or a similar policy, as shown in Figure 5.

An EERS generally requires utilities (primarily investor-owned) or independent program administrators to achieve a specific energy-savings goal by implementing customer-focused EE programs.

EERS policies are the state-level regulatory requirements most likely to overlap with building block 4 of 111(d), since the same EE activities may be potentially eligible for compliance with both regulations. In estimating EE potential to develop state-level 111(d) goals, the EPA assumed that states would, at a minimum, maintain a contribution equivalent to their projected EERS goals throughout the compliance period. The EPA then incorporated these minimum savings estimates into each state's emissions goal.

States with existing EERS have undertaken a deliberate and, in some cases, lengthy process to develop energy savings goals, compliance rules, and third-party EM&V requirements best suited to their market conditions and broader goals and objectives. Utilities within these states have also dedicated considerable effort and resources towards developing successful EE programs and the necessary supporting infrastructure to measure, track, and report EE savings to regulators. Some utilities have offered EE programs for many years and have gained a high level of market maturity and brand awareness of their commitment to efficiency and reducing their customers' energy costs. These states are well positioned to incorporate EE into their state compliance plans.

Table 7 provides an overview of each applicable Western Interconnection state's EERS policy.

Table 7. Western Interconnection States' EERS Policies

State	Year Enacted	Applicable Entities*	Percentage of Sales Affected	Standard
AZ	2010	IOUs, Co-ops	59%	1.25% savings/year from 2011–2015, 2.5% from 2016–2020, total savings of 22% retail sales
CA	2004	IOUs	78%	0.9% annual savings through 2020, demand reduction of 4,541 MW through 2020
CO	2007	IOUs	57%	Black Hills: 0.8% sales savings goal from 2011–2014, 1.35% from 2015–2018, increase to 1.66% in 2019
NV	2009	IOUs	62%	20% of sales met by RE and EE by 2015, 25% by 2025
NM	2013	IOUs	68%	5% reduction in retail sales by 2014, 8% by 2020 (2005 baseline)
OR	2010	Energy Trust of Oregon	70%	0.8% of 2009 sales in 2010, increasing to 1.4% in 2013 and 2014
WA	2006	IOUs, Co-ops, Municipalities	81%	Biennial and 10-year goals vary by utility. All goals based on a law that estimates 1.5% annual savings through 2030

Source: American Council for an Energy-Efficient Economy. *State EERS Policy Brief*. April 2014. Available online: http://aceee.org/files/pdf/policy-brief/eers-04-2014.pdf

* Applicable entities include IOUs, co-operative utilities, municipally owned utilities, and third-party administrators.

Among the Western Interconnection states without a current EERS in place, all offer some form of EE programs or alternative policies to promote customer investment in EE (e.g., rebates, tax credits, loan programs, or other incentives) through individual utilities. However, none require third-party EM&V, which ensures that claimed savings are accurate and attributable to the EE intervention being evaluated.

4.3 Overview of Existing EE Tracking Systems

This section provides an overview of currently used tracking systems that include EE tracking capabilities. Historically, EE tracking has taken place at a utility level. To support state-level EERS reporting requirements, individual utilities must invest in the design and development of customized EE tracking databases to support regulatory reporting. These systems often entail sophisticated functionality to enable users to calculate energy savings from a wide array of measure and project types and to facilitate internal and external reporting. These databases, however, are typically proprietary—the result of significant IOU investments—and are not designed to facilitate EE tracking by more than a single program sponsor. As EE activities are generally tracked at the utility level, the market has never required multi-entity or multi-state tracking or trading of EECs.

Thus, no system has been developed or is being used expressly for interstate EE tracking or trading.

However, three tracking systems currently being used (primarily for REC tracking) provide operating rules to enable tracking EECs in addition to RECs: NAR, NC-RETS, and NEPOOL GIS. APX designed and engineered all three systems, which share a common software core with WREGIS and have a basic framework and functionality not unlike the requirements for tracking RECs.

In sharing a common software framework, the systems currently in place to facilitate REC trading already contain—or can be easily modified to adopt—the functionality required to track EE savings or to facilitate interstate certificate trading. In fact, WREGIS staff did not identify any major technological challenges to implementing the software changes necessary for tracking EE. The features and functionality that enable EE tracking in the systems reviewed can provide the basis for incorporating software modifications into WREGIS or another REC tracking system to enable EE tracking. The necessary modifications start with system operating rules. For the three systems reviewed, the operating rules currently allow maximum flexibility, so they could be easily adopted for compliance with state EERS.

Cadmus examined the three existing tracking systems, specifically documenting their capabilities and functionality associated with EE tracking.

4.3.1 Structure, Key Features, and Uses

While the three tracking systems exhibit similarities, they differ in the rules establishing those permitted to report EE savings and the data included with each certificate. None of the systems prohibit trading EECs, though an EE program administrator may not necessarily permit such exchanges. Table 8 summarizes each system’s tracking features.

Table 8. EE Tracking System Summary

Tracking System Feature	NAR	NC-RETS	NEPOOL GIS
Allows self-reporting of energy saved		■	
Requires third-party verification of energy saved	■		■
Requires third-party submission of energy saved to tracking system	■		State dependent
Requires keeping annual documentation of savings and methods for audit purposes	■	■	■
Certificate data contains MWh of avoided generation	■	■	■
Certificate data contains emissions avoided			■

A brief overview of each system's structure, key features, and current uses related to EE tracking is provided in Appendix E.

4.4 Technical Feasibility: EE Tracking System Gap Analysis

Cadmus evaluated the existing tracking systems indicated in Table 1 above to determine whether they include the necessary functionality to support 111(d) modular compliance tracking. The following sections outline the tracking system data fields and features that are essential or beneficial to enable states to track 111(d) EE activities and resulting impacts, trade 111(d) eligible EECs with other states, and manage progress against their 111(d) EE plan component.[26] Cadmus compared each data field and feature to the current tracking systems' capabilities to assess the technical feasibility of using each of these systems to build a 111(d) tracking system.

To determine whether it is technically feasible to use WREGIS for 111(d) tracking, trading, and reporting needs, Cadmus identified the data fields and functions that are most likely to be required for tracking 111(d) EE activities. We reviewed the proposed rule and supporting documents, as well as recommendations submitted to the EPA through state and relevant stakeholder public comments.

4.4.1 Anticipated Features for Tracking EE Compliance with 111(d)

Cadmus identified two categories of data fields and functions that would support tracking 111(d) EE compliance activities:

1. **Essential features:** the minimum requirements to enable states to track, trade, and report EECs for 111(d) purposes.
2. **Beneficial features:** tracking system features and/or functionality that are not required for basic tracking, but would enhance the system usability for states trading EECs for 111(d) purposes and/or managing compliance against the level of EE projected in the state plan.

26 States do not have to comply at the building block level, only the overall state level.

4.4.1.1 Essential Features for 111(d) Compliance

Cadmus anticipates that the following data fields and functions will be essential (or the minimum criteria) for tracking EE activities for 111(d). WREGIS currently includes similar features that would enable REC trading (discussed in detail in section 3.3.1.3):

- **Account details**: Data fields such as account holder, location, quantity of energy saved, retirement status, and a unique certificate serial number are essential for 111(d) EE tracking, as they identify ownership, help avoid double counting, and allow tracking of a certificate from generation to potential trading to retirement.
- **Vintage**: This data field is essential to ensure that EE was produced during the claimed 111(d) compliance time period.
- **Public reporting**: The reporting function is essential for having transparency of certificates retired for 111(d), which helps avoid double counting and streamlines EE accounting for annual compliance reporting to the EPA.
- **Transfer of ownership**: This function, authenticating the transfer of ownership from one account holder to another, is essential to enable certificate trading between states or between entities that have a compliance obligations (e.g., between two utilities).
- **111(d) eligibility**: This field would indicate whether a certificate was created due to savings from a 111(d)-eligible EE project. This field is essential because some EE activities may be eligible for EERS compliance in one or more states but not be eligible in state 111(d) compliance plans.

The additional features summarized in section 4.4.1.2 may prove beneficial for facilitating 111(d) EE activity tracking, trading, and reporting.

4.4.1.2 Beneficial Features for 111(d) Compliance

The beneficial data fields and features Cadmus identified are strictly related to creating a single tracking system with more comprehensive information for states. In other words, if all essential and beneficial features are incorporated into the tracking system, states can track EE activities and transactions, calculate the resulting emissions reductions, and compare the results of each activity to the expected reductions stated in their plan.

Without these beneficial features, outlined below, states would have to perform some of these functions outside the system, making the process more cumbersome. For example, it could be beneficial to have states use the same emissions quantification assumptions in the tracking system, which could be built into WREGIS or used externally through other resources and tools (such as eGRID and AVERT).

Summaries follow of the specific data fields and functions identified as beneficial.

Calculating Avoided Emissions

One beneficial function for the 111(d) tracking system is avoided emissions quantification that provides a consistent methodology for each eligible EEC, which would facilitate trade. This function could also occur externally, such as through the EPA's AVERT. Appendix H contains a detailed description of AVERT.

The following approaches to quantifying avoided emissions could be included in a tracking system, depending on the final 111(d) required accuracy or the accuracy preferred by states that trade EECs:

- **Average emissions approach**: This approach would be to use a regional emissions factor that consists of historical emissions and generation data (such as those compiled by EPA in eGRID) to derive a grid-average emissions factor that assumes emissions reductions at all EGUs proportionally regardless of fuel type (e.g., coal, wind) on the margin. This factor could be applied uniformly to all EE activities within a region to determine avoided emissions (by multiplying a selected average avoided emissions factor by the quantity of EE savings). This function could be integrated into a tracking system at a minimal cost.

  The policy decisions required to use this approach include determining the sources for appropriate regional average emissions factors and setting timelines for the frequency of updating the emissions factors to accommodate regional changes in the mix of emissions-producing generation sources. This approach also could be applied at the state level if stakeholders determine that the regional averages are too variable.
- **Marginal emissions approach**: This approach would provide a more accurate estimate of emissions reductions resulting from each MWh of avoided generation. It would entail calculating the avoided emissions based on the EGUs that are most likely to be displaced from the EE activity, or based on the EGUs that are estimated to be on the margin at the time of EE savings. This approach would be to use a marginal emissions rate that was either estimated based on historical data or calculated using dispatch modeling of the actual generation of EGUs in the region. Dispatch modeling calculations are considerably more complex to implement, and would require a tracking system to track all generation from each EGU within a given region along with the emissions associated with every MWh generated. This is currently implemented in the NEPOOL GIS system. However, NEPOOL GIS does not currently use these generation and emissions data to model avoided emissions.

EPA included electricity sector modeling in its State Plan Considerations Technical Support Document as an approach to emissions quantification; however, Cadmus did not identify this modeling approach as beneficial since it is likely to complex to incorporate into a tracking system.

Tracking Certificate Imports and Exports, and Interstate Transactions

Though not essential, the following beneficial features could help alleviate the possibilities of double counting if states want to trade outside of the Western Interconnection. These beneficial features will ensure that certificates are identified and claimed:

- **Track certificate imports from and exports to other registries**: States choosing to trade 111(d) eligible EECs with states in other regions or that use other registries may double count the certificate by registering it in two different locations. This function would help states avoid double counting certificates traded outside of the WREGIS system. For example, when a certificate is left one system, it could be placed in that user's reserve sub-account and flagged to illustrate the user no longer owns that certificate.
- **Track interstate power transactions**: State boundaries do not always align with regional power markets, and some states are net importers or exporters of power. When drafting the state 111(d) goals, EPA considered whether a state was a net importer or net exporter, stating in the rule: "For states that are net importers of electricity, the estimated reduction in the generation by the state's affected EGUs was scaled down to reflect an expectation that a portion of the generation avoided by the demand-side EE would occur at EGUs in other states."[27] Despite this consideration when drafting state goals, interstate effects can still impact state accounting of importing and exporting. If a net importer state invests in an EE activity, it can only claim credit for the portion of avoided emissions equivalent to the percentage of its in-state generation. For example, if a state produces 80% of the energy it consumes and imports the remaining 20% from other regions, it can only claim credit for 80% of the avoided generation resulting from EE activities conducted in the state. This also leaves room for EE to not be claimed by any party. Adding a feature that would calculate the eligible percentage of avoided generation based on each state's net energy imports and then apply the percentage to the eligible energy savings represented in a 111(d) certificate would enable users to more accurately and seamlessly use the system to track progress against the level of EE projected in their state plan.

Transparent Indicators of EEC Attributes

In order to use EE as a compliance activity towards the overall state goal, the EPA is proposing that states submit an EM&V plan.[28] EM&V plans will likely vary based on the EE activities conducted within the state, and will be customized to comply with state-level EERS or other requirements.

Before users register EE activities in a tracking system, they must conduct EM&V to quantify energy savings in conformance with their EPA-approved EM&V plan. Therefore, to facilitate trading between states using different EM&V approaches, a tracking system could allow users to upload their EM&V

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[27] U.S. Environmental Protection Agency. EPA Clean Power Plan 111(d) rules. June 18, 2014. 79 FR 34896, Page 34,896. Available online: https://www.federalregister.gov/articles/2014/06/18/2014-13726/carbon-pollution-emission-guidelines-for-existing-stationary-sources-electric-utility-generating#p-953

[28] Ibid. Page 34,920.

plans or to input key information from the EM&V plan, making them visible to potential trading partners. This would allow states interested in purchasing EECs to verify that the represented energy was saved, measured, and verified using state-approved methods.

Creating such transparency within the tracking system would facilitate trading by enabling purchasing states to quickly view key attributes associated with an EEC and determine if the certificate would be eligible for compliance within their state.

As this key attribute information would be available in a state's EM&V plan and available for review by states interested in purchasing EECs, it would not be essential to provide access to EM&V plans in a tracking system. As an alternative, two beneficial data fields could be included in the tracking system to allow potential purchasers to screen available EECs at a high level and determine their eligibility:

- **EM&V protocol indicator**: This function would tag each EEC with the protocol a program sponsor used to measure and verify the energy savings it represents. This provides a simple way for other states to determine if the saving measurement and verification protocols meet the requirements in their state, thereby rendering the certificate eligible toward their compliance goals.
- **Net or gross energy savings indicator**: States have different rules for reporting either net or gross energy savings.[29] The way in which savings are represented in an EEC will impact its trade cost and value. For example, an EEC representing net energy savings would not necessarily be a preferred purchase for a state reporting gross savings, as the certificate would undervalue the actual savings. Similarly, a state reporting net savings would likely not prefer to purchase an EEC that represents gross savings, as a portion of that certificate's value (i.e., the delta between net and gross savings) would not theoretically be eligible toward compliance in the state. As with the EM&V protocol indicator function, this function would allow for applying a tag to the EEC in the tracking system to indicate whether it represents net or gross savings, based on the EM&V methods used. This tag would be assigned when uploading EEC savings to the system, and would ensure transparency for states deciding whether individual certificates have compliance value in their state.

Tracking Progress Against the EE Component of the State Plan

The purpose of this beneficial feature is to allow WREGIS users to monitor the impacts of EE activities against the EE component outlined in their state plan. This feature would allow a state to calculate its progress towards the level of EE projected in its plan, and would require the following features:

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[29] Utilities in states with EERS are required to achieve EE targets, and must report the energy savings they achieve as either gross (the total estimated energy savings) or net (the energy savings that are adjusted to represent only those impacts directly attributable to the EE program or intervention). Net versus gross is further explained in section 0.

- **Calculate total EE impacts:** This function would display the state's anticipated EE contribution level identified in its state compliance plan, and would sum energy savings and/or emissions reduction impacts resulting from all EE activities registered in the system. Total EE savings could then be subtracted from anticipated EE savings to indicate a running tally of the state's progress.
- **Accounting adjustments**: As RECs are not counted towards a state RPS until retired, EECs for 111(d) would function the same way. This accounting adjustment function would apply retired EECs eligible for 111(d) to the state's progress against the level of EE projected in their compliance plans.

4.4.2 Comparison of Reviewed Systems to 111(d) Features

After identifying the essential and beneficial data fields and functions required for a viable 111(d) tracking system for EE activities, Cadmus developed a gap analysis to determine if each of these essential and beneficial fields and functions are present in existing systems. As Cadmus assumed 111(d) EEC tracking, trading, and reporting could function similarly to REC tracking, trading, and reporting within these existing systems, we compared the anticipated essential and beneficial data fields and functions to the fields and functionalities of WREGIS, PJM-GATS, NEPOOL GIS, NC-RETS, NAR, M-RETS, and MIRECS, even though only three of these systems have existing EE features.

Table 9 lists the data fields and functions that currently exist, fields or functions that are technically feasible but would require operational enhancements, and gaps.

