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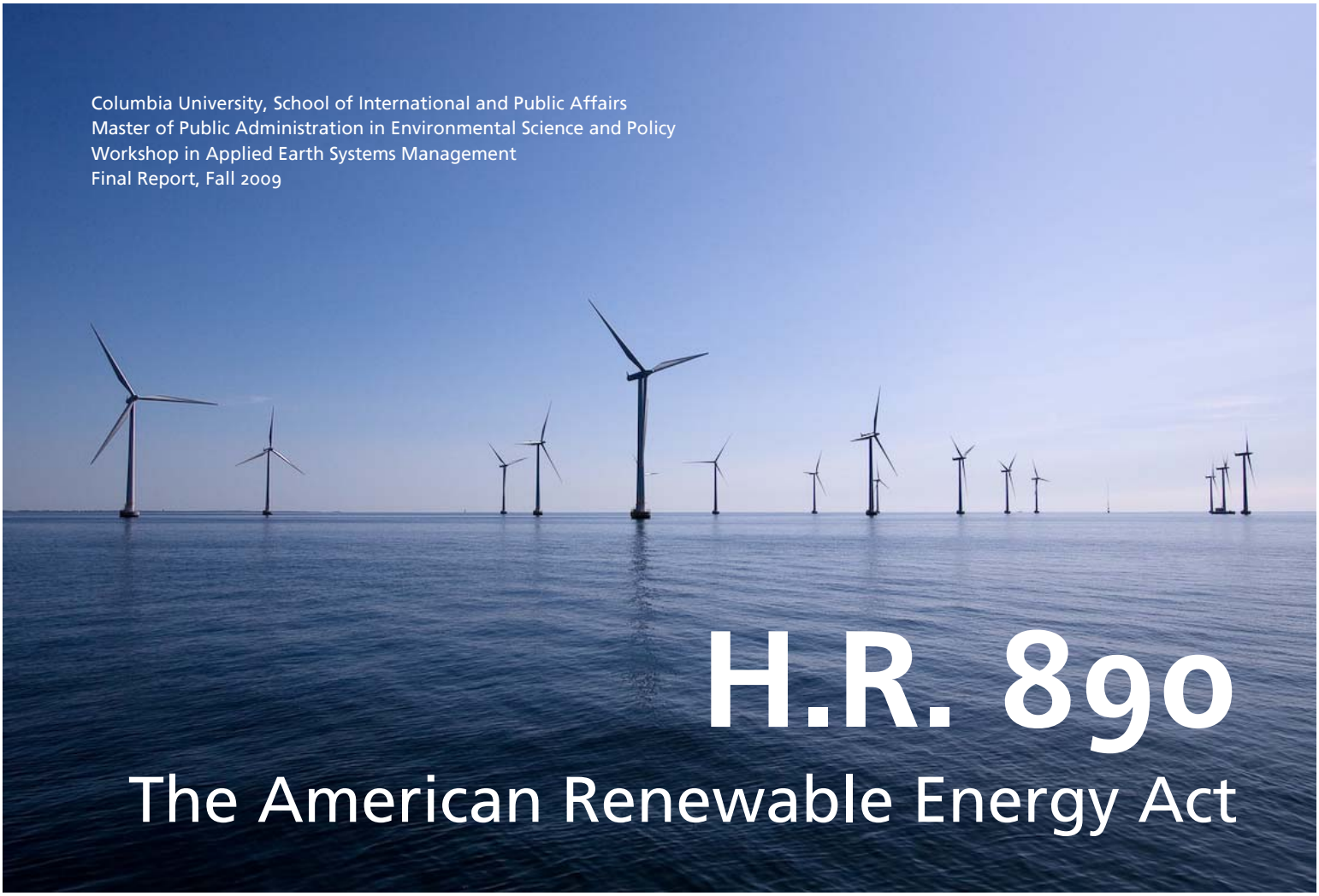

H.R. 890

The American Renewable Energy Act

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PREFACE

This report culminates a two-semester course, the Workshop in Applied Earth Systems Management, which is a core course for the Master of Public Administration in Environmental Science and Policy at Columbia University's School of International and Public Affairs. Over the summer semester of 2009, our team researched the environmental and policy problems addressed by the American Renewable Energy Act, H.R. 890. During the fall semester, our focus shifted towards the policy's implementation. This report summarizes key findings from the summer semester and recommends a program design and implementation plan that we feel best positions H.R. 890 for success, should it become law.

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EXECUTIVE SUMMARY

Electricity generation in the United States promotes a standard of living personified as the American 'Way of Life.' However, energy sources utilized to power this way of life, most specifically coal, present myriad environmental and public health impacts that cannot be sustained in our long-term national energy portfolio. The transition away from traditional electricity sources to newer, more sustainable technologies has been unsuccessful for reasons of technology, infrastructure, politics, and economics. H.R. 890, the American Renewable Energy Act attempts to address these reasons through two mechanisms: the implementation of a national renewable portfolio standard that mandates a certain percentage of all electricity generated from renewable sources and the creation of a national renewable energy credit and market. Through a combination of market flexibility built upon a command and control policy, H.R. 890 expands upon existing state renewable portfolio standards to ensure national compliance of the federal standard.

H.R. 890 is legislation towards the right direction in increasing renewable sources of electricity in the United States. But what will H.R. 890 look like in form and execution? Creating an organizational body charged with implementing H.R. 890 and addressing factors outside the scope of the bill for successful compliance will be a significant undertaking. This policy implementation proposal examines how H.R. 890 may be implemented with goals of cost-efficiency, transparency, and cooperation to shift the national electricity portfolio towards sustainability, security, and progress.

INTRODUCTION

The marketization of environmentalism triggered a shift in contemporary environmental regulation. Command and control-style policies, often regarded as costly and unwieldy, create regulatory bodies oftentimes too cumbersome to incorporate the technology to achieve efficient and desired outcomes. To keep pace with technical innovation is especially challenging in the field of electricity, an area of significant research investment in recent years. The American Recovery and Reinvestment Act, for example, allocated $38 billion dollars for the Department of Energy in 2009 and a significant portion of these funds is allocated for clean energy (Recovery.gov, 2009). Speaking the language of markets, costs, and benefits, environmentalists have earned a credible seat at the table, and thus bolstered their ability to realize policies that make human actions less harmful to the environment. Certainly, this strategy is not fallacious—environmentalism, though long subscribing to logic richer than what economics can provide, is ultimately about human decision-making relative to the environment. And so, cleaving market and environmental agendas together is a noble effort rooted in pragmatism.

Hailed as a great success, the United States Environmental Protection Agency's policy to address sulfur dioxide pollution proved that the marketization of environmentalism, when appropriate, cannot only be pragmatic, but also successful. This landmark program addressed sulfur dioxide (SO_2) emissions from power plants, a primary contributor to acid rain. Economists had long argued that a market for sulfur dioxide credits shaped by an emissions ceiling would effectively reduce the gas to levels that would no longer create the rains that defoliate American forests. The success of the SO_2 market was impressive: emissions decreased 52% from 1990 through 2008—more than five times the decrease observed in the twenty years prior to regulation (The U.S. Environmental Protection Agency [US EPA], 2009a). Further, the SO_2 market achieved its regulatory aims with minimal costs—to government, industry, and electricity consumers. Command and control policies, though in many cases the correct regulatory means, require new bureaucracy, and with it, significant investment. Market solutions are touted due to their cheapness relative to command and control regulation.