Table 9. 111(d) and EEC Tracking System Gap Analysis*

111(d) Anticipated Features	WREGIS	PJM-GATS	NEPOOL GIS	NC-RETS	NAR	M-RETS	MI RECS
Territory	Multi-state	Multi-state	Multi-state	One State Systems	Multi-state	Multi-state Registry	One State Systems
Essential 111(d) Fields and Functions							
Account holder	x	x	x	x	x	x	x
Retirement status	x	x	x	x	x	x	x
Quantity of energy saved	x	x	x	x	x	x	x
Unique serial number	x	x	x	x	x	x	x
Vintage	x	x	x	x	x	x	x
Public reports	x	x	x	x	x	x	x
Transfer of ownership	x	x	x	x	x	x	x
111(d) eligibility	TF	TF	TF	TF	TF	TF	TF
Beneficial 111(d) Fields and Functions							
Calculate emissions avoided	TF	TF	TF	TF	x	TF	TF
Allow for certificate importing	TF	x	x	x	x	x	x
Allow for certificate exporting	x	x	x	x	x	x	x
Track interstate power transactions	GAP	GAP**	GAP**	GAP	GAP	GAP	GAP
EM&V protocol indicator	GAP	GAP	GAP	GAP	GAP	GAP	GAP
Net or gross energy savings indicator	GAP	GAP	GAP	GAP	GAP	GAP	GAP
Calculate EE impacts	GAP	GAP	GAP	GAP	GAP	GAP	GAP
Make 111(d) accounting adjustments	GAP	GAP	GAP	GAP	GAP	GAP	GAP

* In table, x indicates that the field or feature currently exists in the system; TF indicates that the identified system is technically feasible, but is not currently a system function (either comparable functions are offered in sister systems, or the system itself has a comparable feature); and GAP indicates that the feature is not currently part of the system.

** This function exists at the neighboring power pool level for NEPOOL GIS and PJM-GATS, but would need to be established at a state level to facilitate 111(d) compliance.

4.4.2.1 EE Gap Analysis Findings

The gap analysis shown in Table 9 reveals that all systems would require enhancements of essential and beneficial features for use in tracking, trading, and reporting 111(d) EE activities.

While only minimal WREGIS enhancements would be required for the essential 111(d) features, more substantial modifications would be needed to incorporate the identified beneficial features. This finding is supported by conversations with key stakeholders, including WREGIS and APX staff.

At the project outset, Cadmus and WIEB theorized that WREGIS could serve as a starting point to develop a system for 111(d) tracking, trading, and reporting since most Western Interconnection states already use it. Although the gap analysis indicates that NEPOOL GIS and PJM-GATS already contain many of the identified beneficial features for 111(d) tracking that would need to be added to WREGIS, it is likely more cost-effective for Western Interconnection states if the WREGIS were modified to include the beneficial features (replicated from NEPOOL GIS or PJM-GATS) than purchasing and using a new system. Cadmus did not identify prohibitive challenges to using WREGIS for this purpose. Therefore, the findings discussed in the sections below are focused on WREGIS.

Essential Features

WREGIS currently offers all but one of the identified essential features needed for EE tracking, trading, and reporting under 111(d). The only essential 111(d) feature WREGIS does not currently offer is an indicator to show 111(d) eligibility. As discussed, this essential data field would provide verification that certificates generated can be counted toward 111(d) compliance. Table 9 illustrates that WREGIS does currently offer the remaining essential features of account details, such as retirement status, the quantity of energy saved, certificate serial numbers, and vintage. APX further reported that the registry infrastructure in WREGIS and other systems can support tracking emission attributes for every MWh generated.[30] In addition, WREGIS already includes fields and functions to generate public reports and track certificate transactions and ownership details. As these fields and functions already exist in the WREGIS system, only minor modifications would be required to enable 111(d) compliance activity tracking and trading.

Though WREGIS does not currently offer an indicator to show 111(d) eligibility, the system already includes indicators for similar qualifications, such as California RPS, so has the technical capability to incorporate this feature with only slight modifications. This indicator appears on certificates created by eligible generators, and is used in California to confirm eligibility towards the state RPS. A 111(d) indicator would function similarly by illustrating an EEC's eligibility for 111(d) compliance. Similar tags could be used to indicate the certificate's eligibility for other uses, such as EERS.

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[30] APX. "Using Tracking Systems with the Implementation of Section 111(d) State Plans." October 2014. Available online: http://www.apx.com/wp-content/uploads/sites/9/2014/10/APXAnalytics_1_Section111(d).pdf

During discussions, APX and WREGIS staff indicated that this enhancement would require minimal effort and cost.

Gaps in Essential Features

There are no technological gaps in the WREGIS tracking system that would prevent it from being used to track and potentially trade EECs for 111(d) purposes, as the one outstanding essential feature (111(d) attribute) is technically feasible within WREGIS.

Beneficial Features

Of the beneficial features identified, one currently exists in WREGIS: the ability to track certificate exports to other tracking systems.

There are two beneficial features identified as technically feasible that are not currently included in WREGIS: calculating avoided emissions and tracking certificate imports (detailed in bullets below). While WREGIS does not currently have these beneficial features, comparable functions exist in WREGIS or sister systems and would therefore require minimal system enhancements.

- **Calculating Avoided Emissions:** This beneficial feature does not currently exist in WREGIS, but NAR offers this feature for generators eligible for specific programs. Including this feature in WREGIS increases the consistency of emissions calculations. Adding this feature would require a calculation function (using the average emissions or marginal emissions quantification approach) and selecting avoided emissions factors. NAR calculates avoided emissions using emissions inputs provided by the EPA for generators eligible for the Green-e Climate Protocol and EPA's Climate Leader's Protocol.
- **Tracking Certificate Imports:** WREGIS currently permits and tracks certificate exports and has the capability to permit certificate imports, but administrative decisions have excluded this option. As discussed, this beneficial feature would mitigate double counting from states that trade 111(d) eligible EECs with states in other regions or using other registries. Sister systems, including NEPOOL GIS, currently contain this functionality, and receive imported RECs to the recipient's active account.

Gaps in Beneficial Features

Cadmus identified three gaps between WREGIS and the beneficial features: tracking interstate power transactions, providing transparent indicators of EM&V and EE savings, and tracking progress against EE components of state compliance plans. These gaps would require enhancements to WREGIS for use in 111(d) compliance activity tracking and trading, but several features are available in sister systems and could be replicated in WREGIS.

- **Tracking Interstate Power Transactions**: Currently, WREGIS does not track energy imports or exports. Though the capabilities exist in NEPOOL and PJM-GATS for users to generate, reserve, and export certificates due to power transactions between neighboring power pools, they do not exist in any system, including WREGIS, at a state level. This function could likely be incorporated into WREGIS by replicating the applicable components from NEPOOL GIS or PJM-

GATS, but a larger enhancement would be required to modify the neighboring power pool model to enable multi-state trading. APX would need to provide further specifications regarding any potential development of this function.

- **Transparent Indicators of EECs:** Indicators showing how energy savings within an EEC have been calculated would allow states wishing to purchase EECs to verify that the certificate is an eligible compliance mechanism in its state plan. None of the current tracking systems include these indicators, which would show the EM&V protocol or savings calculation method used to measure and verify savings (including whether the EEC represents net or gross savings). Developing EM&V indicators in WREGIS would be similar to adding an e-tag field (or fields) to the EECs, and therefore falls within the WREGIS capabilities. However, APX would need to provide further specifications regarding any potential development of this function.
- **Tracking Progress Against EE Component of the State Plan:** None of the reviewed systems include the features to display, calculate, and adjust EE impacts against the EE level outlined in a state compliance plan. The effort to incorporate the fields and functions needed to offer these features could be minimal; however, the policy implications associated with various accounting adjustments could be significant and would require prior resolution.

4.4.2.2 Potential Costs of WREGIS Enhancements

WREGIS will require minimal enhancements, focused primarily on programming updates, to offer the essential feature of a 111(d) eligibility marker. WREGIS will require more substantial enhancements to offer the beneficial features of calculating avoided emissions and tracking certificate imports, interstate power transactions, and EE activity progress. To implement these enhancements, WECC and the WREGIS Committee would need to modify and customize fee schedules or adopt a new fee. Both APX and WREGIS staff reported that the cost to enhance software to facilitate 111(d) tracking would likely not present a significant challenge, should states pursue using WREGIS as a tracking, reporting, and trading mechanism for 111(d). WREGIS and APX would dictate the time and cost necessary for this work.

The WREGIS Committee would have to approve a fee increase or new fees for system modifications to accommodate 111(d) EE activities. This Committee, according to the director: "…works similar to state commissions. If new services are causing costs, then the Committee would look to account holders using that service to cover the bill. For 111(d) compliance we would anticipate a new fee rather than an increase." The majority of stakeholders noted that cost did not present a significant concern, as WREGIS fees have historically been very reasonable.

In addition to the technological requirements to enhance WREGIS to offer the essential (and, if requested, beneficial) features, there remain several policy considerations. Given that 111(d) is a draft and the EPA is processing upwards of 3 million public comments, the timing and specific compliance requirements remain unknown. Section 4.5 outlines the policy considerations in greater detail.

4.5 EE Policy Considerations

As mentioned, Cadmus identified multiple policy considerations that states must address in order to establish a tracking and trading system for 111(d) EE activities. Though not an exhaustive list of policy considerations relevant to 111(d) EE activities (nor do the descriptions present an exhaustive list of their permutations), states must consider these primary policy issues before trading under 111(d). In a partial multi-state modular approach, two or more states could agree on one or more aspects of a policy consideration and agree to work together in that area (but not have to agree on every aspect of all policy considerations). If states are looking to develop a full multi-state or even regional plan, then broad stakeholder agreements on these issues would likely be a complex and lengthy process, involving multiple state policy entities. In more extreme cases, policy considerations may have broader implications and require EPA guidance or agreements across every state in a region to establish features necessary for equitable tracking and trading. The first two policy considerations listed below are largely resolvable in WREGIS. However, the third policy consideration listed below presents a more complex issue that is not completely resolvable in WREGIS.

The primary policy considerations include:

1. Trading between states with inconsistent EEC definitions
    - This relates to the essential features outlined in section 4.4.1.1. The only essential feature not currently in WREGIS relevant to this policy consideration is a marker indicating that an EEC is eligible for 111(d).
2. States using varying methods to quantify emissions reductions from EE activities
    - This consideration is relevant to the beneficial feature of calculating avoided emissions. Emissions can be calculated in WREGIS or an external tool. In addition, emissions calculations are only necessary if a state chooses a rate-based approach and wants to apply emissions to the numerator to measure progress.
3. Mitigating the risk of double counting
    - For tracking *only* (not trading), this relates to the essential features of account details. If EECs eligible for 111(d) are defined the same way WREGIS now defines RECs (including all attributes), then WREGIS already has the features to address this consideration.
    - For tracking *and* trading, this consideration is the most complex of the proposed rule and it relates to the identified beneficial features of tracking EEC imports and exports, interstate effects, and accounting adjustments. It is the most complex because interstate effects are challenging to measure and can lead to double counting. In addition, trading between states that chose differing measurement approaches (rate-based or mass-based) is a challenging issue that cannot be resolved within WREGIS and thus additional policy discussions would need to take place to ensure double counting is prevented.

Section 4.5 provides context around each policy consideration, relevant comments on the draft rule and from interviews, and analysis and proposed solutions (where possible or the issue is not already resolved in WREGIS). As the proposed rule has not been finalized, these considerations, discussion, and proposed solutions should be considered a snapshot of current thinking on 111(d) issues. Proposed solutions involving EPA decisions may reflect the possible evolution of an issue upon the EPA releasing a final rule: they should not be considered recommendations to the EPA. The majority of interviewed stakeholders asked that their opinions remain anonymous, as they did not represent their state's official stance; therefore, comments are not attributed to specific people.

4.5.1 Policy Consideration 1: Trading Between States with Inconsistent EEC Definitions

EE is much more difficult to quantify than RE. Rather than directly measuring production at the generator, EE program sponsors must find ways to measure the *absence* of energy consumption resulting from a direct program or market intervention. Further complicating this, many different types of activities can produce energy savings, and those energy savings can be measured in multiple ways.

For example, in most states with EERS, utilities offer EE programs that target different customer sectors and segments and they use a range of incentives or other mechanisms to encourage the adoption of various EE measures and/or behaviors. Some states task utilities with achieving goals to earn incentives (or avoid penalties); others rely on third-party administrators to deliver EE programs, while some states have limited or no EE mandates. State or federal agencies and nonregulated entities may offer additional EE programs or market intervention activities (e.g., codes and standards, grants, loan programs), either alongside or as an alternative to utility programs.

Finally, no single, agreed-upon method exists for measuring savings that result from the many different ways of producing EE. Consequently, the EM&V requirements for EE programs vary considerably from state to state, with practices in individual states reflecting their programs' evolutions.

Sections 4.5.1.1 through 4.5.1.3 outline several specific factors contributing to the challenge arising from inconsistent EE definitions: lack of uniform EM&V protocols (including the timing of EM&V); net versus gross energy savings; and eligible EE measures for 111(d) compliance.

4.5.1.1 Lack of Uniform EM&V Protocols

Different states and even different utilities within a state can have broad approaches to EM&V in terms of baseline definition, required analytical rigor, frequency of analysis, data collection, and attribution methods. Historically, most EM&V has been focused on documenting total achieved savings, assessing the cost-effectiveness of efficiency compared to generation alternatives, and determining the utility's (or other program sponsor's) compliance with their regulated targets (along with any applicable incentives or penalties). Nearly all of the stakeholders Cadmus interviewed noted that an EEC must establish a value for something that did not occur (i.e., energy saved and emissions avoided). Thus, achieving consistency around measuring EE proves critical to establishing savings and other attributes associated with an EEC, as well as to determining its value and cost for trading (including defining a consistent currency for trading states), and determining how to handle issues of interstate effects and the potential for double counting.

Many stakeholders also raised concerns about ensuring that EM&V consists of similar (or at least transparent) approaches. States using different EM&V protocols could arrive at very different savings values for the same measure, thereby distorting the value of savings for trading. Many stakeholders reported that, due to the complexities of measuring EE, they found a robust EM&V process necessary. One commissioner commented, “EE has different measurement criteria [as compared to RE]; you need consistent rules between boundaries. Renewable energy is pretty easy but EE has different programs, EM&V, effective useful lives [that go into calculating savings], etc., and [in order to trade 111(d) EE credits] you will need everyone on the same page.”

One stakeholder raised a concern over the timing of EM&V, specifically noting that, as energy savings accumulate through the execution of a utility EE program, the lag in conducting EM&V (sometimes more than one year afterward) could impact the value of tradable certificate. This issue is further complicated when a mass-based state sells power to a rate-based state that sponsors EE programs. The reduction in emissions at the EGU in the mass-based state would occur in real time as the utility program in the rate-based state captures savings throughout a given program period.

The EM&V time lag could also present a challenge for tracking and trading EECs in a multi-state tracking system. Currently, WREGIS operates on a 90-day lag (i.e., certificates from any given month are produced 90 days later). A WREGIS user noted that this could pose an efficiency problem, as the EE intervention, EM&V of the resulting savings, and WREGIS’ internal checks would have to occur during that 90 days. Depending on the program and applicable measures involved, completing EM&V during this period may not be feasible.

One commissioner posed a question addressing the underlying EM&V timing concern: “What do you do down the road if you determine that the certificates were not verifiable?” Certificates for EE savings that are certified at the time of installation (and therefore not subject to verification) entail a value risk if the reported equipment is not installed or if it is installed incorrectly and does not operate at the reported efficiency level.

However, other stakeholders said that in a voluntary trading market, only those engaged in trading need agree on the value of a commodity being traded. In other words, a state interested in purchasing EECs only need to verify that the EEC meets its own regulatory need at an acceptable cost.

As comparing savings across states has not been a pressing need, little effort has been expended to establish consistent requirements, a consistent definition of EE, or consistency in EEC attributes. However, compliance with a federal mandate and the potential for multi-state coordination and trading of EE savings suggests a growing need to better understand and potentially standardize EM&V protocols.

4.5.1.2 EE Savings Quantification and Net Versus Gross

In states that have adopted EERS, regulators often require reporting net savings—or savings that can be directly attributed to a particular EE program. In other words, a consumer must have been directly influenced to purchase and install an energy efficiency measure in order to receive an incentive. Gross energy savings, on the other hand, represent the total energy saved from all program-incented measures, regardless of the incentive's influence on the consumer's decision to install the measure.

Net savings designations are used to calculate fair utility cost recovery and the attribution of costs to ratepayers. However, 111(d) does not address cost recovery; therefore, the attribution of savings to the program intervention should not be necessary. Instead, the use of gross savings will accurately capture total energy saved, enabling an accurate calculation of total emissions reduced—the purpose of 111(d). Further, the use of gross savings is much more simple: the EM&V methods for determining gross (direct) energy savings for EE projects are well documented and relatively standardized. There is much less industry agreement regarding the appropriate value and methods for estimating net savings.

However, there is a challenge in determining the effect of net versus gross savings on the value of an EEC. The differences between jurisdictions in reporting net versus gross program savings could have implications for trading between states that define savings differently: the quantity of energy savings represented in an EEC can be substantially different when calculated as net versus gross states.

Among the states in the Western Interconnection, considerable variation exists regarding how utilities report energy savings. Different states have established rules for reporting net or gross savings from their energy efficiency programs, and continue to debate whether the EPA should accept net or gross EE savings for 111(d) compliance. Some states argue that emissions reductions should be claimed, regardless of whether they resulted from 111(d) compliance efforts, whereas others say net saving should be used to remain consistent with IOU regulations and reporting.

4.5.1.3 Eligible EE Measures

To properly plan for 111(d) compliance, states must know the types of programs and measures that can be counted toward compliance. Several states have requested clarity on eligible EE programs and measures. Some states commented on specific EE activities that should be considered allowable under 111(d), including codes, standards, demand response, market transformation, and distribution system improvements,[31] as well as regional market transformation efforts, behavioral programs, and state and

[31] Oregon Department of Environmental Quality. *Docket ID: EPA-HQ-OAR-2013-0602*. Page 16. October 16, 2014. Available online: http://www.deq.state.or.us/aq/climate/docs/epaLcomment.pdf
Colorado Department of Public Health and Environment et al. *Comment submitted by Larry Wolk, Executive Director and Chief Medical Officer, on the Environmental Protection Agency (EPA) Proposed Rule: Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units.* Page 6. December 1, 2014. Available online: http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2013-0602-22856

federal appliance standards.[32] One stakeholder said: "Uncertainty over the types of programs that can contribute toward energy efficiency may result in lost opportunities or delays in programs that provide significant cost savings to customers, as well as reduce energy consumption and emissions."[33]

Most states with existing EERS require utility DSM efforts to be cost-effective at either a program or portfolio level, but allow utilities wide latitude to offer any efficiency measure or intervention strategy within this requirement. Assuming the EPA allows for similar broad flexibility in eligible EE measures, states will likely revert to their EERS protocols. A tracking and trading system could include a marker indicating the source of EE savings (e.g., specific project and/or measure type) represented in an EEC, allowing trading partners to purchase only those EECs that are compliant with their state EERS.

4.5.1.4 Potential Solutions

To develop a comprehensive tracking and trading system that ensures an EEC represents consistent attributes and value, policy makers in each state within a trading region (e.g., the Western Interconnection states) would need to agree on the policy considerations described above. In other words, stakeholders must agree to common EM&V protocols, timing, attribution (i.e., net or gross savings), and eligible measures. Although a range of industry accepted approaches have been peer-reviewed and accepted as best practice by several states, these existing protocols emphasize different measurement methods and many include customized calculations to account for local conditions (these are described in Appendix I). For example, roughly one-half of U.S. states have formally adopted EM&V protocols; these include five of the 11 states within the Western Interconnection: California, Idaho, Montana, Oregon, and Washington.[34] However, only three of the five states use a common approach.

A common definition of an EEC would establish a simplified, level playing field to allow states to buy and sell EECs that represent consistent attributes and value. However, in a voluntary trading market, it is not necessary to establish a common unit of trade, as long as the tracking system can be developed to provide transparent information of each EEC's composition.

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32 State of Washington. Office of the Governor. *Comments on the Environmental Protection Agency's Proposed Clean Power Plan for Existing Power Plants under Section 111(d) of the Clean Air Act.* Page 19. December 1, 2014. Available online: http://www-dev.governor.wa.gov/sites/default/files/documents/State_of_Washington_Comments_EPA.pdf

33 State of Nevada. *Comment submitted by: Colleen Cripps, Ph.D., Administrator, Department of Conservation and Natural Resources, Nevada Division of Environmental Protection; Carolyn Tanner, Esq. General Counsel, Public Utilities Commission of Nevada; and Paul Thomsen, Director, Nevada Governor's Office of Energy on the Environmental Protection Agency (EPA) Proposed Rule: Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*. Page 29. November 24, 2014. Available online at: http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2013-0602-22723

34 In states within the Northwest Regional Technical Forum (RTF; Idaho, Montana, Oregon, and Washington), the protocols apply mainly to public utilities that receive EE funding from the Bonneville Power Administration.

States wishing to trade certificates could agree to a common definition of a savings unit, established through bilateral or multilateral agreements, or simply agree to a certain value for each given EEC based on its relative composition. For example, the cost of an EEC could reflect an agreed-upon value in a compliance scenario, partly based on the methodology and rigor level applied to the evaluation. An EEC tracking and trading system with a high level of built-in transparency could facilitate such bilateral state trading with an established set of tags or markers that enable states to quickly assess a potential trading partner's EEC and by setting the cost of a certificate based on a range of defined value parameters.

Further, it is likely the EPA will rule on some or all of these issues in the final 111(d) rule, which would resolve some or all of these concerns. In the draft rule, the EPA stated it would develop guidance on acceptable EM&V methods in the final rule, thereby allowing states to incorporate EE into their state plans.[35] Thus, the EPA will likely establish some basic definitions to help resolve inconsistencies around EECs, such as eligible measures and acceptable minimum EM&V standards.

4.5.2 Policy Consideration 2: States use Varying Methods to Quantify Emissions Reductions

As the state goals under 111(d) are expressed as tons of emissions for mass-based states and as pounds of emissions/MWh for rate-based states, the way states calculate emissions reductions resulting from EE activities has significant policy implications. This challenge stems from multiple approaches to quantifying emissions. The EPA may dictate an acceptable uniform quantification method, but has not indicated an intention to do so. In the proposed rule, the EPA references several potential emissions quantification methods, but does not indicate that states must use one of these methods nor specify which method they should use.

The EPA identifies emissions quantification approaches[36] that range in complexity and include:

- An average emissions rate approach, which uses average emissions rates from sources such as eGRID to estimate avoided emissions for a region or sub-region. This is the easiest and least cost method for calculating avoided emissions and can be readily incorporated as a beneficial feature in WREGIS.
- A marginal emissions rate approach, which is supported by tools such as AVERT. This approach represents the specific emissions rate of EGUs that are most likely to be affected by the emissions reductions in a given state or region. It offers a more accurate method for calculating

[35] Federal Register. Vol. 79 No. 117. Part II. EPA. 40 CFR Part 60. *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Proposed Rule*. June 18, 2014. Available online: https://www.federalregister.gov/articles/2014/06/18/2014-13726/carbon-pollution-emission-guidelines-for-existing-stationary-sources-electric-utility-generating

[36] U.S. Environmental Protection Agency. *TSD: State Plan Considerations*. Pages 24-31. June 2014.

avoided emissions using either estimated marginal emissions rates or modeled emissions rates, though at a greater cost than the average emissions rate approach.

- An electricity sector modeling approach, which is more complex and entails quantifying avoided emissions through retrospective modeling. In this approach, actual realized EGU emissions generated are compared to projected emissions that would have occurred without the EE activities. The model can be set to different look-back periods—long term or short term—and to simulate changes to the “build margin,” such as whether new generating capacity will be added in the future. This is the most accurate, but also the most difficult, approach to implement. Cadmus did not identify this approach as a beneficial function in the gap analysis because it is not likely to be feasible within a tracking system due to its complexity.

If states are allowed to use different emissions quantification methods, the chosen method will affect the volume of emissions reductions resulting from the same EE activity. In other words, if two states implement the exact same EE project, under identical conditions, but measure the emissions impacts differently, the resulting emissions that each state could claim toward compliance could be vastly different.

In interviews, stakeholders generally did not express strong opinions regarding which of these approaches states should use; however, several cited the related consistency as a significant concern. One air regulator said, while he did not have an opinion favoring a method, consistency would be important so “you know a ton is a ton is a ton.” If the EPA does not dictate a specific quantification method, states that plan to use a rate-based approach and apply emissions reductions from RE activities to the numerator will need to propose a method in their state plans for EPA approval. To ensure a level playing field, at a minimum, it will be important that states maintain transparency in these calculations.

Although this represents a significant policy question for the EPA and states as they consider compliance and reporting options under 111(d), the method or methods used to quantify emissions do not represent a significant challenge to tracking system functionality.

4.5.2.1 Potential Solution

As noted in section 4.4, including emissions quantification functionality in the tracking and reporting system is a beneficial feature that would enable states to track EE emissions impacts against the level of EE projected in their state plan, rather than simply tracking EE savings. From a technological perspective, programming emissions quantification functionality into WREGIS or another tracking system can entail varying levels of complexity (depending on the approach chosen), but remains within the systems’ capabilities. Furthermore, using a centralized system such as WREGIS would not necessarily require users to agree upon a common GHG quantification approach. Alternative methods could be programmed into a system, allowing states to select the relevant approach and claim the resulting emissions reduction against the EE component outlined in their state plan.

While it will be important for states to identify an equitable approach to quantifying emissions for tracking compliance against their 111(d) goals, such considerations are outside the scope of this study. If stakeholders agree that adding emissions quantification functionality to a tracking system is desirable, and they choose an average emissions approach, then users will need to agree on a common source of emissions factors. For example, eGRID provides average, regional emissions factors. If states opt to use the marginal emissions rate calculation approach, they must agree on appropriate parameter values based on EGUs affected and their marginal emissions rates.

The benefits and costs of incorporating this function will vary based on the emissions calculation approach selected, and states must determine whether the cost of these system modifications represents a worthwhile investment.

Alternatively, these calculations can take place outside a tracking, trading, and reporting system using a tracking system such as eGRID or AVERT. The EPA's AVERT tool offers peer-reviewed and accepted calculation parameters that balance simplicity and precision. States that want to convert their RE impacts into emissions can use AVERT as a centralized module.

4.5.3 Policy Consideration 3: Mitigating the Risk of Double Counting

Double counting is a critical policy consideration for implementing 111(d). It occurs when energy savings impacts are claimed by more than one entity or claimed for more than one purpose. Double counting in the context of 111(d) can arise from the following primary factors:

1. **Ownership of environmental attributes**: In situations in which EE impacts occur in one state but a different state invests in the EE activity, there is potential for both states to claim ownership of the EE.
2. **Interstate effects in states with mass-based versus rate-based compliance approaches**: When one state has opted for a mass-based measurement approach and another uses a rate-based approach, the potential for double counting is high. In addition, power markets do not align with state borders, and EE programs can create impacts in a state that did not sponsor those programs, creating trading complexity.
3. **Dual Compliance**: In states with an existing EERS in place, energy savings resulting from EE programs and initiatives will likely be counted toward compliance in both regulations.

Sections 4.5.3.1 through 4.5.3.3 explore these issues in greater detail.

4.5.3.1 EE Ownership

The issue of who owns an EEC, the program sponsor or the entity where the impacts occur (in cases where they are different) has vast implications in interconnected grids where EE programs in one state can affect EGUs in other states. Determining the ownership of saved energy, accurately measuring the impacts, and ensuring that savings are claimed by the rightful owner are all crucial to mitigating double counting and establishing a platform where EE trading is possible.

As part of the state plan development process, states must identify how they expect to claim EE emissions impacts. Few states have explicitly commented on the issue of ownership of EE impacts and the associated emissions reductions, but those that have agreed that the program sponsor should claim credit. A stakeholder from Washington said they "support a consistent compliance approach where the state that implements EE measures claims equivalent emissions reduction benefits in its state compliance plan. Allowing the state that implemented the EE program to claim the savings and emission reductions is consistent with the approach the EPA took when it calculated building block 4 savings."

Because this is a developing policy area, there are currently no established rules within existing tracking systems regarding certificate ownership; however, in all three of the systems Cadmus reviewed, initial ownership is granted to the administrator of the EE program for which certificates are generated, consistent with the approach suggested by stakeholders. In a 111(d) environment, it is likely that users will be allowed to transfer certificate ownership through purchase and that any certificates submitted for 111(d) will be retired in order to demonstrate compliance (as is the case with RECs used for state RPS compliance).

Because the assignment of ownership entails similar issues for RE and EE, users of WREGIS and other existing tracking systems have largely implemented methods for accounting and tracking ownership rights within the system. The stakeholders Cadmus interviewed indicated that similar accounting functionality could be incorporated into a tracking system for EECs.

4.5.3.2 Interstate Effects Between States with Mass-Based and Rate-Based Compliance Measurement Approaches

The EPA has proposed to allow states two different ways to measure progress towards their state goal: a mass-based or a rate-based approach. States that choose a mass-based approach adopt a cap on their overall tonnage of CO_2 emissions, and monitor compliance by directly measuring emissions at the EGU stack. States that choose a rate-based approach measure emissions reductions as the quantity of CO_2 per MWh of electricity generated for affected EGUs. While rate-based goals can accommodate increases in generation due to increased demand, mass-based goals are more simple to measure. EEC trading between states that have adopted differing measurement approaches is complicated and introduces a high potential for double counting.

Because power markets are not contained within state boundaries, generator states can be influenced by EE activities sponsored in states that import their power. When one state implements EE activities that affect emissions in a neighboring state, both states may have a legitimate claim to the certificate. A corollary challenge, although less likely, could result if one or both states underreport EE impacts due to uncertainty about ownership rights. Allowing states to opt for different measurement approaches further complicates this issue and introduces significant challenges. Even in the absence of trading, when a state that imports power implements 111(d) compliance activities that impact generation in an exporting state that has chosen the alternative measurement approach, it can introduce the potential for double counting.

To illustrate this challenge, State A could choose a mass-based goal, implement compliance activities within its borders, and measure emissions reduction at the EGU stack to determine and report compliance with 111(d). However, if State A exports power to State B, which implements EE activities, State B could legitimately claim ownership of emissions reductions resulting from EE compliance investments in its own state.

If every state in the Western Interconnection chooses to use a mass-based approach, there would be no need to track EECs for 111(d) purposes, since all compliance measurement would take place at the EGU. If every state in the Western Interconnection chooses to use a rate-based approach, double counting could be avoided by ensuring that the 111(d) attributes (MWh or avoided emissions) of each EEC are only used in one state, by one entity, and could be tracked in a regional system such as WREGIS. The challenge arises when states that choose different measurement approaches wish to trade EECs for 111(d).

These challenges are beyond the capabilities of a tracking system to resolve. Therefore, states will need to engage in policy discussions to formulate an equitable approach to allocating EE impacts. In addition, states that trade with a state that has adopted a different measurement approach will need to engage in policy discussions to mitigate double counting.

4.5.3.3 Dual Compliance: State EERS and 111(d) EE Compliance

The draft rule suggests that EE activities implemented to comply with EERS may also qualify as 111(d) compliance activities. The EPA does not appear to limit the use of EE savings to comply with both state level regulations and 111(d) requirements, providing this example: "… new demand-side EE measures installed in 2015 or later to meet an existing, on-the books energy efficiency resource standard (EERS) would be a qualifying measure. However, only MWh savings beginning in 2020 and related avoided CO2 emissions could be applied toward meeting a required rate-based emission performance level."[37]

However, some state EERS rules may include provisions that energy savings created to comply with the EERS cannot be used for other regulatory compliance purposes. Therefore, policy makers in states with these limits in place may need to re-evaluate their state-level policies to enable dual compliance with 111(d) to avoid being burdened with significantly higher compliance requirements than other states.

4.5.3.4 Potential Solutions

In the draft rule, the EPA proposed several ways to avoid double counting and requested stakeholder comments on this issue, but fell short of issuing definitive guidelines. It is expected that EPA will ask states to identify how they will avoid double counting in their state plans, then will approve or reject states' proposed approaches based on their consistency with the rule. As discussed above, a regional tracking system, such as WREGIS, can be used to assign clear ownership rights from generation to retirement by applying a marker to each EEC that documents its ownership rights, regulatory eligibility (e.g., for EERS, 111(d), or other compliance needs), and retirement status. WREGIS currently includes this type of functionality for RECs. To ensure accountability and accuracy, these markers would need to entail transparent documentation and access to the data each state used to make these determinations.

[37] 79 Federal Register. (Page: 34919).

States should carefully consider the potential impacts of interstate effects when selecting a mass-based or rate-based measurement approach and, as suggested by EPA in the proposed rule, develop a method to mitigate double counting or under-reporting of EE in their state plans. The simplest way to address the interstate effect challenge would be for all states within an interconnected power grid to agree on a consistent measurement approach and submit regional plans to the EPA that clearly define how interstate effects will be determined and how EE savings will be allocated between states based on their net power imports and exports. However, the flexibility built into the 111(d) rules makes this approach unlikely.

To some extent, a tracking system can be used to address the effects of interstate power trading by adding beneficial features that track imports and exports. The EPA has proposed that states can adjust impacts to account for reduced emissions at EGUs affected by the implementation of EE measures or programs in other states.[38] However, due to the complexities associated with interstate power markets and with accurately calculating the impacts of interstate effects on the composition and value of an EEC, fully resolving this issue is beyond the capabilities of a tracking system.

This issue is paramount for states wishing to trade EECs for 111(d) purposes. In order to ensure equitable valuation of EECs and accounting of impacts against the level of EE projected in a state's plan, trading states with differing measurement approaches must collaborate to ensure the prevention of double counting. For more information on the complexities of rate- and mass-based measurement approaches see the literature review sources in Appendix A.

[38] U.S. Environmental Protection Agency. *TSD: State Plan Considerations*. Pages 84-96. June 2014.