In keeping with this logic, H.R. 890, the American Renewable Energy Act (herein, "H.R. 890," or the "Act"), is one of the latest manifestations of a market-based approach to an environmental problem. By mandating the creation of a national-level renewable electricity portfolio standard (RPS), electricity providers will become accountable for their electricity generation portfolio in a new way. A national RPS will require every American utility to supply increasing percentages of electricity from six well-defined renewable sources: wind, solar, biomass, geothermal, new hydroelectric, and hydrokinetic. In doing so, H.R. 890 seeks to prompt the growth of renewable technologies relative to traditional sources of electricity. Coupled with this mandate is a currency: a national-level renewable energy credit (REC). This currency and its mandate create a flexible market that can realize huge growths in renewable technologies relative to existing, environmentally degrading ones.

In conceptualizing how an RPS program might be established, form must follow function. A cost-effective program architecture will ensure that the mechanisms of this new market can realize program aspirations. The objective of this report is to examine one possible form an RPS program might take, given the details provided in H.R. 890, as well as the external realities. In developing an approach to program implementation, we identified four cornerstones that represent both the opportunities and challenges to program success. First, we must establish procedures for every state to transition to the new national standard. Second, we must design a system of creating, tracking, and verifying RECs, the program's currency. Third, we must ensure that there is adequate renewable electricity generation, and that this supply can be transmitted to consumers. And finally, we must help build the market exchange that will allow for efficient and transparent trading of credits to ensure that all utilities can meet the program's mandate.

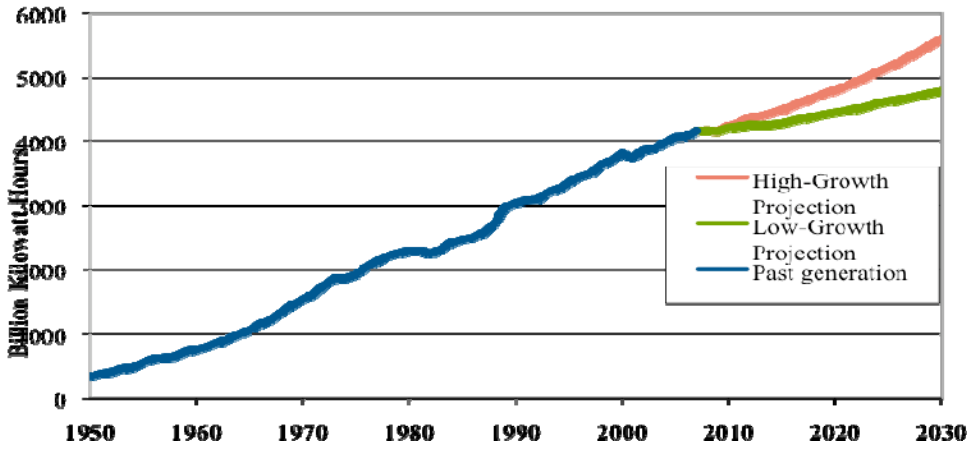
This report advances in six parts. The first section will define the problem of electricity generation in the United States and the solution proposed by H.R. 890. The second section discusses the legislative and political backdrop that gave rise to the Act, shedding light on the discursive politics that adumbrate legislative form. The third and fourth sections use H.R. 890 as a conceptual platform from which to discuss what a Renewable Portfolio Standard program might look like. The fifth section presents an implementation strategy to create a successful program. Finally, we will highlight some of the means by which we could judge program performance, both internally and externally.

The challenges of establishing a renewable portfolio standard for electricity generation are numerous, as this document will show. A well-designed and managed program can effectively overcome these obstacles and ultimately realize success in growing renewable energy share in the U.S. electricity generation portfolio.

THE ENVIRONMENTAL PROBLEM OF ELECTRICITY

The environmental problem of electricity is twofold; first, the United States is projected to continue steady demand growth for electricity; and second, our current sources of electricity have hazardous environmental impacts.

Figure 1
Total and projected electricity generation in the United States from 1950 to 2030 (US DOE EIA, 2009a)



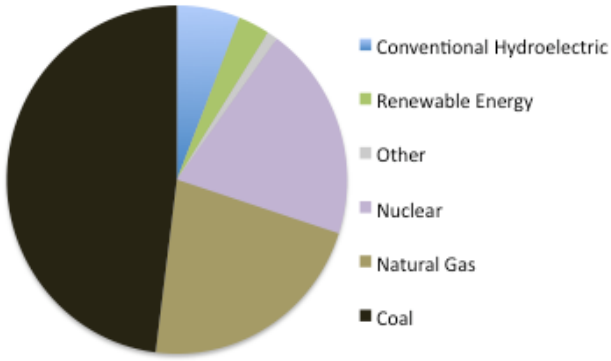


Figure 2
Total electricity generation by energy source, 2008 data (US DOE EIA, Table 1.1, 2009b)

Increasing Demand for Electricity

North America, dominated by the United States, is the most electricity intensive region of the world. The U.S. is the largest electricity consumer in the world. Current annual electricity generation in the U.S. is roughly 4,200 billion kilowatt-hours. To put this in a global context, North American per capita electricity consumption is nearly double the next most intensive region, Western Europe (Dahl, C. 2004). By 2030, U.S. electricity generation is projected to increase between 15% and 34% relative to 2007 levels (U.S. Dept. of Energy, Energy Information Association [US DOE EIA], 2009a).

In part, this growth forecast is fueled by projected increases in per capita consumption (U.S. Department of Commerce [DOC], 1996). In recent history, advances in consumer electronics have been a major contributor to this growth. In New York City, for example, electricity demand increased 22% over the last decade while population only increased by approximately 10%. This rise in demand is largely attributed to the increasing number of air conditioners, computers, and other electronic devices per capita in the New York City area (Con Edison, 2009).

Growth in electricity consumption alone, however, is insufficient to define the problem with electricity. A full picture of this problem is only garnered when we understand the environmental consequences of electricity generation in the United States, as the next section will show.

Current Electricity Sources

Fossil fuels – coal and natural gas – account for 70% of the United States electricity portfolio. At 20% of total consumption, nuclear is the third largest source of power. Conventional hydroelectric power accounts for 6%, which is twice as much as the renewable share of 3%.

Fossil fuels, and coal in particular, have leading electricity market share for several reasons, the most salient of which are their abundance and a well-established infrastructure (McCollum, Ogden, Sperling, & Yang, 2007). Although they maintain operational and economic advantages compared to renewable sources, fossil fuels are relatively disadvantaged from an environmental and human health perspective.

To illustrate the adverse effects of the current model of electricity generation in the U.S., we will examine the most dominant source for electricity generation: coal (see the case study and Table 1, next page). It is important to note that all sources of energy for electricity impact the environment in some way, the numerous environmental and public health effects of coal-fired electricity are compounded by the fact that coal is the most dominant source of electricity in the U.S. H.R. 890 attempts to shift the nation's energy portfolio towards less harmful sources of electricity through a mandate and a market mechanism, growing the supply of renewable sources. The next section examines the solution that H.R. 890 proposes—the creation of a renewable portfolio standard.

CASE STUDY
THE ENVIRONMENTAL AND HEALTH IMPACTS OF COAL

Mining

Coal mining significantly alters landscapes, destroys habitat, and reduces biodiversity. Since mountaintop removal coal mining began in 1970, more than:

- 470 mountaintops have been destroyed
- 1,200 miles of streams buried
- 1.5 million acres of hardwood forest are no longer in existence
  (Center for Biological Diversity, 2009)

In addition, mining causes contaminated rock wastes and tailings to accumulate in waterways, where they leach heavy metals. This decreases pH levels and harms aquatic species (Driscoll, Han, Chen, Evers, Lambert, Holsen, Kamman, & Munson, 2007). Mercury contamination can also result from coal mining. Mercury is released as a byproduct of mining and settles into watersheds. In that environment, bacteria transform the element into the compound methylmercury, which then bioaccumulates up the food chain. Human health is affected by consuming fish and other aquatic life that ingest methylmercury. Overconsumption of contaminated aquatic life can lead to mercury poisoning. Mercury inhibits the nervous system and can lead to paralysis and ultimately death.

Emissions

On an annual basis, the conversion of coal into electricity emits hundreds of millions of tons of deleterious chemicals into the atmosphere. The combustion of coal releases over 73 elements through stack emissions (Anderson, R. M., et al., 2000). According to the Energy Information Administration, the most prevalent compounds released, in descending order, are: carbon dioxide, sulfur dioxide, and nitrogen oxides (US DOE EIA, 2009c). These emissions are linked to many environmental and public health issues, as shown in Table 1.

	Environmental Impact	Human Health Impact
Sulfur Dioxide	**Acid rain** impacts forests, water quality, and soil composition (Likens & Davis, 2007).	**Respiratory disease**, difficulty breathing, premature death (US EPA, 2009b).
Nitrogen Oxides	**Smog** (US EPA, 1986).	**Sinus and respiratory system damage** (US EPA, 1986).
Carbon Dioxide	**Climate Change** (US EPA, 2009c).	**Distribution of infectious diseases** like Malaria and yellow fever (US EPA, 2009c).

Table 1 Environmental and human health impacts of common coal plant emissions

THE H.R. 890 SOLUTION: A NATIONAL RENEWABLE PORTFOLIO STANDARD

The American Renewable Energy Act (H.R. 890), introduced on February 4, 2009 by Representative Edward Markey (D-MA), seeks to reduce the environmental and health effects of our current practices of electricity generation by supporting the growth of less harmful renewable electricity sources. In the absence of a policy intervention, renewable energy is likely to remain a small portion of total electricity supply because renewable technologies are not currently price-competitive relative to traditional sources. H.R. 890 is proposed to support renewable growth and catalyze a shift in the electricity market. In amending the Public Utility Regulatory Policies Act of 1978, H.R. 890 gives the Department of Energy authority to establish a federal renewable portfolio standard (RPS), which requires utility companies to supply a percentage of their total electricity from designated renewable sources. H.R. 890 utilizes market optimization principles known to create economic efficiency and as a consequence, indirectly offers the potential to achieve its desired renewable energy sector growth at minimal economic expense.

The following sub-sections provide an overview of H.R. 890. For additional details, see Appendix 1: Key Specifications in H.R. 890.

If adopted, the federal RPS would commence in 2012 and mandate that all utilities generate a minimum percentage of their total electricity each year from renewable sources. As indicated in Figure 3, the minimum percentage for renewable electricity starts at 6% in 2012 and steadily increases to its target of 25% by 2025.

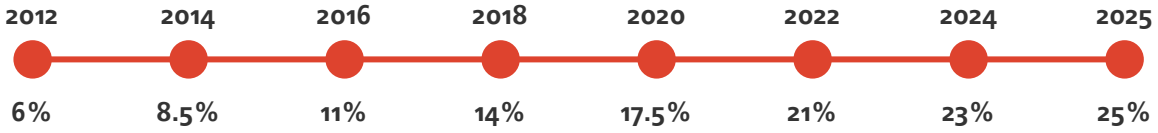


Figure 3 Percentage of renewable electricity required each year by H.R. 890 (U.S. Congress, 2009)

Options for Utility Compliance

Utilities have three options to comply with the renewable portfolio standard. Should a utility fail to meet the required renewable percentage, enforcement actions as described on page 11 in H.R. 890 would take place.

Option 1: Increasing Renewable Capacity

As defined by H.R. 890, there are six technologies that qualify as "renewable," namely wind, solar, geothermal, biomass or landfill gas, qualified hydropower, and marine and hydrokinetic renewable energy. Renewable sources of electricity are defined as energy sources that can be replenished in a short period of time. If it is a viable option, utilities can build new renewable energy plants and generate renewable electricity directly. While the resource availability and economic attractiveness for most of these technologies varies considerably across the country, all regions have access to biomass-based electricity generation (Sullivan, Logan, Bird, & Short, 2009).

H.R. 890 defines utilities, or "retail electric suppliers" as any utility that sells at least 1,000,000-megawatt hours of electricity to consumers for use (as opposed to resale).

Qualified hydropower is defined as electricity generated from increased efficiency, capacity additions, or new facilities established since January 1, 2001.

Option 2: Renewable Energy Credits (RECs)

A renewable energy credit is a market instrument representing the renewable rights to a quantity of electricity generated from renewable sources. These credits act as a currency for the program, allowing utilities to purchase the rights to renewable energy from renewable suppliers in lieu of producing the renewable energy internally. Given the geographic and environmental variability in the United States, some regions are more conducive to renewable power generation than others. Through the use of RECs, H.R. 890 aims for market efficiencies: though each utility may not actually produce its required quota of renewable electricity, the entire system will fulfill the quota through a market exchange of renewable energy credits.

RECs may be sold, exchanged, transferred, or submitted by utilities for compliance within three years of issuance. Thus, if a utility generates or purchases an excess of RECs one year, they can apply those credits for up to three subsequent years. This mechanism is designed to promote near-term renewable energy generation and provide utilities additional flexibility.