5 Re-Dispatch Strategy Compliance Scenario Analysis

Section 111(d) outlines re-dispatch under building block 2, serving as a key policy tool that states may use to attain emissions reductions. EPA defines re-dispatch as “coal-to-gas” and defines proposed capacity factor values as reasonable natural gas combined cycle (NGCC) utilization ceilings. The EPA used these ceilings in calculating state goal adjustments related to re-dispatching coal. Notably, building blocks are not goals, but rather serve as a means for the EPA to assess emissions reductions potential.

Cadmus investigated the feasibility of achieving the EPA targeted capacity factors through an integrated planning model strategy. The re-dispatch strategy compliance scenario analysis demonstrated the opportunity of re-dispatch of coal and natural gas units using a two-state approach based on publicly available data. Primarily, we sought to quantify the re-dispatch contribution, interpreted as the maximum amount of coal displacement to NGCC.

The flexibility afforded under 111(d) allows states to pursue compliance paths deemed as the most cost-effective. The state’s buy-versus-build economics determine whether a particular compliance path proves cost-effective.

For this analysis, Cadmus defined buying as procuring energy from a lower emitting resource outside the state, and defined building as pursuing the development of a lower emitting resource inside the state. When taken in isolation, a coal-dominated state can use three options to re-dispatch its coal plants:

- Buy NGCC energy from another state by pursuing a multi-state approach;
- Build a new NGGC plant; and/or
- Pursue another compliance strategy, such as one of the other building blocks, in tandem.

Re-dispatch presents one compliance option. A state’s buy-versus-build economics primarily depend on fuel prices, RE obligations, and the resource mix. Cadmus’ analysis indicates that re-dispatch should be considered as part of a least-cost, integrated resource planning strategy, relative to the following conditions:

- Outside-the-state options;
- Inside-the-state build options; and
- The benefit/cost of pursuing heat rate improvement (HRI), RE, and EE.

The multi-state solution offers tangible economies for compliance, and is mutually beneficial. It is more cost-effective for state B than the build and more profitable options for state A in terms of gains in producer surplus. Relative to the multi-state base case, the two state collaborative approach yields greater reductions than the sum of the two single-state re-dispatch strategies.

5.1 Introduction

For this compliance scenario analysis, Cadmus sought to demonstrate how re-dispatch of coal and natural gas units can inform a multi-state 111(d) strategy. Analysis goals include:

- Determining the maximum reapportionment feasible; and
- Quantifying the benefit/cost of pursuing this strategy.

Section 5.2 provides a detailed examination of compliance costs resulting from re-dispatch, but is not a complete comparison of different building block strategies. The findings (section 5.3) and other considerations (section 5.4) provide decision support at the state and federal levels.

5.2 Approach

Cadmus used its Resource Portfolio Strategist, a transparent and flexible long-term resource planning tool, to model several coal and natural gas unit re-dispatch scenarios in testing feasible reapportionment in a two-state scenario. We used publicly available data to create resource, market, and load input arrays for each state and joint scenario, then dispatched the least-cost mix of resources to meet the independent and joint system loads. (Appendix I provides further detail on model treatments and data sources.)

5.2.1 Capacity Addition Paths and Resource Attributes

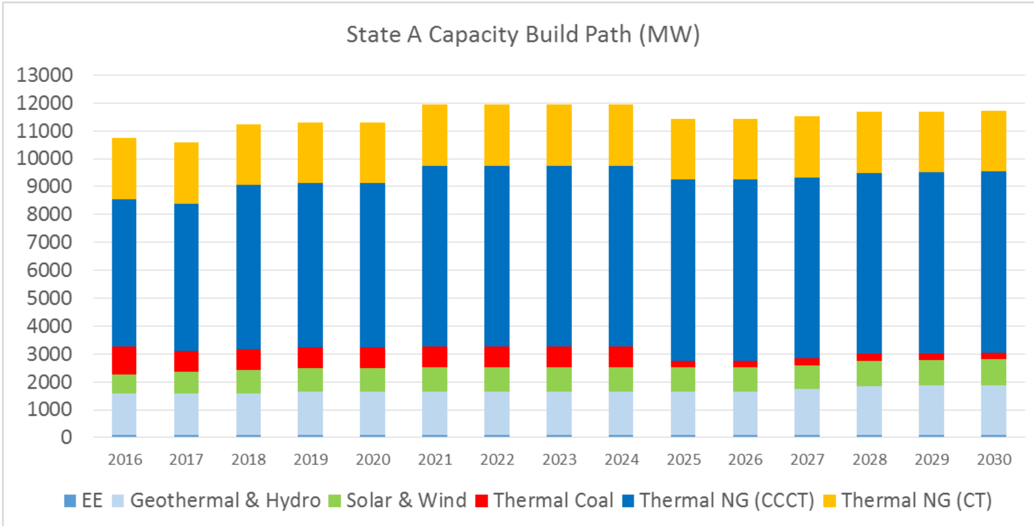
Cadmus reviewed a selection of candidate states that primarily depend on the degree that their relative resource mixes prove complementary; this allowed us to explore the variety of viable compliance options available to each candidate and the synergies that might occur between them. Additionally, Cadmus adopted the EPA's Integrated Planning Model (IPM)[39] load shapes, which are based on regional designations that do not necessarily align with state boundaries, so the choice of candidate states also depended on how closely their boundaries matched the IPM region.

As shown in Figure 6, State A possesses a diverse resource mix, planned capacity additions totaling 1,200 MW of NGCC by 2021, and RPS-mandated annual solar and geothermal resource additions totaling 260 MW and 255 MW, respectively, by 2030. State A also has 750 MW of coal retirements planned by 2025.

[39] The EPA applied ICF International's IPM to calculate state goals for 111(d).

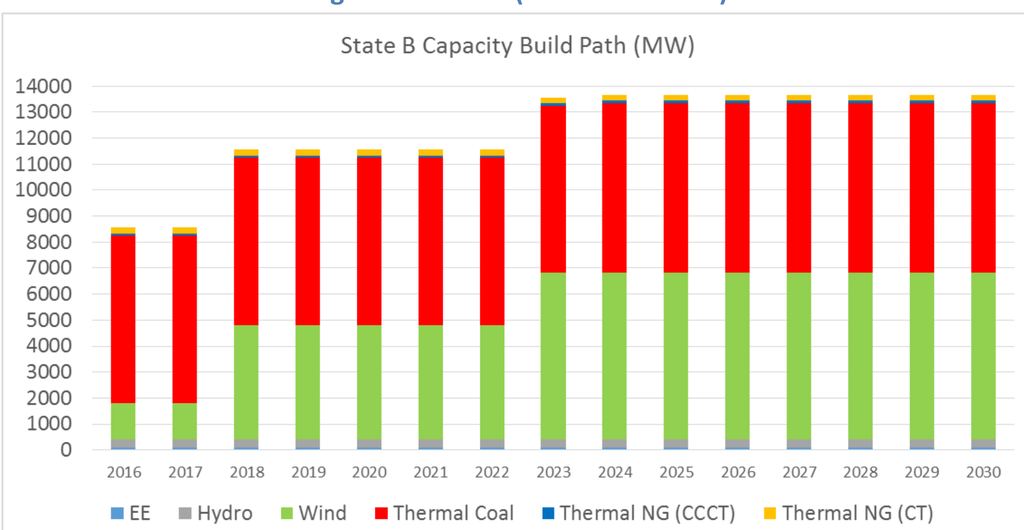
EPA Power Sector Modeling Platform v.5.14, Retrieved from: http://www.epa.gov/powersectormodeling/

Figure 6. State A (Diverse)



As shown in Figure 7, State B possesses a coal-dominated resource mix, attributing 75% of its electric capacity to coal at the outset. State B also has planned capacity additions totaling 5 GW of wind by 2023, though this capacity is expected to be exported. Further, State B has very low coal prices due to the generation's close proximity to coal mines. Thermal NG (CCCT) denotes a natural gas combined-cycle combustion turbine, while Thermal NG (CT) denotes a typically far less efficient natural gas simple-cycle combustion turbine.

Figure 7. State B (Coal Dominated)



5.2.2 Methodology

Cadmus tested the hypothesis that a multi-state re-dispatch strategy could prove beneficial in the context of a state's independent compliance choices. Primarily, we sought to quantify the re-dispatch

contribution, interpreted as the maximum amount of coal displacement to NGCC. Such ramping down of coal and ramping up of NGCC is known as the *max potential*.

5.2.2.1 Scenario Analysis

Cadmus first established a base case for each state, including all new and existing resources. New resources include all plants referenced in respective state utility integrated resource plans (IRPs) and, per the EPA, any resource under construction after January 8, 2014. Subsequently, Cadmus used an iterative process to quantify the max re-dispatch potential for the single-state and multi-state options, then quantified and compared buy versus build options for the coal-dominated State B.

Cadmus constructed the scenarios presented in Table 10 to demonstrate the interplay between single-state and multi-state and the cost-effectiveness of options available for complying with proposed emissions guidelines. Cadmus constructed multiple multi-state re-dispatch scenarios each with differing coal capacity factors ("Coal CF"). The multi-state scenarios are denoted (5) through (2) to represent the increase in coal MWh re-dispatched from the maximum (6) to the minimum (1) re-dispatch case.

Table 10. Alternate Paths

Scenario	Description
State A 2012 Base Case + New	The as-is case for an independent state
State A 2030 Re-dispatch	Block #2 Maximum Potential
State B 2012 Base Case + New	The as-is case for an independent state
State B 2030 Re-dispatch	Block #2 Maximum Potential
State B 2030 Re-dispatch Build NGCC	Block #2 Maximum Potential + 500 MW NGCC
State B 2030 Re-dispatch Build RE	Block #2 Maximum Potential + 500 MW Wind
Multi-State 2012 Base Case + New	The as-is case for the states in aggregate
Multi-State 2030 Re-dispatch—max (6)	Block #2 Maximum Potential w/ Coal CF 0.18
Multi-State 2030 Re-dispatch (5)	Block #2 Maximum Potential w/ Coal CF 0.24
Multi-State 2030 Re-dispatch (4)	Block #2 Maximum Potential w/ Coal CF 0.29
Multi-State 2030 Re-dispatch (3)	Block #2 Maximum Potential w/ Coal CF 0.35
Multi-State 2030 Re-dispatch (2)	Block #2 Maximum Potential w/ Coal CF 0.40
Multi-state 2030 Re-dispatch—min (1)	Block #2 Minimum Potential w/ Coal CF 0.45

5.3 Key Findings

Cadmus performed a detailed examination of compliance costs due to re-dispatch by taking two sequential steps:

- First, we quantified the re-dispatch contribution (or max potential with respect to ramping down coal resources), representing the minimum coal capacity factor and, therefore, the max re-dispatch. (See Appendix C for a comparison of scenarios.)
- Second, Cadmus compared the max potential scenarios to alternative multi-state and build scenarios to determine which path proved most cost-effective.

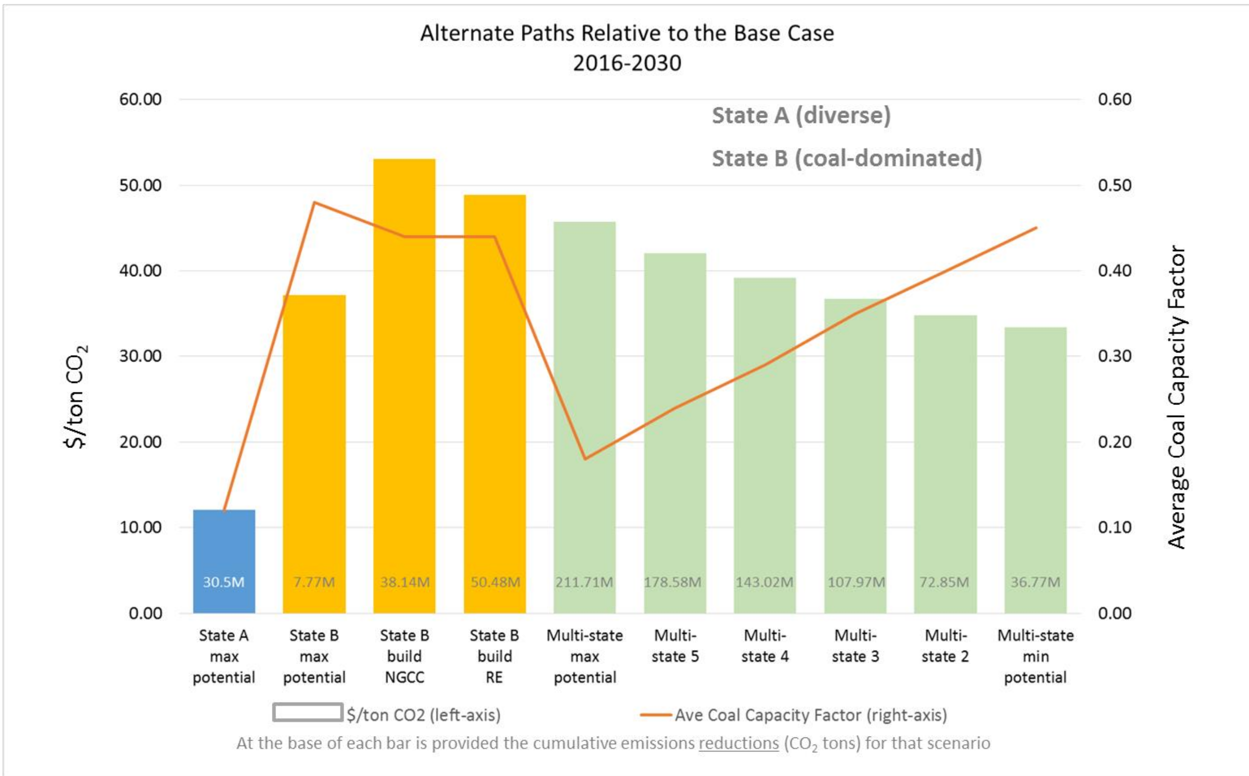
5.3.1 Results Summary

The analysis produced the following results:

- On a single-state basis, State A and State B max potential scenarios yielded cumulative 2016–2030 emissions *reductions* of 14.1% and 1.6% (or 30.5 million tons of CO2 and 7.7 million tons of CO2), respectively, relative to the base case by pursuing a re-dispatch strategy in isolation.
- On a single-state basis, State A and State B max potential scenarios realized *increased* total operating costs of 1.6% and 1.8% (or $368 million and $289 million), respectively, relative to the base case by pursuing a re-dispatch strategy in isolation.
- On a multi-state basis, the analyzed states joint max potential yielded cumulative 2016–2030 emissions *reductions* of 30.3% (or 212 million tons of CO2) relative to the base case by pursuing a re-dispatch strategy in isolation.
- On a multi-state basis, the analyzed states realized an *increase* in aggregate total operating costs to achieve the max potential reduction of 24.3% (or $9.7 billion) by pursuing a re-dispatch strategy in isolation.
- For State B, a multi-state approach to re-dispatch proved more cost-effective than a single-state approach at moderate coal ramp-down levels; the collaborative strategy offered the optimal re-dispatch compared to build options.
- For State B, pursuit of a build strategy resulted in more costs per ton of CO2 for a lesser reduction in cumulative emissions relative to the multi-state approach.
- The multi-state approach led to significant gains in producer surplus for State A due to transfers of wealth implicit in the re-dispatch trade; however, partaking in a multi-state compliance partnership actually increased State A's emissions due to increases in its NGCC generation.
- One state will realize a compliance benefit through reduced emissions, and the other state will realize a monetary benefit through increased sales.

Figure 8 compares the single-state and multi-state max potential scenarios and the State B build scenarios.

Figure 8. Re-Dispatch Scenarios Relative to Base Case



In Figure 8, the left-axis represents the imputed carbon price ($/ton CO2) per scenario, shown as vertical bars. The blue bar represents State A's max potential (the maximum amount of coal displacement to NGCC); the orange bars represent State B's max potential and build scenarios; and the green bars represent the multi-state aggregate scenarios. All scenarios are provided relative to their respective base cases.

The right-axis represents the average coal capacity factor from 2016 to 2030 for each scenario. Additionally, to aid comparisons, the base of each bar shows the cumulative emissions (CO2 tons) for the scenario.

The State A max potential bar, State B max potential bar, and multi-state max potential bar represent the max re-dispatch potential for each state, if acting independently and in aggregate. That is, given their respective resource mixes, these bars represent the max coal resource ramp-down feasible to still meet system load.

For example, State A has a max re-dispatch potential of 30.5 million tons of CO2, achieved when coal resources converge to an average capacity factor of 0.12, and at a cost of $12.10 per ton of CO2. The two additional orange bars represent the addition of 500 MW of new-build NGCC and wind RE, respectively. The additional multi-state scenarios represent the economic dispatch of aggregate resources at increasing coal capacity factors.