Option 3: Compliance Fee

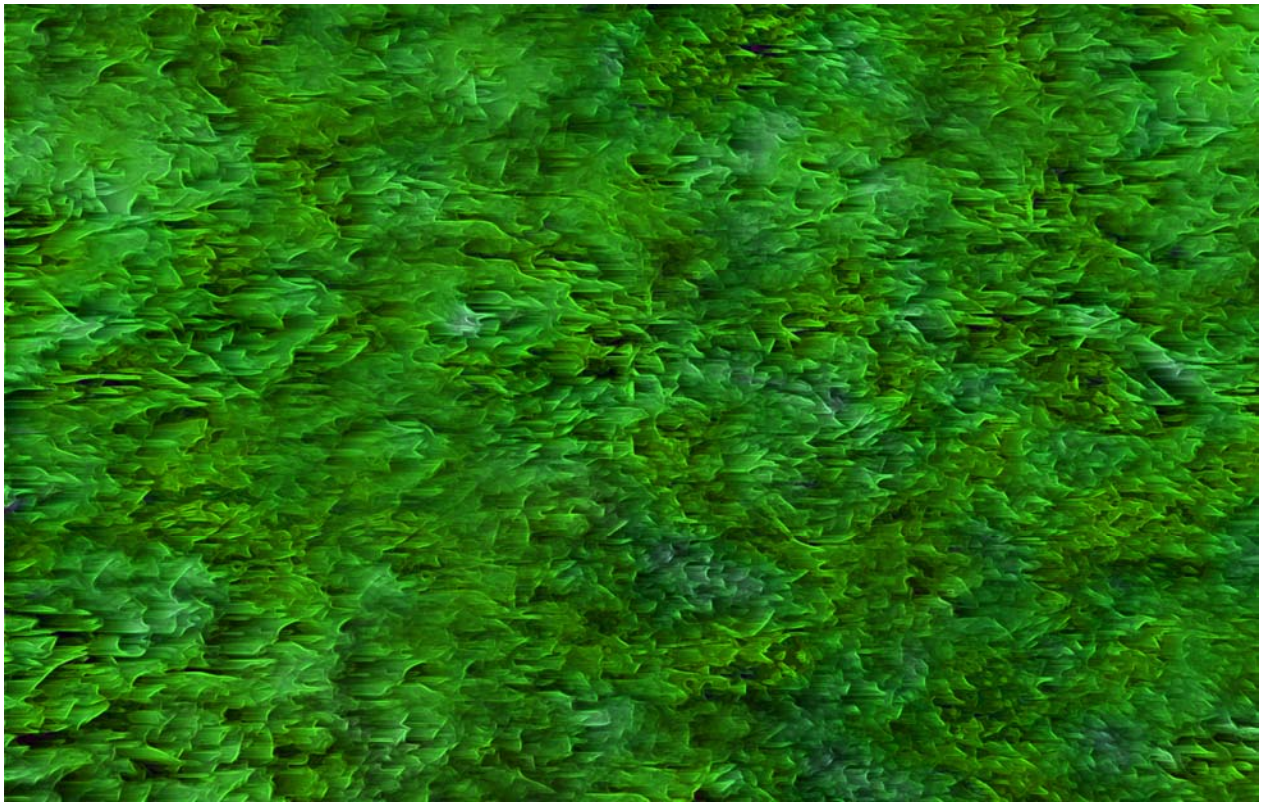
Rather than submitting renewable energy credits, utilities can meet a portion or all of their required percentage by paying alternative compliance payments. Rates of alternative compliance payments will equal 200% of the average market value of the Federal renewable energy credits for the previous compliance year or 5 cents, adjusted annually by the Federal government to account for price changes (U.S. Congress, 2009).

Enforcement

The Federal government will levy a fine on any utility that fails to fulfill its minimum renewable requirement through a combination of any of the above-mentioned options. Fines will be proportional to each utility's shortfall: for each required credit not submitted the utility owes twice the compliance payment amount calculated for that year. As with compliance fees, enforcement penalty payments will also contribute to the Renewable Electricity Deployment Fund. H.R. 890 stipulates that this fund will be distributed to utilities that comply through generating renewable energy or by trading renewable energy credits. The specific refund amount is calculated based on the number of credits submitted by the utility as a proportion of the total number of credits submitted that year.

Compliance payments and civil penalties collected under the Act's auspices are deposited into the Renewable Electricity Deployment Fund. The Secretary redistributes those funds on an annual basis to those utilities that complied with the bill through credit submission.

The Renewable Portfolio Standard (RPS) defined in H.R 890 builds upon similar, existing state programs. In 1983, Iowa adopted America's first renewable portfolio standard by committing to generate 105 megawatt-hours of renewable electricity. Today, 28 states and Washington, D.C. either implemented or approved renewable portfolio standards. In addition, five states have set non-binding renewable goals. With disparate state programs lacking national cohesion, a challenge of H.R. 890 is to establish a national and consistent RPS. The following section is an overview of state programs and a discussion of how these programs are impacted by the national RPS.



LEGISLATIVE CONTEXT

STATE RENEWABLE PORTFOLIO STANDARDS

Collectively, states with existing RPS programs cover more than half of the total electricity generated in the U.S. Given the fact that similar policies are in place at such a significant level, what is the case for a national policy? Further examination of the weaknesses in state policies illustrates the need for a national standard such as the one H.R. 890 proposes.

State Performance to Date

With a narrow policy focused on hydroelectric generation requirements, Iowa implemented the first renewable portfolio standard in 1983. In the late 1990s, other states began to follow Iowa's lead. Figure 4 shows all states that have a RPS in place as well as those with a voluntary goal in place. Nearly half of all policies have been enacted in the last two years.

Figure 4
Map of United States with existing renewable portfolio standards (Wiser & Barbose, 2008; DSIRE, 2009)

Eleven of the sixteen states with operational performance data from 2006 met more than ninety percent of their goal (Wiser & Barbose, 2008). Nine states met their goals in full. These results suggest that RPS goals are achievable, although success is contingent on stringency of respective state renewable requirements. Further, the results offer insight about challenges faced by some states. Arizona, for example, has a solar-focused policy that fails to meet goals partly because of insufficient funding for solar capacity in the state. New York fulfilled 52% of its goal in 2006, the first year of the policy. This failure was mainly due to construction delays of the state's largest renewable electricity facility and partly due to renewable energy credit prices that exceeded budgeted prices (Wiser & Barbose, 2008).

Insights from State Policies

A comparison of current state policies shows tremendous diversity in fundamental aspects of program design; states' programs differ from each other in definitions of renewable energy technology, the required renewable percentages, the compliance payment structure, and the constraints placed on the renewable energy credit market (Wiser & Barbose, 2008). These credit restrictions hamper interstate credit exchange and largely localize credit markets at the state level.

Given this variety, it is difficult to analytically compare state policies. Though economic impacts vary between states, rate increases for end customers are typically less than one percent excluding transmission costs (Chen, Wiser, & Bolinger, 2007).

Rationale for H.R. 890, a National Policy

H.R. 890 offers two main advantages over state-level policies. First, a national policy will standardize the definition of eligible renewable technologies as well as improve evaluation and require participation by all utilities. Participation will increase in two different ways: first, the remaining 22 states without a state RPS will be required to adopt the Federal RPS requirement, and second, generators with existing renewable electricity generation facilities will be encouraged to increase capacity.

The second advantage of H.R. 890 is the potential to maximize efficiency on a national scale. State experience indicates that regional restrictions on the renewable energy credit market can reduce efficiency by raising credit prices and impede results (Wiser & Barbose, 2008). By standardizing the renewable energy credit market across the country, renewable energy generators will not need to rely on within-state utilities to purchase the renewable energy credits they produce. Instead, the pool of potential credit buyers will expand to consist of all utilities in the country. This is expected to be particularly beneficial in the later years as the minimum renewable energy requirement increases towards 25%.

Current Status of H.R. 890

Upon introduction to the House of Representatives by Rep. Markey, H.R. 890 was referred to the House Committee on Energy and Commerce, where it currently sits. In addition to H.R. 890, there are currently four pieces of legislation that include a national renewable portfolio standard:

Bill	Sponsor	RPS	Energy Efficiency Clause?	Current Chamber
H.R. 890	Representative Edward Markey (D-MA)	25% by 2025	No	House Committee on Energy & Commerce
H.R. 2454	Representatives Edward Markey (D-MA) and Henry Waxman (D-CA)	20% by 2020	Yes	Passed in the house (219-212), placed on Senate Agenda
S. 1462	Senator Jeff Bingaman (D-NM)	20% by 2021	Yes	Committee
S. 433	Senator Tom Udall (D-NM)	25% by 2025	No	Committee

Table 2
Status of federal bills with renewable portfolio standard clauses as of December 1, 2009 (Library of Congress, 2009)

One noteworthy aspect of renewable portfolio standard legislation is the inclusion of an energy efficiency clause to jointly promote the growth of renewable sources of supply and the reduction of total electricity demand due to efficiency improvements. H.R. 890 does not include an efficiency clause; its goal is simply to increase renewable share of electricity in the market. In contrast, three of the prospective bills do include an efficiency clause, suggesting that they place more emphasis on emission reductions and climate change. In those cases, the renewable portfolio standard can be partially met through energy efficiencies.

Any significant shift of the nation's electricity portfolio requires careful analysis and consideration of the policy and market mechanisms available. Electricity in the U.S. relies on a nebulous relationship comprised of public and private stakeholders, each with a differing view of how energy policy should be implemented. H.R. 890, with its hybridization of both command and control policy (the RPS mandate) and market mechanisms (the REC market) inspires both support and contention. Fundamental points of both arguments are highlighted in the next section.

Proponents' Rationale

Supporters of H.R. 890 believe that a national RPS will yield economic development and decrease harmful impacts to the environment by restructuring the energy portfolio of the United States towards renewable sources.

Economic Development

Trade organizations, such as the American Wind Energy Association, and policy institutes, such as the Drum Major Institute, assert that the implementation of an RPS will create up to 1.7 million new jobs in the clean energy sector (Center for American Progress, 2009). The restructuring of the United States' energy portfolio will revitalize many manufacturing sectors and create jobs (Drum Major Institute, 2009).

Decreased Environmental Impacts

The Natural Resources Defense Council, the Environmental Defense Fund, the Pew Center for Climate Change, and the Union of Concerned Scientists strongly argue for a renewable portfolio standard in order to reduce stack emissions that contribute to pollution and climate change (U.S. Congress House Committee on Energy and Commerce, 2009).

Opponents' Rationale

Opponents of H.R. 890 and the RPS it mandates argue that incentivizing energy sources that are not cost-effective and unable to meet demand is unfeasible and economically inefficient. In addition, H.R. 890 is criticized for its specificity and lack of attention to relevant, critical issues such as energy efficiency and transmission.

Unreliable, Inefficient, and Costly Renewables

Lobbying groups such as Americans for Clean Coal Energy and the Natural Gas Alliance assert that coal and natural gas are more reliable energy sources and that funding should be prioritized for clean coal technology and natural gas transmission. There are numerous problems with renewable energy sources, such as wind variability, the high costs of solar photovoltaic cells, technical barriers, and inadequate transmission infrastructure. These problems necessitate the need for traditional sources of electricity to maintain reliability and cost-efficiency to provide Americans with affordable energy. With abundant coal and natural gas deposits in the United States, investments in renewable electricity sources detract from what could be a vibrant clean coal technology and natural gas sector. A related point supporting this position pertains to the timing of renewable electricity availability, specifically wind. In many regions of the United States, wind is strongest at night when electricity demand is low, and generation cannot be stored easily for later use. This contradiction of availability of supply against demand highlights, that in the absence of cost-effective capacity technology, current renewable energy supply cannot fulfill U.S. electricity demand.

The Perils of Government Intervention

In implementing an RPS, the Federal government incentivizes what it determines as eligible renewable energy sources. This intrusion of the federal government in the free market does not allow the market to flow as it would in determining what are sustainable and cost-effective technologies and sources for energy (Apt et al., 2008). The government should instead "specify goals—reduce pollution and greenhouse gas emissions, enhance energy security, maintain electricity supply reliability, and control costs" and allow the market to reach these goals in any manner it determines (Apt et al., 2008).

H.R. 890's Narrow Scope

H.R. 890 seeks to reduce negative environmental impacts of electricity by growing the renewables sector. Another way to accomplish that goal is to reduce demand for electricity through conservation and efficiency programs. As noted above, some renewable portfolio standards Congress is considering include energy efficiency provisions, but H.R. 890 does not. In addition, state experiences demonstrate the critical role of transmission on the ability of renewable electricity sources to capture a greater share of the current electricity portfolio. Transmission can be an expensive challenge because renewable supply is often located far away from population centers. There is no funding specified in H.R. 890 to finance new, renewable-oriented transmission infrastructure. Hence, some opponents argue that the scope of H.R. 890's renewable portfolio standard is too narrow to realize practical success.

PROGRAM DESIGN CONSIDERATIONS

In designing a program office to implement and maintain the renewable portfolio standard set forth in H. R 890, strategic consideration must be given to both the provisions explicitly mandated in the bill as well as key success factors for which policy action is not specifically prescribed.

PROVISIONS MANDATED IN H.R. 890

There are four main provisions in H.R. 890: those pertaining to standards, state program compatibility, credit tracking, and a market exchange.

1

Standards: Technologies, Credits, and Compliance

H.R. 890 provides clear language on the fundamental policy design aspects of a renewable portfolio standard. These standards address the majority of the state-level policy design diversity.

- **Renewable requirement.** H.R. 890 defines an incremental schedule of renewable portfolio share that utilities must meet en route to the ultimate goal of 25% by 2025. These standards are shown in Figure 3.
- **Renewable technologies.** Six explicit technologies are defined as eligible means to meet the renewable portfolio standard. These six renewable forms of energy include wind, solar, biomass, new and qualified hydropower, marine and hydrokinetic, and geothermal.
- **Renewable energy credits.** H.R. 890 defines a renewable energy credit as equivalent to the "renewable rights" of one kilowatt-hour (kWh) of renewable electricity generated. The bill includes provisions for a three-year banking period for credits as well as an incentive for distributed generation. More details can be found in Appendix 1.
- **Compliance.** As previously mentioned, utilities have three options for compliance. In effort to meet RPS standards, utilities may a) own and produce renewable energy, b) purchase renewable energy credits (RECs), and/or c) pay a compliance fee. Further, the specific calculation of the compliance payment is described in the bill and can be found in Appendix 1.

2

State Program Compatibility

According to the United States Department of Energy, 29 states plus the District of Columbia have renewable portfolio standards (US DOE EIA, 2009d). All of these programs are administered through a public function of the statewide government. In consideration of how to incorporate the present offices, H.R. 890 mandates that administrators must "preserve the integrity, and incorporate best practices, of existing State renewable electricity programs" (U.S. Congress, 2009).

States will maintain discretion over local RPS programs; however, states that have incongruous eligibility requirements for renewable energy sources will have to juggle both state and national standards. Additionally, states with ambitious local targets will likely surpass the requirements of the national renewable portfolio standard, while those states with existing RPS programs that do not meet the national threshold will still be required to meet the nationwide timeline. Nevertheless, representatives from existing RPS programs express little concern over the establishment of a national RPS, as long as the national standards do not impinge upon their local requirements and do not create excessive managerial obstacles (Baker, A., personal communication, September 22, 2009; Tannenbaum, M., personal communication, September 23, 2009).

For ease of administration, it behooves states with established RPS programs to examine and incorporate the national and local standards wherever possible. In an effort to reduce inefficiency and increase efficacy, the national RPS program office will follow the requirements of the bill, which urge the program to "cooperate with States to facilitate coordination between state and Federal renewable electricity programs and to minimize administrative burdens and costs to retail electric suppliers" (U.S. Congress, 2009).