5.3.2 State Perspectives

In both the single-state and multi-state scenarios, the replacement of lower-cost, higher-emitting resources with higher-cost, lower-emitting resources primarily drives the increase in total operating cost and the reduction in emissions. The impact of this re-dispatch from lower-cost resources to higher-cost resources becomes most apparent in the multi-state scenario, where State A NGCC generation replaces State B coal generation. The re-dispatch of State B coal generation—at a fuel cost of $0.91/MMBtu to State A NGCC generation at fuel cost of $5.236/MMBtu—drives this impact.

Under a multi-state approach, states agree to comply as a joint body, file a joint/multi-state plan to the EPA, and share the cost and deployment of compliance activities. The multi-state scenarios do not account for benefits to State A in pursuing a multi-state approach. Rather, the multi-state scenarios account for the increase in costs due to shifts from State B coal to State A NGCC (if the two states complied jointly).

State A has the technical potential to generate additional NGCC generation and sell it to State B, thereby realizing a monetary benefit that offsets its compliance costs. In other words, the multi-state approach leads to significant gains in the producer surplus for State A due to the transfer of wealth implicit in the re-dispatch trade. State A, however, increases its emissions by partaking in a multi-state strategy as it produces more NGCC generation.

State B faces a buy-versus-build decision. It may buy energy from State A to pursue one of the multi-state scenarios, probably multi-state scenario 2, as that scenario reduces an equal amount of emissions as the State B max potential for a lower price per ton of CO2.[40]

Alternatively, State B could explore local options and pursue the construction of a 500 MW NGCC or 500 MW of wind. A variety of regulatory and construction risk factors will influence the decision to build, but the analysis indicates that both build options are less cost-effective than a multi-state re-dispatch option.

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40 Comparing the State B maximum potential scenario to a joint scenario proves valid; increased operating costs result almost entirely from State B's procurement of lower-emitting NGCC over its coal generation. At the outset, 1.990 GW of coal make up State A's resource mix, while 13.042 GW make up State B's mix.

5.4 Other Considerations

As the proposed rule remains in draft form, and the EPA is currently reviewing comments, these policy issues will likely evolve. The conclusions drawn here illustrate policy challenges as they currently stand. The following is a list of other considerations that arose when examining the potential of re-dispatch:

- Net export states, with high coal and low NGCC capacity, have limited capability to reduce emissions through building block 2, especially in light of ambiguity regarding whether the credit for new renewables does or does not redound to the benefit of the state in which those resources are located.
- An industry-wide increase in demand for NGCC generation may result in increased demand for natural gas. This may increase the price of natural gas, altering the economics of a re-dispatch strategy.
- If coal resources are no longer used, this would affect a utility's ability to recover costs on such rate-base assets. Given the remaining useful lives of such plants, some asset value erosion would likely occur (and is not currently accounted for).

5.4.1 Scenario Comparison

Cadmus did not assess the allocation per state of costs and benefits borne under a multi-state approach. However, accounting for coal retirements and assumed resource capacity factors, 96% of the coal displacement would be attributed to State B. Therefore, the State B max potential scenario relative to a multi-state scenario remains a valid comparison.

Comparing State A's max potential to a multi-state scenario proves dimensionally faulty for two reasons:

- First, Cadmus sought to model the max potential for re-dispatch and not to model multiple scenarios of like emissions reductions.
- Second, the multi-state scenario does not account for monetary benefits afforded to State A for the increase in emissions due to further deployment of its NGCC resources. This benefit represents a large negative operating cost for State A.

Consequently, it is not accurate to sum the costs and emissions in the State A scenario and compare them to the costs and emissions in aggregate.

However, a comparison of the multi-state base to the multi-state max potential, and to the multi-state additive case (or a sum of the independent max potential cases) reveals that the two-state collaborative approaches yield greater reductions than the sum of the two single-state re-dispatch strategies (see Appendix C). For example:

- When states A and B pursue re-dispatch on their own without collaboration, they are able to reduce CO2 emissions by 3.3 million tons to 38.9 million tons in 2025. The average system power cost in this scenario is $45.47 per MWh.
- When states A and B pursue re-dispatch on a joint or collaborative basis, they are able to reduce CO2 emissions by 15.1 million tons to 27.1 million tons in 2025. The average system power cost in this scenario is $56.10 per MWh.

Comparing these two sets of results shows that with joint or collaborative re-dispatch, the two states can achieve an additional 11.8 million tons of CO2 reduction in 2025 for an increase in average system power cost of $10.63 per MWh. This is equivalent to an average cost of $28.24 per ton of CO2 reduction. States can compare these cost metrics to similar metrics for reduced emissions from RE and EE.

Finally, as buy-versus-build economics primarily depend on state fuel prices, RE obligations, bilateral agreements, and the resource mix, re-dispatch as a compliance strategy should not be considered in isolation. Rather, it should be considered relative to the benefit/cost of pursuing HRI, RE, EE, and out-of-state options as part of a least-cost, integrated resource planning strategy.

A portfolio modeling approach, such as Cadmus' Resource Portfolio Strategist, provides an effective and efficient means of quantifying emissions reductions and costs at the state and multi-state levels and serves as a transparent and flexible alternative to utility IRP optimization. The multi-state solution offers tangible economies for compliance. Expanding the scope of compliance options by including additional building blocks can enrich the analysis and offer a more comprehensive solution, while providing an additional perspective on multi-state compliance options.

6 Summary and Conclusions

The draft rules established in Section 111(d) of the EPA's CPP allow considerable flexibility for states to satisfy their regulatory obligations using broad market-based solutions, including developing collaborative multi-state approaches where such approaches are in the state's best interest. To explore ways for states to collaborate on compliance options, WIEB initiated this study in an effort to understand whether a regional tracking, trading, and reporting tool could be used to by states in the Western Interconnection to facilitate modular compliance.

A modular approach entails multi-state collaboration on elements of compliance through one of three options:

1. A single-state approach, whereby each state develops an individual compliance plan and executes compliance activities independently, but may engage in informal collaboration with other states to develop modules that facilitate compliance (e.g., regional EM&V protocols);
2. A partial multi-state approach, where two or more states develop their own compliance plans but collaborate on certain components of compliance such as RE and EE; and
3. A full multi-state approach, where two or more states develop joint compliance plans to meet aggregated goals.

Cadmus conducted multiple research activities to explore both technological and policy considerations with implications for the development of a tracking, trading, and reporting system that could serve as a platform for states to engage in a modular compliance approach. We analyzed several tracking systems currently in use across the U.S. to determine whether they currently offer—or could be modified to provide—tracking, trading, and reporting functionality necessary for states to track RE and EE activities undertaken for 111(d) compliance. Further, Cadmus considered how this type of system might be used to facilitate tracking for states that take a modular compliance approach. Finally, we assessed the potential costs and benefits of a two-state collaborative scheme whereby states with complementary resource mixes engage in trade in the context of re-dispatch of coal generation to natural gas.

This section presents Cadmus' principal findings and conclusions regarding these research areas.

6.1 Tracking and Reporting

There are 10 REC tracking and trading systems operating in different regions of the country, some of which were implemented as early as 2001. These systems cover geographic areas of different sizes ranging from one state (i.e., those operating in Michigan, Nevada, North Carolina, and Texas,), to regional systems (i.e., NEPOOL GIS and the Midwest Registry), to very large, multi-state systems (such as PJM GATS, WREGIS, and NAR). All of these systems were developed to facilitate market-based tracking and trading of energy and/or environmental attributes associated with renewable energy generation.

There are no comparable systems in use for tracking and trading EECs. Primarily because compliance with state EE regulation has historically been conducted at the utility level, the existing tracking systems for EE are generally designed to support compliance tracking by a single program sponsor.

Cadmus determined that because the existing systems have been used and refined over many years, they operate quite effectively to enable tracking and trading of RECs. Although some additional features and functions would be required to enable tracking of RE activities for 111(d) compliance, these modifications are generally achievable. Furthermore, some REC tracking systems have already begun to adopt similar functionality for tracking EE activities; however, enabling full tracking and trading functionality for EE is likely to be considerably more complicated, primarily due to a range of policy considerations (discussed below) rather than technological limitations within WREGIS.

Cadmus identified two categories of features and capabilities needed for 111(d) tracking, trading, and reporting of RE and EE activities: essential and beneficial.

- **Essential features**, including account details, reporting functions, and eligibility markers, represent the minimum requirements a system would need to track 111(d) RE and EE activities.
- **Beneficial features**, including functions to calculate avoided emissions, track power and certificate transactions, identify EE indicators, and track RE or EE progress, would streamline reporting, ensure transparency to enable a robust trading platform, and provide a more comprehensive tool for states engaged in modular compliance, but are not required to conduct basic tracking and trading of RE and EE activities.

Because most states in the Western Interconnection already use WREGIS to track and trade RECs, Cadmus focused on this platform as a baseline tool for providing the identified essential and beneficial features. We also examined several other systems to determine whether they offered features that could be replicated to fill any gaps in WREGIS' capabilities. Cadmus determined that WREGIS offers a technologically robust and flexible platform that can readily be modified to facilitate tracking and reporting state compliance with 111(d). WREGIS or one of its sister systems provides all of the essential capabilities and the necessary functionalities to track, establish transfer of ownership, retire, and generate compliance reports for 111(d)-eligible RE and EE activities.

WREGIS does not currently offer several of the features that would enhance its usability for 111(d) compliance tracking and reporting, particularly for EE. These features include:

- Essential feature: A marker to establish a certificate's eligibility for 111(d) compliance. This feature would require minimal enhancements to WREGIS.

- Beneficial feature: A module for calculating avoided emissions resulting from both RE and EE activities. This can be done in a common tracking system or in an external tool. Incorporating this feature in WREGIS is technically feasible and the degree of enhancements depends on the complexity of the approach selected.
- Beneficial feature: The ability to apply adjustments to account for the impacts of interstate power transactions and enable states to apply the impacts of RE or EE activities against the level of RE or EE specified in their state plan (to indicate progress toward the state goal). Cadmus identified this feature as a gap and thus WREGIS would require enhancements to incorporate it.

6.2 Policy Considerations

In addition to evaluating WREGIS' technological capabilities to enable 111(d) certificate tracking, trading, and reporting, Cadmus assessed several policy considerations that are integral to enabling a fully functioning modular compliance approach. The findings of this study revealed that some policy considerations thought to be significant barriers to enabling a modular compliance approach could likely be addressed through voluntary bilateral negotiations supported by a regional tracking, trading, and reporting system, such as WREGIS. A few policy considerations, however, represent significant challenges that will need to be resolved—either through the EPA rulemaking process or through a multi-state negotiation and agreement process—to determine workable solutions before states can engage in compliance.

6.2.1.1 Definition of Certificates

It is important to establish uniform definitions of RECs and EECs to ensure they represent the same values for the same activities, and that these values are determined using reliable and replicable methods. WREGIS currently defines a certificate as one MWh of eligible renewable generation bundled with all environmental attributes. If RECs eligible for 111(d) are defined in the same way, then there is no challenge for RE from this policy consideration. If states want to unbundle some of the attributes from the associated energy to allow for disaggregated trading under 111(d), then the system must minimally include transparency around what constitutes a REC in each state.

For EE, this consideration does constitute a challenge. Specifically, it is thought that state regulatory protocols entailing vastly different methods and rigor levels to calculate savings from energy efficiency activities will present a significant challenge for multi-state collaboration on EE activities. In other words, when two states calculate energy savings using different methods, the same activity could result in very different energy savings impacts. These challenges can be addressed through regional adoption of standardized methods to measure and verify energy savings, such as those being developed under the Uniform Methods Project, sponsored by the U.S. Department of Energy.[41] Agreement of a regional EM&V protocol for EE constitutes developing a module that is relevant for each of the compliance options described above. Specifically, in a single-state compliance approach, two or more states would

[41] U.S. Department of Energy, the Uniform Methods Project. For information on this project see: http://energy.gov/eere/about-us/ump-home

agree to the protocol to enable more streamlined and consistent calculations of EE savings, but would not commit to formal collaboration on EE activities with other states, nor engage in trading. In a partial multi-state compliance scenario, multiple states may formally commit to adopting joint EM&V protocols in their compliance plan as a precursor to establishing a common value of EECs for trading purposes.

However, lack of agreement on the adoption of regional protocols does not necessarily preclude a modular compliance approach. In a voluntary trading market, states may engage in bilateral trades in which they negotiate the cost and value of a tradable 111(d) certificate based on its relative composition. Once states define this currency, WREGIS is capable of tracking the certificate transaction.

6.2.1.2 Ownership of Certificates

In the draft 111(d) rules, the EPA did not define how ownership is determined in situations where an RE or EE activity is funded in one state, but the impacts occur in a different state. This ambiguity in the rules creates the possibility of double counting, as both the sponsoring and consuming state may legitimately claim ownership of the resulting impacts. Policy makers need to address this lack of clarity to enable consistent and accurate tracking of 111(d) impacts toward state compliance goals. The EPA will likely rule to authorize crediting emissions reductions to the state that invests in the compliance activity, regardless of where the impacts occur. Regardless of states' compliance approaches, resolution of this issue is critical to mitigating double counting and ensuring that RE and EE impacts are claimed by only one entity. While a tracking system can help manage this issue by detecting multiple ownership claims on a single REC or EEC, the definition of ownership must be resolved at a policy level. In the absence of an EPA ruling, states will need negotiate ownership rules that are consistent and fair—a potentially significant undertaking. Once defined, WREGIS can easily be used to track REC and EEC ownership from generation to retirement.

6.2.1.3 Choice of Compliance Measurement Approach

States' choice of the rate-based or mass-based compliance measurement approach is another policy matter with potentially significant ramifications in a modular approach, particularly when trading is involved. States that choose a mass-based approach adopt a cap on their overall tonnage of CO2 emissions, and monitor compliance by directly measuring emissions at the EGU's stack. The rate-based approach entails measuring emissions reductions as the quantity of CO2 per MWh of electricity generated for affected EGUs. While rate-based goals can accommodate increases in generation due to increased demand, mass-based goals are simpler to measure.

For both RE and EE, trading certificates between states that choose differing measurement approaches remains the most challenging policy consideration due to the complexity of the proposed rule and the high potential for double counting. This consideration is particularly acute for EE due to the effects of interstate power transactions. Because the electric grid is interconnected, EE activities in one state may decrease the output and therefore emissions at generators in other, power exporting states. If the power exporting state selects a mass-based compliance option and the EE implementing state uses a rate-based compliance measurement option, the same emissions reduction is claimed by both states (i.e., the generator state measures impacts at the stack and the EE implementer state calculates the emissions impact on CO_2 intensity per MWh savings). For RE, interstate effects are largely resolved within the existing REC market. Since EECs represent the absence of energy consumptions and cannot be tied to specific EGUs, this challenge is not fully resolvable within a tracking system.

Cadmus recommends tracking interstate power transfers in WREGIS as a beneficial feature to help mitigate the impacts of EE interstate effects and to illustrate the percentage of EE that importing and exporting states can claim (and identify the EE benefits that are not claimed). States with differing measurement approaches that want to trade RECs or EECs for 111(d) purposes should establish clear policies to ensure accurate attribution of emissions reductions and to prevent double counting.

6.3 Modular Approach

There remains considerable uncertainty about how EPA will rule on the above and other fundamental policy matters that remain open in 111(d). The manner in which these issues are addressed in the final rule will have significant implications for states seeking to execute a modular compliance approach.

The principal finding of the study is that the modular approach is a valid and practical strategy for compliance with the requirements of 111(d). In addition, similar, multi-state collaborative frameworks are being evaluated in other regions, such as the common elements approach in the Southeast that offers tangible and quantifiable benefits, including:

- Facilitating multi-state solutions without requiring two or more states to engage in complex interstate negotiations and agreements on all plan elements. (These negotiations would be necessary to develop a full multi-state compliance strategy and joint compliance plan).
- Offering the opportunity to lower overall compliance costs by allowing states to share the costs of developing modules and compliance activities.
- Importantly, allowing for greater compliance flexibility by enabling REC and EEC trading in cases where such transactions offer comparative advantages for collaborating states.

A modular approach can be structured in a single, partial, or full multi-state compliance form. The findings of this study reveal that, given the unique policy and regulatory environments of the states in the Western Interconnection, the partial multi-state approach would likely provide the most practical option. It offers states greater control over their plans while enabling formal collaboration on one or more elements of the plan and subsequent compliance activities. Such an approach encourages multi-state collaboration in the development of common protocols, tools, or trading parameters, but does not bind states to develop a full joint compliance plan.

As an example, two or more states may formally agree in their state compliance plans to participate in a partial multi-state compliance approach using at least one modular compliance activity. In this scenario, States A and B engaging in EEC trading through the use of a multi-state tracking system such as WREGIS would need to agree on specific modules to help resolve potential policy challenges, such as EM&V protocols, common assumptions and definitions of constituent attributes contained in an EEC, ownership rules, and emissions calculation methods. Under the partial multi-state approach, these jointly adopted modules would facilitate trading by creating a consistent currency (i.e., the EEC). In their state plans to the EPA, both states would file their intention to collaborate on defining modules and tracking and trading EECs for 111(d) purposes, but would not adopt a joint goal or necessarily coordinate on any other compliance activities or elements of their plans. Establishing a common definition of EEC attributes within the tracking system enables trading to take place and both states to track the resulting impacts against their individual compliance goals.