Ensuring state program compatibility during the implementation of H.R. 890 will require focused attention by the program office. In particular, it is important that the program office create information systems to facilitate knowledge and best practice sharing across state program offices, utilities, and other stakeholders.

3

Credit Tracking Systems

In accordance with H.R. 890 stipulations, the program office will make a concerted attempt to utilize existing state or regional tracking systems and coordinate with state programs to minimize additional administrative costs to utility companies (U.S. Congress, 2009). Currently, tracking systems do exist to manage state RECs and their subsequent portfolio standards. Six regional tracking organizations have been established to date (Center for Resource Solutions, 2007). They are outlined in Figure 5, where white states represent those states that are not currently part of a tracking system. Typically the tracking organizations are paired with the Electricity Coordinating Council for that region.

Electricity Coordinating Council: Regional electric reliability councils that serve as the umbrella organization for coordinating electricity in their region. Currently, nine coordinating councils manage areas of the U.S. electrical grid.

A registry is an online database that stores information about a REC's origin and status.

Little standardization exists between tracking organizations, although in general, the tracking organizations are paired with APX, the software company controlling the region's registry. APX is responsible for building five of the six regional registries (Webb, J., personal communication, September 23, 2009). Renewable electricity generators will communicate with APX and/or the regional tracking organization, at which point RECs are issued a unique identification number and logged in the registry for sale. Due to the inconsistency in REC standards across state RPS programs (Environmental Tracking Network of North America, 2009), little interstate REC trading takes place. Furthermore, there is little communication between the regional tracking agencies (Frantz, M., personal communication). This is a significant obstacle to develop a well-functioning national REC market (Zimmer, Hungerford, & Rohleder et al, 2007.)

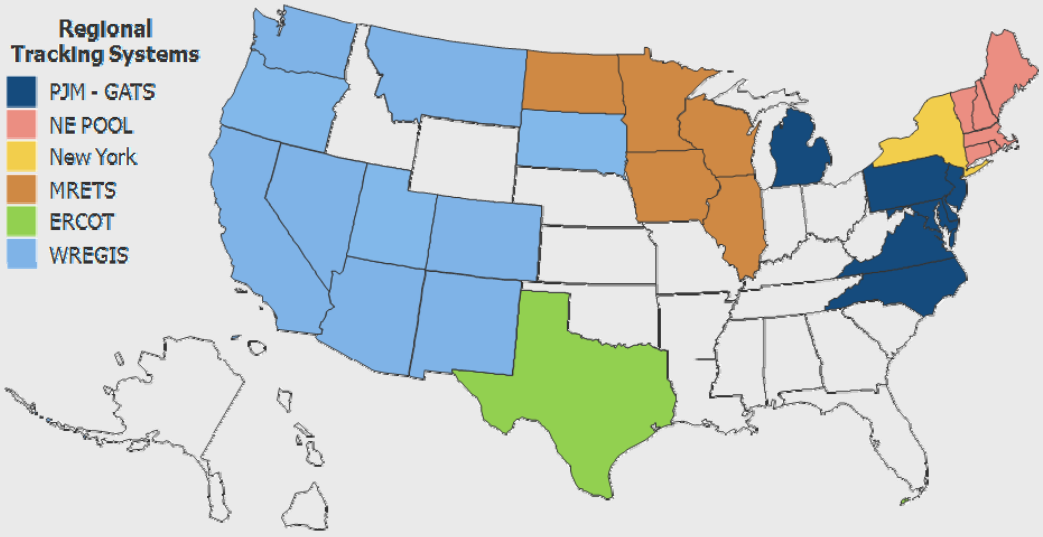


Figure 5
The six main REC tracking systems currently in place in the United States (Center for Resource Solutions, 2007)

Current credit tracking systems pose a couple of challenges to the implementation of H.R. 890. First, given the state-by-state diversity in renewable portfolio standard policy designs, not all credits that are currently tracked in regional systems are equivalent to a Federal renewable energy credit as mandated in H.R. 890. Thus, implementing a national system will require attention to ensure that renewable energy credits that qualify for the federal program are appropriately identified. Perhaps credits are ascribed two different unique identifiers, one identifier for federal eligibility and one for the relevant state program. The second challenge a national program faces is that the existing regional systems are not linked. This can be addressed by creating a distinct national credit tracking system or, more cost-effectively by integrating the existing regional systems (Webb, J., personal communication, September 23, 2009). Under either approach, utilities will have nationwide visibility into Federal renewable energy credits, a capability that does not exist today.

4

Infrastructure for Success: Market Exchange

H.R. 890 provides limited guidance about the creation of a market exchange for renewable energy credits. A market to exchange RECs would allow those states disadvantaged in renewable energy generation to efficiently buy and sell credits to meet the mandated portfolio standards. The legislation does not explicitly outline the market design, but instead offers Secretarial (Department of Energy) discretion in creating a transparent and efficient national market for Federal renewable energy credits (U.S. Congress, 2009). This market-based approach is a cost-effective and efficient way to build the renewable market in comparison to traditional command and control system (Holt & Bird, 2005).

Currently, state-based RPS programs developed local based market mechanisms. At present, there are 14 total local markets, creating a system-wide REC market value of $608 million by 2010 (Holt &, Bird, 2005). The current system, however, does not allow for economic efficiency. As a result of the variations among state RPS, most RECs are not traded across state lines. Thus, states experience great fluctuations in REC prices. For example, 1 unit of renewable energy in New Hampshire can translate into a $37 REC, as compared to $2 in Pennsylvania (Webb, J., personal communication, September 23, 2009). In this situation, meeting the RPS from a utility's perspective is much more economically viable in Pennsylvania than New Hampshire.

Thus, a national RPS standard should facilitate a national market. This will allow utilities nationwide to be on a level, cost-competitive playing field. An integrated national REC market is more cost-effective than state-based regional REC markets at meeting environmental goals (Mozumber &, Marathe, 2004).

KEY FACTORS FOR SUCCESS NOT EXPLICIT IN H.R. 890

In addition to the above-mentioned explicit considerations, there are significant key factors for success that are not specifically addressed by H.R. 890.

1

Renewable Energy Supply

First and foremost, H.R. 890 assumes a current sufficient supply of renewable energy to allow utilities to meet its renewable portfolio standard. Over time, this supply must steadily increase to keep pace with the escalating mandate set forth by H.R. 890.

An Energy Information Administration Department analysis, shown in Figure 6 on the next page, indicates that at around 2015, the supply of renewable electricity will have to exceed current projections of renewable capacity.

Ensuring that utilities can supply the kWh of electricity required to meet both the growth in overall electricity demand as well as the requirement of renewable

energy under the bill is an important endeavor; however, it is not a direct role of the national RPS program office. Rather, the incentives created by the national RPS will use market mechanisms to ensure that demand is met with a steady supply. Those utilities well-positioned to produce renewable electricity will have an economic incentive to produce as much as possible. That is, the cost of producing a kilowatt-hour of renewable energy is at least partially offset by the sale of its renewable energy credit to another utility that is in short supply of credits. Shortages of RECs, a function of a shortage of renewable electricity generation, will encourage renewable generation growth due to the high price it demands. The bill sets a standard that private entities will have to meet—it does not manage how they meet the standard. For example, renewable portfolios will differ greatly across and even within regions; Texas utilities will rely on wind and biomass, while New Mexico's utilities will rely on solar and geothermal (Sullivan, Logan, Bird, & Short, 2009). The strategies to ensure supply will be based on management at the local, state, and regional levels. Nonetheless, renewable energy capacity is critical to the success of the bill, and although the national RPS office will have no direct role in the growth of renewable supply, the RPS program office should actively build relationships with key stakeholders and monitor the industry closely.

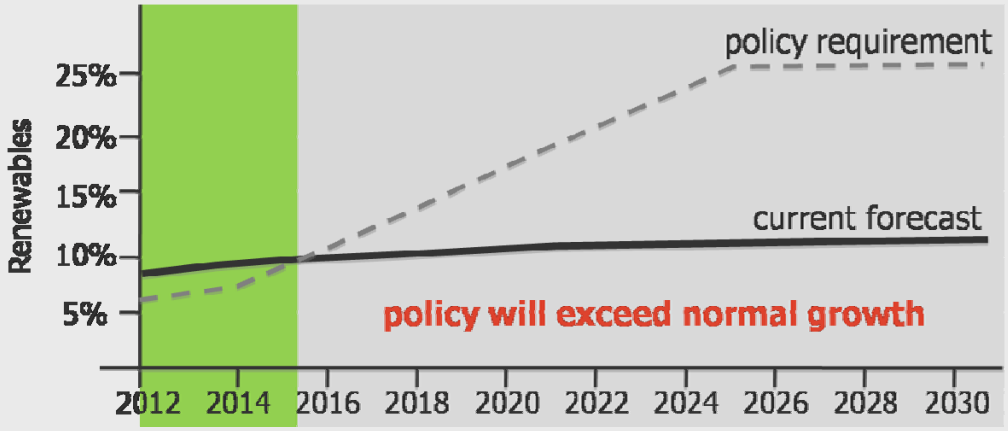


Figure 6
Renewable electricity growth under H.R. 890, relative to a reference case of no bill (US DOE EIA, Table 1.1, 2009e)

2

Transmission Infrastructure

Closely related to the issue of adequate renewable supply is the challenge of transmitting electricity to consumers over an adequate grid infrastructure. In fact, regardless of renewable growth, transmission infrastructure growth will be a pressing issue for the power industry over the next 20 years. Low-voltage transmission lines are nearing capacity, requiring the need to build more efficient, high-voltage transmission lines (see Figure 7). A 25% growth in renewables will require significant capital to move the electricity from producer to consumer. Additionally, renewable electricity-related infrastructure will likely be built in remote areas, some distance from existing transmission and major population centers (see Figure 7).

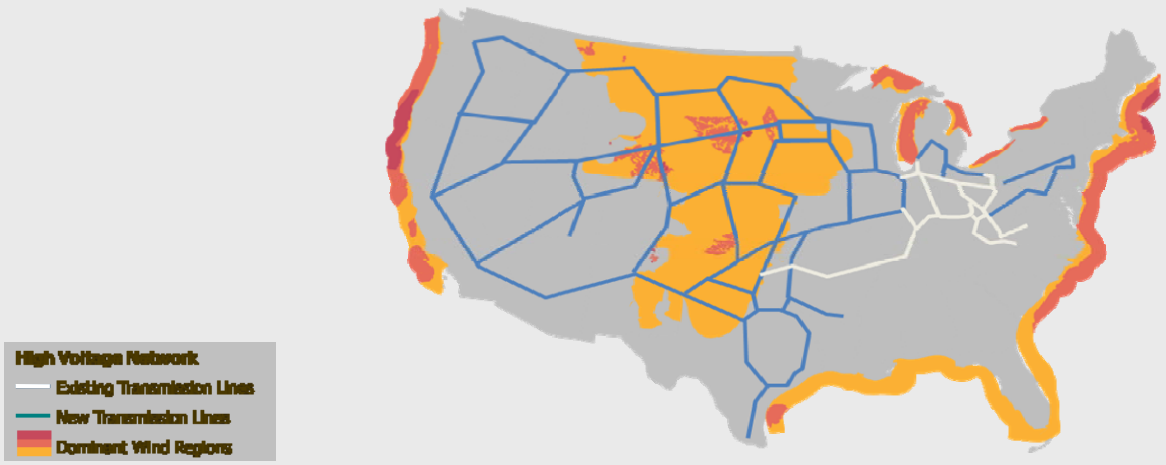


Figure 7 The map highlights areas of wind potential paired with existing transmission lines (white lines) and proposed new transmission lines (blue lines) needed to harness the wind energy (US DOE EIA, 2008)

Transmission is defined as an "interconnected group of lines and associated equipment for the movement or transfer of electric energy between points of supply and points at which it is transformed for delivery to customers or is delivered to other electric systems" (U.S. Dept. of Energy, Energy Information Association [US DOE EIA], 2009f).

FERC is the "Federal agency with jurisdiction over interstate electricity sales, wholesale electric rates, hydroelectric licensing, natural gas pricing, oil pipeline rates, and gas pipeline certification. FERC is an independent regulatory agency within the Department of Energy and is the successor to the Federal Power Commission" (U.S. DOE EIA, 2004).

Irrespective of H.R. 890, a scenario of massive transmission issues is imminent. The Department of Energy forecasts an anticipated growth of 15-35% in electricity consumption by 2030, and supply will need to be delivered (US DOE EIA, 2009a). However, due to a lack of explicit provisions in the bill, there will be distinct limits to any role that the H.R. 890 program office has in infrastructural issues—likely to be limited to analysis and advocacy. H.R. 890's program office does not have a role in funding, planning, and building the requisite electricity infrastructure required under a 25% by 2025 scenario. Other legislation and private investment will have to fill that role. H.R. 890's program office will need to be apprised of infrastructural issues, and will provide substantive analysis and advisement to stakeholders on new policy development, coordinating with the Federal Energy Regulatory Commission (FERC), the Office of Management and Budget (OMB), the North American Electric Reliability Corporation (NERC), regional transmission organizations (RTOs), the U.S. Department of Energy's Office of Electricity Delivery and Energy Reliability (OE) and Office of Energy Efficiency and Renewable Energy (EERE), and independent system operators (ISOs).

NERC is a corporation formed in 1968 by the electric utility industry to promote the reliability and adequacy of bulk power supply in the electric utility systems of North America. NERC consists of regional reliability councils and encompasses essentially all the power regions of the contiguous United States, Canada, and Mexico (U.S. DOE EIA, 2004). NERC aims "to develop and promote rules and protocols for the reliable operation of the bulk power electric transmission systems of North America" (NERC, 2009).

Independent System Operators (ISOs) are independent, Federally-regulated entities established to coordinate regional transmission in a non-discriminatory manner and ensure the safety and reliability of the electric system (U.S. DOE EIA, 2004).

3

Renewable Energy Credit Integrity

A final strategic consideration for H.R. 890 program design pertains to renewable energy credit verification. When a credit is issued by a tracking system, it must be verified to maintain the integrity of the renewable energy credit currency. Currently, this process varies widely among state RPS programs. Typically, a REC is verified before it is accepted into the regional registry. This process involves working with the renewable energy generator to confirm that they generated the total kilowatt-hours the generator reported (Center for Resource Solutions, 2007.) Brokers, public utility commissions, and/or third party certifiers complete the process of verification as determined by the regional tracking organization.