The results of Cadmus' analysis also indicated that the multi-state solution offers tangible economies for compliance in the context of re-dispatch. Expanding the scope of compliance activities to encompass additional building blocks would likely enrich the analysis and provide a more comprehensive solution, while providing an additional perspective on multi-state compliance options. The portfolio modeling approach also proved effective for quantifying emissions reductions and costs at the state and multi-state levels.

Cadmus notes that the EPA may provide additional guidance or definitive rulings on any of these challenges in the final rule. Such an occurrence would alleviate the relevant challenges, and no further resolution or development of these specific modules by states would be necessary. However, regardless of whether the EPA provides definitive direction, the modular compliance approach can be a highly flexible and potentially cost-effective way to help states realize emissions reductions and meet their regulatory obligations under 111(d). Further, full development of a robust regional tracking, trading, and reporting system can provide a valuable tool to help states manage compliance and mitigate many of the policy considerations identified in this study.

Appendix A. Project Approach Details

Cadmus focused the project research on gathering information on several key indicators to provide insights into the research questions listed in Table 11.

Table 11. Research Questions and Indicators

Researchable Question	Key Indicators
What data and functionality are required for an RE and EE tracking system to enable tracking compliance under 111(d)?	• Renewable generation and efficiency features expected to be tracked and reported according to EPA proposed rules. • Range of available compliance methods in Western Interconnection states (such as avoided emissions or avoided MWh).
What data, analysis, and tracking functions are currently available through WREGIS and other REC tracking systems and/or through existing EE tracking systems?	• Existing tracking system data fields. • Methods of establishing certificate ownership. • Methods for tracking transfers and retirements.
How will Western Interconnection states use a tracking system to track RE and EE activities against individual compliance requirements?	• Existing RPS and/or EERS. • State definitions of RE.
What commonalities and differences exist between utility and state-specific energy-savings calculation methods and EM&V protocols?	• Measures included in existing protocols. • Approach to calculating savings (i.e., deemed or algorithm based).

Literature Review

Cadmus conducted a literature review to guide interviews and supplement findings from those interviews. For this research, we explored existing tracking systems and the policy implications associated with using each system for 111(d) compliance tracking. Specific research areas included:

- Necessary features for tracking RE and EE 111(d) certificates in a tracking system.
- Policy challenges associated with tracking and trading RE and EE certificates for 111(d) compliance.
- Existing state RE and EE policies and their implications with regard to 111(d) implementation.
- EM&V rules and use of established evaluation protocols in the Western Interconnection states.

Cadmus reviewed EPA technical documents, relevant stakeholder publications, and public comments submitted to the EPA regarding 111(d) by relevant states and organizations.

Literature Reviewed

Cadmus reviewed the documentation listed below for each key research area.

111(d) Policy

- Clean Power Plan rule and technical support documents.
- Comments submitted to the EPA by Western Interconnection states and other stakeholders on the proposed 111(d) rule.
- Research papers focused on policy issues surrounding the rule, including the following:
  - Analysis Group. *EPA'S Clean Power Plan: States' Tools for Reducing Costs and Increasing Benefits to Consumers.* July 2014.
  - APX Research: *Using Tracking Systems with the Implementation of Section 111(d) State Plans*. October 2014.
  - Center for the New Energy Economy. *A State Planning Guide for Clean Air Act Section 111(d)*. June 2014.
  - Center for Resource Solutions. *Comments of Center for Resource Solutions (CRS) on Clean Power Plan, Docket ID: EPA-HQ-OAR-2013-0602*. December 1, 2014.
  - Center for Resource Solutions and Regulatory Assistance Project. *Tracking Renewable Energy for the U.S. EPA's Clean Power Plan: Guidelines for States to Use Existing REC Tracking Systems to Comply with 111(d)*. June 25, 2014.
  - Center for Resource Solutions and Regulatory Assistance Project. *Supporting Compliance with the EPA Clean Power Plan: Recommendations for Renewable Energy Certificate Tracking Systems.* February 11, 2015.
  - Duke Nicholas Institute for Environmental Policy Solutions. *Enhancing Compliance Flexibility under the Clean Power Plan: A Common Elements Approach to Capturing Low-Cost Emissions Reductions.* March 2015.
  - The Climate Registry. *An Energy Efficiency Registry: A Flexible and Transparent way to Track and Report Energy Efficiency under the Clean Power Plan*. September 1, 2014.
  - Center for Resource Solutions and Regulatory Assistance Project. *Navigating EPA's Clean Power Plan for Compliance with Renewable Energy.* February 11, 2015.
  - Sotkiewicz, Paul and A.R. Muhsin. *EPA's Clean Power Plan Proposal Review of PJM Analyses Preliminary Results.* November 17, 2014.
  - Western Resource Advocates. *Carbon Reduction Credit Program*. November 12, 2014 (revised).

Tracking and Trading Environments for Environmental Certificate Trading

- Tracking system operating manuals.
- WREGIS training materials.
- WREGIS governance documents.

Established Evaluation Protocols

- Northeast Energy Efficiency Partnerships Regional EM&V Methods and Savings Assumptions Guidelines (2010).
- National Action Plan For Energy Efficiency Model Energy Efficiency Program Impact Evaluation Guide (2007).
- International Performance Measurement and Verification Protocol (updated 2012).
- PJM Manual 18B: Energy Efficiency Measurement and Evaluation (2006).
- SEEAction Energy Efficiency Program Impact Evaluation Guide (2012).
- Uniform Methods Project (ongoing, most recent addition 2015).
- Northwest Power and Conservation Council Regional Technical Forum Standard Protocols (ongoing).
- California Energy Efficiency Evaluation Protocols (2006).

For each protocol, Cadmus examined whether it addressed basic EM&V techniques, such as the following:

- How to determine the baseline, savings, and appropriate confidence and precision levels;
- How to calculate net versus gross savings; and
- Whether they included guidelines for calculating GHG emissions.

Structured Interviews

Cadmus interviewed four types of stakeholder groups: public utility commissions; state energy and air officials; utilities; and research organizations, including NGOs (these stakeholders are listed by state in Table 12). During the interviews, stakeholders reported not being far enough in their plan development to make public statements on most interview topics; therefore, Cadmus does not attribute any statements to specific states or parties.

Table 12. Renewable Energy Interview Participants

State	Public Utility Commission	Energy/Air Office	Utility (Including WREGIS Users)	Research Organizations
Arizona		■	■	Five Total
California	■	■	■	
Colorado			■	
Idaho	■		■	
Montana	■		■	
Nevada		■	■	
New Mexico				
Oregon	■	■	■	
Utah			■	
Washington	■		■	
Wyoming	■	■	■	

Note: Gaps in the table indicate that state contacts could not participate due to scheduling challenges or declined to participate. Additionally, each square in the table represents one or more participants.

In addition to these stakeholders, Cadmus interviewed WREGIS and M-RETS tracking system operators, as well as APX[42] staff who represent six systems. We focused these interviews on the potential for using WREGIS or other tracking systems as a compliance mechanism and on policy and implementation challenges associated with using a tracking system to facilitate quantifying, trading, and reporting on compliance under 111(d).

42 APX is the software provider and maintainer of most REC systems in the U.S. (http://www.apx.com/)

Appendix B. Compliance Scenario Analysis Assumptions

Model Treatments

Cadmus' Resource Portfolio Strategist is a transparent and flexible, long-term resource planning tool, with the capability to achieve the following:

- Model the uncertainty of key variables via Monte Carlo simulations; and
- Perform scenario analysis via the dispatch and commitment of supply- and demand-side resources and power purchase agreements, based on availability, operational efficiency, emissions, market price references, load forecasts, and transmission and liquidity constraints over 8-bin annual time periods.

The Resource Portfolio Strategist model has supported numerous client requests, from reliability and fuel diversity risk assessments, to capacity expansion analyses, to compliance scenario modeling.

Cadmus made certain computational adjustments to model the re-dispatch scenarios. A list of treatments follow, applied for modeling the re-dispatch scenarios in this compliance scenario analysis. We ran all scenarios deterministically (i.e., Monte Carlo simulations were not employed).

Resource Inclusion and Attributes

- Resource Portfolio Strategist includes new resources that list all plants referenced in the respective state IRPs and, per the EPA, any resource under construction after January 8, 2014.
- Though this approach diverges from that taken in the EPA ICF IPM, Cadmus pursued this path to produce a more realistic scenario by better characterizing the examined states based on the realities they face.
- The model includes new resources and only those existing resources denoted as "Include" in the EPA data emissions rate calculation, excepting hydro facilities, with one exception. For State B, we did not include the 5 GW of new wind in the emissions calculation, given expectations that this capacity will be exported.

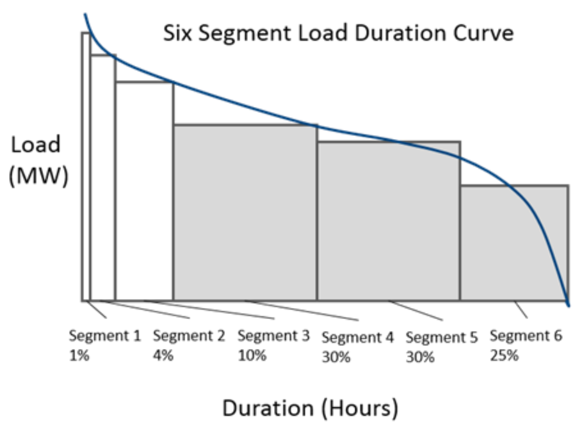
Market Prices

- Resource Portfolio Strategist relies on regional power and coal prices from the ICF IPM, but uses Henry Hub monthly gas prices.
- To achieve greater granularity, Cadmus used monthly Henry Hub natural gas futures prices, rather than natural gas prices put forth by the EPA.

Inside-the-State Constraints

- To portray an inside-the-state scenario for each state, Cadmus built a new load duration curve (LDC) into Resource Portfolio Strategist, assuming unlimited access to the power market, then adjusted it to account for EPA transmission import/export and dispatched state resources, assuming no access to the power market.
- Cadmus constructed load duration curves in three steps: (1) scaled the LDCs from the ICF IPM to account for annual projected load growth; (2) adjusted the values for ICF IPM-provided imports/exports for each region; and (3) aggregated net values with the applicable region's LDC.
- Cadmus assumed that sufficient transmission capacity exists for re-dispatch.
- Cadmus set the model to adopt 6-bins (or segments) per month, corresponding to LDC segments in the ICF IPM, with each load segment representing the time and capacity that the electric dispatch mix must produce to meet system loads.
- Plants dispatched to meet this load are based on economic considerations; we assigned the most cost-effective plants to meet loads in all six segments of the LDC.
- Cadmus assumed coal resource flexibility only for LDC segments 4, 5, and 6; assuming coal resources will be required to maintain reliability during peak demand, as shown in Figure 9.

Figure 9. EPA ICF IPM LDCs*



* Cadmus relaxed this constraint for the State B build RE scenario, since nobody can stop the wind from blowing.

Other Matters

- Cadmus did not presuppose tracking or exchange mechanisms implemented to facilitate a transfer/trade between states.

Data Sources

For our analysis, Cadmus used the following publicly available data sources:

- [Clean Power Plan Proposed Rule Technical Documents and Associated Data Files]
- [EPA's Power Sector Modeling Platform v.5.13 documentation]

- National Electric Energy Data System v.5.13
- IPM Run Files EPA Base Case for the Proposed Clean Power Plan
- EPA Goal Computation Technical Support Document
- EPA GHG Abatement Measures Technical Support Document
- Henry Hub Natural Gas Futures and Basis Quotes

Appendix C. Compliance Scenario Comparison Grids

As discussed, comparing the State A maximum potential to a multi-state scenario is dimensionally faulty. For example, to compare the State A max potential 2025 scenario to the multi-state max potential 2025 scenario might lead one to conclude that it would be more costly for State A to pursue a multi-state approach, at $56.10/MWh versus $45.89/MWh. However, this does not account for State B driving up compliance costs, the compensation State A would receive from State B, the NGCC capacity factor increasing from 50% to 73% (because more NGCC resources would be available jointly), or far greater emission reductions.

	State A base case							
	coal cf	NGCC cf	$	CO2 tons	Redispatched MWh	MWh	$/CO2	$/MWh
2020	0.83	0.43	$1,338,117,720	15,010,415	0	34,733,410	$44.57	$38.53
2021	0.83	0.40	$1,407,732,884	15,172,771	0	35,098,723	$46.39	$40.11
2022	0.83	0.40	$1,478,448,189	15,316,378	0	35,458,429	$48.26	$41.70
2023	0.83	0.41	$1,549,667,056	15,468,763	0	35,821,639	$50.09	$43.26
2024	0.83	0.42	$1,629,638,101	15,622,884	0	36,188,387	$52.16	$45.03
2025	0.76	0.43	$1,628,252,596	15,517,206	0	36,556,630	$52.47	$44.54
2026	0.76	0.49	$1,779,219,694	13,398,236	0	36,921,811	$66.40	$48.19
2027	0.76	0.49	$1,863,798,325	13,302,803	0	37,299,382	$70.05	$49.97
2028	0.76	0.48	$1,950,256,711	13,073,666	0	37,680,631	$74.59	$51.76
2029	0.76	0.48	$2,050,431,213	13,154,385	0	38,065,594	$77.94	$53.87
2030	0.76	0.49	$2,161,983,147	13,299,329	0	38,454,307	$81.28	$56.22

	State A max potential							
	coal cf	NGCC cf	$	CO2 tons	Redispatched MWh	MWh	$/CO2	$/MWh
2020	0.12	0.52	$1,359,049,712	12,076,339	4,560,299	34,733,410	$56.27	$39.13
2021	0.12	0.48	$1,430,891,153	12,206,353	4,560,299	35,098,723	$58.61	$40.77
2022	0.12	0.48	$1,509,107,645	12,351,868	4,560,299	35,458,429	$61.09	$42.56
2023	0.12	0.49	$1,587,736,238	12,506,606	4,560,299	35,821,639	$63.48	$44.32
2024	0.12	0.50	$1,674,826,078	12,663,038	4,560,299	36,188,387	$66.13	$46.28
2025	0.11	0.50	$1,677,502,968	12,774,926	4,231,058	36,556,630	$65.66	$45.89
2026	0.11	0.52	$1,797,701,787	12,645,265	1,246,447	36,921,811	$71.08	$48.69
2027	0.11	0.51	$1,884,571,495	12,549,309	1,246,447	37,299,382	$75.09	$50.53
2028	0.11	0.50	$1,973,301,563	12,320,093	1,246,447	37,680,631	$80.08	$52.37
2029	0.11	0.51	$2,076,262,234	12,400,874	1,246,447	38,065,594	$83.71	$54.54
2030	0.11	0.51	$2,190,860,790	12,546,087	1,246,447	38,454,307	$87.31	$56.97

	State B base case							
	coal cf	NGCC cf	$	CO2 tons	Redispatched MWh	MWh	$/CO2	$/MWh
2020	0.53	0.00	$995,424,160	34,808,498	0	34,471,363	$14.30	$28.88
2021	0.53	0.00	$1,015,310,779	34,927,361	0	34,587,877	$14.53	$29.35
2022	0.53	0.00	$1,035,547,557	35,016,200	0	34,708,416	$14.79	$29.84
2023	0.41	0.00	$1,158,696,910	27,225,779	0	27,942,410	$21.28	$41.47
2024	0.41	0.00	$1,190,456,751	26,502,361	0	27,323,582	$22.46	$43.57
2025	0.41	0.00	$1,210,836,547	26,650,806	0	27,450,532	$22.72	$44.11
2026	0.42	0.00	$1,234,255,885	26,800,759	0	27,578,679	$23.03	$44.75
2027	0.42	0.00	$1,256,865,674	26,952,120	0	27,708,040	$23.32	$45.36
2028	0.42	0.00	$1,280,153,110	27,105,468	0	27,838,632	$23.61	$45.98
2029	0.42	0.00	$1,303,776,983	27,155,130	0	27,970,471	$24.01	$46.61
2030	0.43	0.00	$1,327,917,800	27,309,648	0	28,103,572	$24.31	$47.25

	State B max potential							
	coal cf	NGCC cf	$	CO2 tons	Redispatched MWh	MWh	$/CO2	$/MWh
2020	0.51	0.71	$1,009,934,844	34,288,056	693,496	34,461,492	$14.73	$29.31
2021	0.52	0.71	$1,030,936,882	34,405,279	696,148	34,577,210	$14.98	$29.82
2022	0.52	0.72	$1,052,487,446	34,492,476	698,891	34,697,059	$15.26	$30.33
2023	0.40	0.69	$1,178,672,803	26,688,572	725,131	27,934,389	$22.08	$42.19
2024	0.40	0.67	$1,210,996,491	25,979,274	705,136	27,316,358	$23.31	$44.33
2025	0.40	0.68	$1,232,882,809	26,125,053	709,032	27,443,308	$23.60	$44.92
2026	0.40	0.68	$1,257,868,663	26,272,203	712,965	27,571,272	$23.94	$45.62
2027	0.41	0.68	$1,282,153,462	26,420,694	716,936	27,700,379	$24.26	$46.29
2028	0.41	0.68	$1,307,231,963	26,571,076	720,944	27,830,635	$24.60	$46.97
2029	0.41	0.69	$1,332,774,652	26,620,550	724,990	27,962,136	$25.03	$47.66
2030	0.41	0.69	$1,358,965,933	26,772,092	729,075	28,094,808	$25.38	$48.37

Joint base case

	coal cf	NGCC cf	$	CO2 tons	Redispatched MWh	MWh	$/CO2	$/MWh
2020	0.56	0.43	$2,320,108,282	49,812,682	0	69,207,313	$23.29	$33.52
2021	0.56	0.39	$2,410,530,855	50,092,907	0	69,686,600	$24.06	$34.59
2022	0.56	0.40	$2,509,588,420	50,325,329	0	70,166,845	$24.93	$35.77
2023	0.45	0.40	$2,720,543,401	42,687,050	0	63,764,050	$31.87	$42.67
2024	0.46	0.41	$2,829,964,437	42,117,316	0	63,511,969	$33.60	$44.56
2025	0.45	0.42	$2,849,169,441	42,161,567	0	64,009,096	$33.79	$44.51
2026	0.43	0.49	$3,023,307,530	40,185,972	0	64,500,490	$37.62	$46.87
2027	0.43	0.48	$3,130,502,058	40,241,975	0	65,007,422	$38.90	$48.16
2028	0.43	0.47	$3,240,283,855	40,166,765	0	65,519,263	$40.34	$49.46
2029	0.44	0.48	$3,364,147,059	40,296,715	0	66,036,065	$41.74	$50.94
2030	0.44	0.48	$3,499,772,340	40,596,018	0	66,557,879	$43.10	$52.58

Joint Additive max ("AB system max")

	coal cf	NGCC cf	A+B $	A+B CO2 tons	A+B Redispatched MWh	A+B MWh	$/CO2	$/MWh
2020	-	-	$2,368,984,556	46,364,395	5,253,795	69,194,902	$25.55	$34.24
2021	-	-	$2,461,828,035	46,611,632	5,256,447	69,675,933	$26.41	$35.33
2022	-	-	$2,561,595,091	46,844,344	5,259,190	70,155,488	$27.34	$36.51
2023	-	-	$2,766,409,042	39,195,178	5,285,429	63,756,028	$35.29	$43.39
2024	-	-	$2,885,822,570	38,642,312	5,265,435	63,504,745	$37.34	$45.44
2025	-	-	$2,910,385,777	38,899,979	4,940,090	63,999,938	$37.41	$45.47
2026	-	-	$3,055,570,450	38,917,468	1,959,412	64,493,082	$39.26	$47.38
2027	-	-	$3,166,724,957	38,970,002	1,963,383	64,999,760	$40.63	$48.72
2028	-	-	$3,280,533,527	38,891,168	1,967,391	65,511,266	$42.18	$50.08
2029	-	-	$3,409,036,886	39,021,424	1,971,437	66,027,730	$43.68	$51.63
2030	-	-	$3,549,826,723	39,318,179	1,975,522	66,549,115	$45.14	$53.34

Joint max potential

	coal cf	NGCC cf	$	CO2 tons	Redispatched MWh	MWh	$/CO2	$/MWh
2020	0.22	0.77	$2,868,996,244	35,066,886	21,251,309	68,714,551	$40.91	$41.75
2021	0.17	0.76	$3,061,559,045	32,906,793	24,576,722	69,175,448	$46.52	$44.26
2022	0.17	0.76	$3,205,721,279	33,314,229	24,364,875	69,652,344	$48.11	$46.02
2023	0.10	0.73	$3,400,141,395	27,043,873	22,359,332	63,173,140	$62.86	$53.82
2024	0.11	0.73	$3,535,701,859	26,833,719	21,875,203	62,945,028	$65.88	$56.17
2025	0.11	0.73	$3,556,452,699	27,088,386	21,551,389	63,389,911	$65.65	$56.10
2026	0.11	0.74	$3,729,703,025	27,257,065	18,377,850	63,879,319	$68.42	$58.39
2027	0.11	0.74	$3,880,389,460	27,243,407	18,473,875	64,398,746	$71.22	$60.26
2028	0.11	0.74	$4,048,522,938	26,863,147	18,874,754	64,888,906	$75.35	$62.39
2029	0.11	0.74	$4,216,602,040	27,149,114	18,756,084	65,406,117	$77.66	$64.47
2030	0.12	0.74	$4,403,413,892	27,572,688	18,636,147	65,905,903	$79.85	$66.81

Appendix D. State REC Definitions

The following REC definitions have been identified from state regulatory agencies.

Arizona

"Renewable Energy Credit" means the unit created to track the kWh derived from an eligible renewable energy resource or the kWh equivalent of conventional energy resources displaced by distributed renewable energy resources. For distributed renewable energy resources, one REC shall be created for each 3,415 BTUs of heat produced by a solar water heating system, solar industrial process heating and cooling system, solar space cooling system, biomass thermal system, biogas thermal system, or solar space heating system.

An affected utility may transfer RECs to another party and may acquire RECs from another party. A REC is owned by the owner of the eligible renewable energy resource from which it was derived, unless specifically transferred.[43]

California

California law (Public Utilities Code §399.12[f]) defines a REC as:

"A certificate of proof, issued through the accounting system established by the Energy Commission… that one unit of electricity was generated and delivered by an eligible renewable energy resource.

'Renewable energy credit' includes all renewable and environmental attributes associated with the production of electricity from the eligible renewable energy resource, except for an emissions reduction credit issued pursuant to Section 40709 of the Health and Safety Code and any credits or payments associated with the reduction of solid waste and treatment benefits created by the utilization of biomass or biogas fuels."[44]

Colorado

"Renewable energy credit" or "REC" means a contractual right to the full set of non-energy attributes, including any and all credits, benefits, emissions reductions, offsets, and allowances, howsoever entitled, directly attributable to a specific amount of electric energy generated from a RE resource. One REC results from 1 MWh of electric energy generated from a RE resource. For the purposes of these rules, RECs acquired from on-site solar systems before August 11, 2010 shall qualify as RECs from retail

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43 Arizona Corporation Commission. *Docket NO RE-0000C-05-0030.* Available online: http://www.azcc.gov/divisions/utilities/electric/res.pdf?d=749

44 California Public Utility Commission. "Renewable Energy Credits." Last modified February 1, 2012. http://www.cpuc.ca.gov/PUC/energy/Renewables/FAQs/05REcertificates.htm

renewable distributed generation for purposes of demonstrating compliance with the RE standard. RECs acquired from off-grid on-site solar systems prior to August 11, 2010 shall also qualify as RECs from retail renewable distributed generation for purposes of demonstrating compliance with the RE standard.[45]

Idaho

While Idaho does not have a specific REC definition, Senate Bill 1364 defined environmental attributes for qualifying facilities:

"'Environmental attributes' means any and all claims, credits, benefits, emissions reductions, offsets and allowances, howsoever entitled, resulting from the avoidance of the emission of any gas, chemical or other substance into the air, soil or water. Environmental attributes shall include, but are not limited to: (i) green tags, green and/or clean energy credits, renewable energy credits or renewable energy certificates; (ii) any avoided emissions of pollutants to the air, soil or water such as sulfur oxides, nitrogen oxides, carbon monoxide and other pollutants; (iii) any avoided emissions of carbon dioxide, methane and other greenhouse gases. Environmental attributes do not include: (i) tax credits or other tax incentives existing now or in the future associated with construction, ownership or operation of the qualifying facility; or (ii) adverse wildlife or environmental impacts."[46]

Montana

"Renewable energy credit" is a tradable certificate of proof of 1 MWh of electricity generated by an eligible renewable resource that is tracked and verified by the commission and includes all of the environmental attributes associated with that 1 MWh unit of electricity production.[47]

Nevada

The State of Nevada defines a "portfolio energy credit" as any credit that a provider has earned from a portfolio energy system or efficiency measure and that the provider is entitled to use to comply with its portfolio standard, as determined by the commission.[48]

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45 Colorado Department of Regulatory Agencies. *4 Code of Colorado Regulations (CCR) 723-3, Part 3 Rules Regulating Electric Utilities*. Available online: http://cdn.colorado.gov/cs/satellite

46 Legislature of the State of Idaho. *Senate Bill No. 1364.* Available online: http://legislature.idaho.gov/legislation/2012/S1364.pdf

47 2015 Montana Legislature. *House Bill No. 230.* Available online: http://leg.mt.gov/bills/2015/billhtml/HB0230.htm

48 Nevada Legislature. *Chapter 704 – Regulation of Public Utilities Generally*. Available online: http://www.leg.state.nv.us/NRS/NRS-704.html#NRS704Sec7821

New Mexico

A renewable energy certificate means a certificate or other record, in a format approved by the commission, that represents all the environmental attributes from 1 kWh of electricity generation from a RE resource.[49]

Oregon

"Renewable Energy Certificate" (REC or Certificate) means a unique representation of the environmental, economic, and social benefits associated with generating electricity from RE sources that produce qualifying electricity. One certificate is created in association with the generation of 1 MWh of qualifying electricity. While a certificate is always directly associated with the generation of 1 MWh of electricity, transactions for certificates may be conducted independently of transactions for the associated electricity.[50]

Utah

A banked renewable energy certificate means a bundled or unbundled RE certificate not used in a calendar year to comply with this part or with a RE program in another state, and carried forward into a subsequent year.

A bundled REC is a RE certificate for qualifying electricity acquired by a municipal electric utility through trade, purchase, or other transfer of electricity that includes the RE attributes of—or certificate issued for—the electricity, or by a municipal electric utility by generating the electricity for which the RE certificate is issued.[51]

Washington

"Renewable energy credit" means a tradable certificate of proof of at least 1 MWh of an eligible renewable resource where the generation facility is not powered by fresh water. The certificate includes all of the nonpower attributes associated with that 1 MWh of electricity, and is verified by a REC tracking system selected by the department.[52]

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49 New Mexico Public Regulation Commission. *Public Utilities and Utility Services Electric Services Renewable Energy for Electric Utilities.* Title 17, Chapter 9, Part 572. Available online: http://164.64.110.239/nmac/parts/title17/17.009.0572.htm

50 Oregon Department of Energy. "Renewable Portfolio Standard." http://www.oregon.gov/energy/RENEW/RPS/Pages/RPS-RECs.aspx

51 Utah. "UT Code 19-1-102 (2014)." http://law.justia.com/codes/utah/2014/title-10/chapter-19/part-1/section-102

52 State of Washington. *Initiative 937.* Available online: http://www.secstate.wa.gov/elections/initiatives/text/I937.pdf

Wyoming

None.

Appendix E. Tracking System Descriptions

North American Renewables Registry

NAR, operating across much of the southern Great Plains, Midwest, and Southeast, covers very different regions and has a structure that eliminates what the operators consider to be needless complexity, such as the high standards for proving energy efficiency savings (as is used in the NEPOOL GIS system).[53] This registry provides separate account types for renewable generation and EE. Renewable generation accounts may only register and report on renewable generation assets (i.e., generated MWh); similarly, an energy efficiency account may only register and report on EE assets (i.e., avoided MWh). Certificates generated by NAR also have optional fields indicating whether a particular certificate is an eligible compliance mechanism under the RPS rules of several member states, or if it may be used as a trading currency under several voluntary programs including Green-e Energy or Climate, the EPA Green Power

Certificates include fields for avoided emissions pursuant to the Green-e Climate Protocol and EPA Climate Leaders Protocol, calculated based on resource types and locations (if the generator is eligible for these programs).

The NAR database tracks fuel types of its registered generators; for multi-fuel or alternative fuel generators registered with the system, it only generates certificates for the renewable portion of fuel consumed by the generator during a month.

NAR operating procedures[54] specify that RECs may only be issued for RE generation based on data transmitted to NAR by a qualified reporting entity via a secure transmission protocol and in document format specified by the NAR administrator. The data must contain month and year of generation. Similarly, EECs may only be issued for energy savings based on data transmitted to NAR by a Qualified Reporting Entity via a secure transmission protocol *and* in a document format specified by the NAR administrator. The data must contain the month and year savings are generated and monthly accumulated savings for each project.[55] These data must be confirmed through an EM&V process, with independent certification o f the savings.

Currently, APX is working to enhance NAR to create an EE tracking system for potential 111(d) compliance purposes. The Climate Registry, which has partnered with APX on this initiative, would develop the operating procedures and serve as the governing body for the system.

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53 North American Renewables Registry Operating Procedures. April 2013. Available online: http://www.narecs.com/wp-content/uploads/sites/2/2013/12/NAR-Operating-Procedures_April_2013.pdf

54 Ibid, section 6.2

55 NAR leaves it up to the program administrator to determine if certificates should be based on annual savings, or based on the monthly savings out of the lifetime of the installed measures.

North Carolina Renewable Energy Tracking System

NC-RETS[56] operates only in North Carolina to facilitate the tracking of RECs and EECs, which are both eligible compliance mechanisms under North Carolina's RPS. RE generators and EE or DSM programs register in the system as distinct assets, except for aggregated generators, in which case the aggregation is registered. The system tracks REC attributes including generator fuel types and whether the certificate is eligible for the Green-e Energy and Low Impact Hydropower Institute programs, though it does not track avoided emissions.

For EECs, the system requires electric power suppliers or their utility aggregators to use a self-reporting interface to enter data regarding annual EE, and maintain auditable working papers and EM&V findings that detail how customer participation and energy savings are calculated to determine the number of EECs to be generated. The procedures do not explicitly state that EM&V must be conducted by an independent verifier.

New England Power Pool Generation Information System

Of the REC systems Cadmus reviewed, NEPOOL GIS uses the most rigorous and comprehensive operating procedures.[57] It is capable of tracking all generation serving the power pool, not just renewable generation (as is the case with other tracking systems), as well as EE impacts, which the system documentation refers to as "conservation and load management" (C&LM). All certificates contain the quantity of generated emissions, and zero emission generators must still populate the emissions field in spite of always amounting to zero emissions. For multi-fuel and alternative fuel EGUs, users must report the quantity of emissions for each fuel type used during a month. NEPOOL GIS differs from most other systems by creating certificates on a quarterly, rather than 90-day, cycle, though all RE and EE savings must be reported on a monthly basis.

Each section of the rules explains whether C&LM certificates follow the general rule for all certificates or entail special handling procedures. Energy savings for C&LM certificates can be self-reported by users, unless state policy requires reporting by another authority (such as an independent EM&V contractor). C&LM savings must be certified by a state's energy regulatory agency, and the C&LM administrator must commit to submitting an annual report to the applicable regulatory body prior to reporting savings. Certificates may contain avoided emissions in addition to avoided MWh, if reported.

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56 North Carolina Renewable Energy Tracking System Operating Procedures. January 31, 2011. Available online: http://www.ncrets.org/wp-content/uploads/sites/7/2014/03/NC-RETS-Operating-Procedures.docx

57 New England Power Pool Generation Information System Operating Rules. January 1, 2015. Available online: http://www.nepoolgis.com/wp-content/uploads/sites/3/2015/01/GIS-Operating-Rules-effective-1_1_15.doc

Midwest Renewable Energy Tracking System

Covering the northern Great Plains and Midwest, M-RETS only tracks RE.[58] M-RETS certificates track emission factors and fuel types, though they do not convert these values into emissions for multi-fuel or alternative fuel EGUs. M-RETS has implemented many of the most common tracking system features, but does not implement features not already in other systems.

PJM Generation Attributes Tracking System

PJM-GATS operates from the Mid-Atlantic states and westward through Ohio, Indiana, and Illinois.[59] All generation is tracked, not just renewable generation. Similarly to most other systems, PJM-GATS receives and creates certificates monthly. It tracks emission factors and fuel types, though it does not attach emissions to certificates. Among all of the tracking systems, PJM-GATS implements one of the simplest and most cost-effective methods for tracking EECs. When an EE program is registered with PJM-GATS, all necessary fields are populated as if it is a generator, though it is assigned a fuel type of "Energy Efficiency."

Michigan Renewable Energy Certification System

MIRECS was formed to facilitate issuing and tracking credits pursuant to Michigan's Clean, Renewable, and Efficient Energy Act. The system uses "credits" instead of "certificates," differing primarily in terminology. Fundamentally, credits from MIRECS track the same data as certificates in other systems. However, unlike other programs, MIRECS supports an RPS that creates multiple credits for certain qualifying REs in a program that favors the development of certain technologies. The system does not track EE or emission factors, though it does track fuel types for multi-fuel and alternative fuel generation.

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[58] Midwest Renewable Energy Tracking System Operating Procedures. April 23, 2010, amended August 11, 2014. Available online: http://www.mrets.org/wp-content/uploads/sites/8/2014/03/Operating-Procedures-09-09-14.pdf

[59] Generation Attribute Tracking System Operating Rules. May 8, 2014. Available online: http://www.pjm-eis.com/~/media/pjm-eis/documents/gats-operating-rules.ashx

Appendix F. WREGIS Certificate, Fields, and Functions

Example of Certificate Information viewable in WREGIS (entire certificate not shown)

--This example is to show the fields on a certificate and is not an accurate illustration of static and dynamic information--

Data Fields on a Certificate are outlined in the WREGIS Operating Rules – Appendix B-1 located on the official WECC website, www.wecc.biz/WREGIS or www.wregis.o

Certificate Data

WREGIS Generating Unit ID: **W1**
Generating Unit Name: **General Motors Corporation RC**
Primary Facility Name: **General Motors Corporation RC**
Vintage Month: **8**
Vintage Year: **2007**
Certificate Serial Numbers: **1-CA-53-18 to 40**
Total Certificates: **23**
Generation Period Start Date: **08/01/2007**
Generation Period End Date: **08/31/2007**
Certificate Creation Date: **10/20/2007**

Static Generating Unit Data

Facility County: **San Bernadino**
Facility State or Province: **CA**
Facility Country: **US**
Multi-Fuel Generator Indicator: **No**
Generation Technology/Prime Mover: **Solar Photovoltaic**
Fuel Type/Energy Source:
Wind
Fuel Source/Other Criteria or Eligibility Characteristics:
Wind-Wind*-Wind*
Date when Generating Unit first commenced operation: **11/07/2006**
Nameplate Capacity: **0.921**
Facility Operator Info: Company or Organization Name: **DEERS**
Customer Sited Distributed Generation (Y/N): **No**
Reporting Entity Company or Organization Name: **QRE Test1**
Reporting Entity Type:
Balancing AuthorityNon-Balancing Authority Reporting Entity
Generating Unit in WECC Region Declaration Indicator (Y/N): **Yes**
Utility to which the Generating Unit is interconnected: **Southern California Edison Company**

Source: Western Electricity Coordinating Council. *WREGIS System User Training*. January 29, 2015. Available online: https://www.wecc.biz/Administrative/WREGIS%20User%20Training%20Slides.pdf

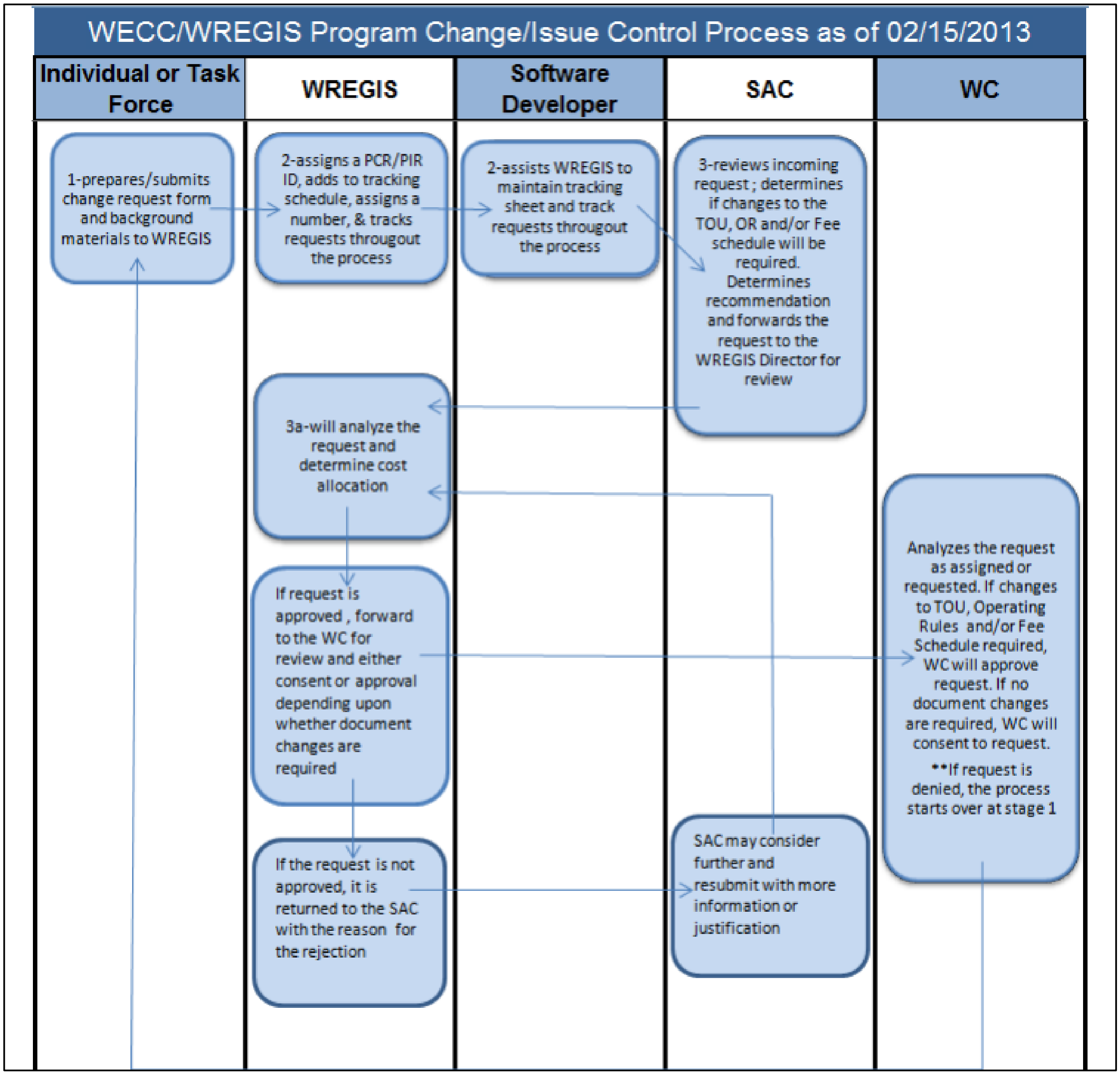
WREGIS Fields and Functions

To accurately track each certificate, WREGIS has developed a series of reports that each account holder can view in their account at any time. These reports include the following information:

- **My Event Log:** Provides activity information for all transactions conducted in the account.
- **My Sub-Accounts Certificate Disposition:** Provides certificate information to view recurring certificate transfers (forward transfers and standing orders).
- **My Recurring Transfers:** Provides the transferee information to view recurring certificate transfers (forward transfers and standing orders).
- **Certificate Transfer History:** Provides log information on every certificate transfer conducted through the life of the account, including transfer dates.
- **My Account Registration History:** Provides account information history.
- **My Generating Unit Registration History:** Provides a history of all EGUs registered in the account.
- **Generating Units by Status:** Provides a list and status of all EGUs registered in WREGIS (excludes those in the account holder's account).

- **State Provincial/Voluntary Program Admin Access Selection:** Allows an account holder to grant access to the program administrator to review all certificates in sub-accounts and the state provincial/voluntary compliance report.
- **My Generation Activity Log:** Provides history of generation data information loaded for EGUs registered to the WREGIS account as it moved through the certificate issuance cycle.
- **My Report Export Request:** Tracks status of export report requests.
- **My Generation Activity Report:** Shows a summary of generation data loaded for all EGUs for an account holder by vintage.
- **State Provincial/Voluntary Compliance Report:** Provides certificate batch information in retirement sub-accounts (program administrators can only view accounts where account holders selected them to view these details on the state provincial/voluntary program admin access selection screen).
- **Account Holder Fees Report:** Shows details of account holder’s monthly WREGIS fees.
- **Certificate Import Request:** Shows detail regarding all import requests from a compatible tracking system.
- **Generator Annual Production:** Shows EGUs that had generation data loaded by vintage.
- **Certificate Annual Issuance:** Shows certificates created for each EGU by vintage.
- **E-Tag Summary Report:** Lists all e-Tags contained within the account for use in compliance retirements.
- **My Generating Units:** Provides entire EGU registration for all EGUs registered in the account.
- **My Aggregations:** Provides entire small-scale aggregate registration for all small-scale aggregates registered in the account.
- **Meter Uploaded by Facility:** Provides generation data reported for a specific EGU.
- **Engineering Feasibility Calculations:** Provides status of generation data reported for all EGUs registered in the account.

Appendix G. WREGIS Change Control Process



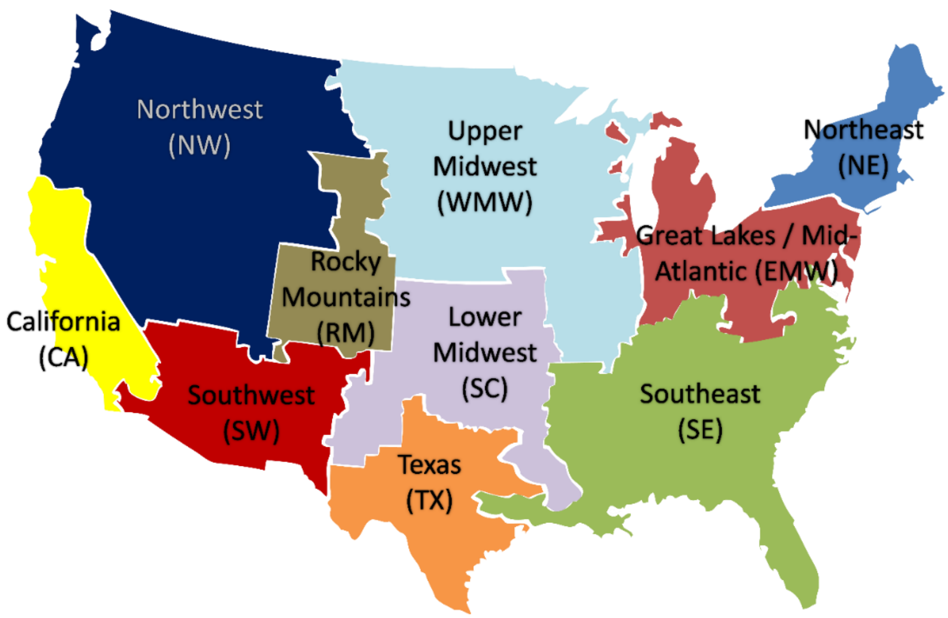
Note: Figure acronyms are as follows: Operating Rules (OR), Program Change Requests (PCR), Program Issues Requests (PIR), Stakeholder Advisory Committee (SAC), Terms of Use (TOU), WREGIS Committee (WC).
Source: Western Electricity Coordinating Council. *WREGIS Change Control Processes.* Page 7. February 15, 2013.
Available online: https://www.wecc.biz/Administrative/WREGIS%20Change%20Control%20Process.pdf

Appendix H. Description of AVERT

The EPA suggested AVERT[60] as an option for calculating avoided emissions from avoided generation using a methodology that attempts to balance simplicity and precision. AVERT could be a feasible centralized module for those states wanting to convert their EE savings into emissions and also potentially assess interstate effects.

AVERT was developed by Synapse Energy Economics, LLC, under a contract with the EPA. AVERT provides analysis at a regional level, with 10 regions available. As shown in Figure 10, the Western Interconnection spans four of these regions: California, Northwest, Rocky Mountains, and Southwest. When converting avoided generation to avoided emissions, users are urged to select the region most representative of where the energy-saving measures were installed. Thus, when an EE credit produced through a program in western Wyoming avoids generation in a northwestern state, its emissions value should be calculated based on the Northwest region rather than the Rocky Mountains region.

Figure 10. Regions Used by AVERT



AVERT is composed of two modules: the Statistical Module and the Main Module. The Statistical Module is a MATLAB®-based component, which is most useful for an energy planner or air quality analyst attempting to research future impacts caused by the addition and retirement of EGUs within their region. The Main Module is a Microsoft Excel®-based component that accepts as inputs the region and

[60] U.S. Environmental Protection Agency. *AVoided Emissions and geneRation Tool (AVERT).* Accessed November 21, 2014. Available online: http://epa.gov/avert/

avoided generation due to an EE project, and provides as outputs avoided emissions within the region attributable to the EE project.

AVERT uses an economic dispatch model constructed using Monte Carlo methods to estimate the probability that an EGU within a region is operational at a particular level of energy demand throughout an 8,760-hour period.[61] The AVERT user enters the amount of avoided generation according to one of several schemes provided[62] and runs the model with the avoided-generation assumptions to obtain estimates of avoided emissions.[63] This output would be sufficient for use in rate-based compliance calculations. The Main Module is also able to generate Sparse Matrix Operator Kernel Emissions[64] formatted files for use by air quality analysts.

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61 U.S. Environmental Protection Agency. *AVoided Emissions and geneRation Tool (AVERT) User Manual Version 1.2.* Pages 60-64. October 2014. Available online: http://www.epa.gov/statelocalclimate/documents/pdf/AVERT%20User%20Manual%2011-05-14_508.pdf

62 Ibid, pages 26-29. Schemes include "Manual User Input," "Reduce Generation by a Percent in Some or All Hours," "Reduce Generation by Annual GWh," "Reduce Each Hour by Constant MW," and "Renewable Energy Proxy."

63 Ibid, page 31.

64 Community Modeling and Analysis System Center by the Center for Environmental Modeling for Policy Development at the University of North Carolina at Chapel Hill. Last modified November 13, 2014. Available online: https://www.cmascenter.org/smoke/index.cfm

Appendix I. EM&V Protocols

Many states with established EERS and mature EE programs have adopted some form of common EM&V protocols. These may be based on one of a number of industry-accepted approaches, customized for a specific programmatic need, or be a combination of the two. States often adopt a Technical Reference Manual to establish allowable EM&V methods and deemed savings values that draw from existing EM&V protocols, then apply parameter value assumptions that reflect local conditions. Roughly one-half of U.S. states have formally adopted EM&V protocols; these include five of the 11 states within the Western Interconnection: California, Idaho, Montana, Oregon, and Washington.[65] Table 13 lists the current states that have formally adopted EM&V protocols or have those protocols under development.[66]

Table 13. Current State EM&V Protocols

State	Existing	Under Development
California	■	
Florida	IPMVP	
Iowa	IPMVP	■
Illinois		■
Maryland		■
Michigan		■
Minnesota	■	
New Jersey	■	
New York	■	
Ohio		■
Oregon	■	
Pennsylvania	■	
Texas	■	
Wisconsin	■	

65 In states within the Northwest Regional Technical Forum (RTF; Washington, Oregon, Idaho, and Montana), the protocols apply mainly to public utilities that receive EE funding from the Bonneville Power Administration.

66 National Energy Efficiency Evaluation Measurement and Verification Standard: Scoping Study of Issues and Implementation Requirements. SEEAction; April 2011.

State	Existing	Under Development
Northwest RTF*	■	
NEEP EM&V Forum**	■	
BPA		■

Rows shown in bold are applicable to Western Interconnection states.

* The protocols of the Northwest RTF are followed by most public or consumer-owned utilities in Idaho, Montana, Oregon, and Washington.

** The protocols of the Northwest Energy Efficiency Partnership EM&V Forum are followed by utilities in Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. ,

As part of our research, Cadmus examined a wide range of existing EM&V protocols to determine whether any would be suitable for a multi-state application for 111(d) compliance. For each protocol, Cadmus first examined whether it addressed basic EM&V techniques, such as:

- How to determine the baseline, savings, and appropriate confidence and precision levels;
- How to calculate net versus gross savings; and
- Whether they include guidelines for calculating GHG emissions.

Cadmus found that, while each protocol addresses many evaluation basics, different protocols entailed different emphasis areas. For example, the IPMVP is focused on technical verification techniques in general, whereas the UMP provides specific protocols for a growing number of EE measures. The other documents provide overall protocols addressing the evaluation elements. The biggest difference between the protocols was the general absence of guidance on net-to-gross (NTG) and GHG emissions calculations. Table 14 provides a high-level summary of the key features included in each protocol.

Table 14. Components of Selected Protocols

Feature	NEEP	NAPEE	IPMVP	PJM	RTF	UMP	SEEAction	CPUC
Installation Verification	X	X	X	X	X	X	X	X
Baseline	X	X	X	X	X	X	X	X
Energy Use	X	X	X	X	X	X	X	X
Measure Life and Persistence	X	X	X	X	X			X
Statistical Precision	X	X	X	X	X	X	X	X
Uncertainty	X	X	X	X	X	X	X	X
NTG		X					X	X
GHG Emissions		X					X	

To gain deeper insights into these issues, Cadmus examined whether the protocols address measure-specific analysis. This analysis revealed some limitations of the current protocols. While several protocols specify EM&V techniques at the measure level, most do not, and those that do differ in their treatment. Some protocols specify a deemed savings value, others provide a formula for calculating

savings, and some specify a custom methodology to determine savings on a case-by-case basis. Three of the protocols we analyzed included no measure-specific guidance at all.

This illustrates a key challenge facing states when creating standardized methods for calculating EE savings. While it may be advisable, from a compliance perspective, to adhere to protocols entailing the highest level of evaluation rigor and accuracy, states that have previously adopted a specific protocol or approach to measuring savings may be less inclined to adopt new methods.