H.R. 890 calls for standardization of this process. To achieve consistency, a single set of generally accepted auditing standards will be created concerning the treatment of RECs by the accounting profession. These standards will include both accounting and auditing procedures for RECs in order for a relevant auditing firm to issue an opinion. This would be included as part of the annual independent auditing process. Thus, utilities and renewable energy generators alike can use any auditor to account for their REC practices. Once the audit is completed, the generator will provide an audit opinion on the reliability of the RECs traded and renewable energy generated to the Federal program office. At this point, the national RPS program office will review the reports. Additionally, the federal program reserves the right to perform any inspection (spot checks or other types of verification) on any renewable generator.

This approach has the potential to serve as the basis for a robust market exchange. The American Institute of Certified Public Accountants (AICPA) can incorporate generally accepted REC auditing practices within the first year of the program. These standardized practices can be utilized by any accrediting accounting organization. As a result, RECs across the country will be accounted for consistently. Thus, market participants are confident in credit validity, a requisite condition for a healthy marketplace (Zimmer, Hungerford, & Rohleder, 2007). Because reports are inspected at the national RPS program office, this may require additional program staff or this review process can be contracted out for a fee.

PROGRAM DESIGN APPROACH

Key Success Factors	Main Tasks
All states must transition to the national RPS by 2012.	Build a web portal to facilitate information sharing across states, utilities, regulatory agencies, and other stakeholders. Host an annual conference to convene stakeholders and discuss pertinent implementation issues such as credit tracking and verification.
A nationally viable and consistent credit currency must represent the national RPS.	Integrate and expand existing regional tracking systems to include federal credit identifiers and provide nationwide visibility into credit availability.
The integrity of the RPS currency, the REC, must be maintained.	Develop auditing guidelines to verify renewable energy credits.
Public and private agencies must address issues of supply and transmission, outside the scope of H.R. 890, to ensure the success of a national and functioning RPS.	Build relationships with and monitor progress of key federal, state, and local agencies actively involved in renewable supply and transmission planning and expansion.
Flexibility in implementing the RPS requires the creation of a REC market to ensure compliance respective to geographic renewable capacity.	Partner with appropriate regulatory agencies to catalyze the development of a market exchange infrastructure for national renewable energy credits.

IMPLEMENTATION PLAN

THE ROAD TO 2012

The renewable portfolio standard mandated by H.R. 890 commences in 2012 with a requirement for utilities to generate 6% of electricity from renewable sources. As a result, program implementation will focus on building key systems and capabilities in 2010. The main focus of 2011 will be to pilot standard operating procedures and systems to ensure a timely and efficient program start date in 2012.

Milestones & Objectives for 2010

The first objective for 2010 will be securing key personnel, such as the program director. A second objective in 2010 will be to complete proposal solicitation and selection for all systems contracts by the end of the first quarter. Once in place, these contract teams will build the technology systems that are critical to H.R. 890 implementation: the web portal and integrated tracking system. Third, the program office will build relationships with key stakeholders and convene an Advisory Council to provide input on the audit guidelines process described in the program design approach. 2010 culminates with the first annual conference, where newly built systems will be debuted and audit guidelines will be shared and discussed. Figure 8 illustrates these 2010 objectives visually on a timeline. For more detail, see Appendix 2: Detailed Calendar of 2010 Events.

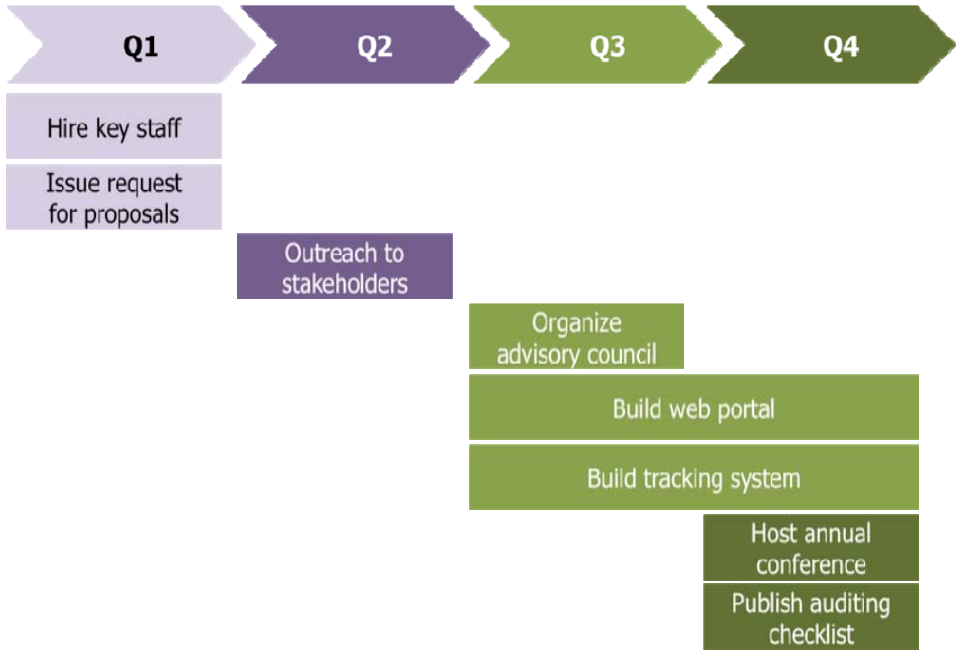


Figure 8
Milestones and objectives for 2010

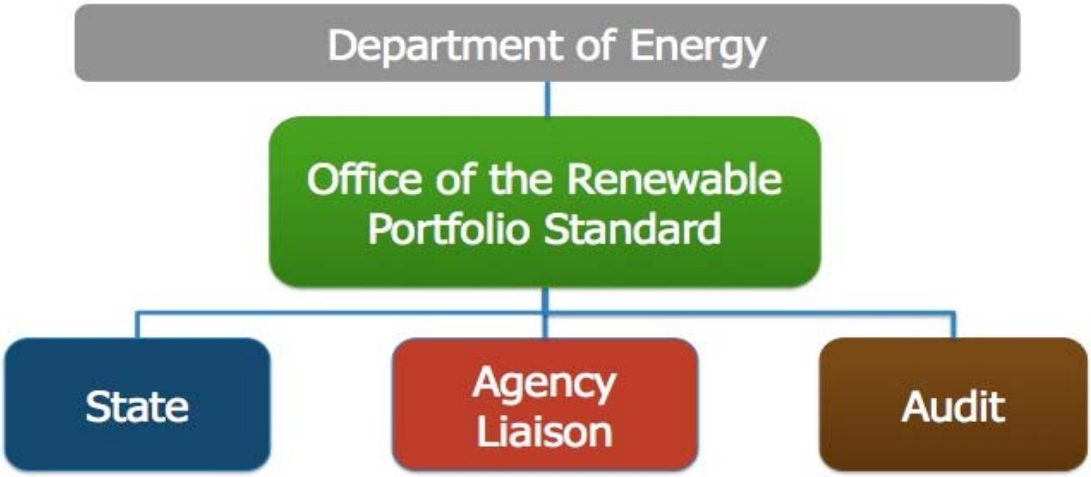


Figure 9
Office of the Renewable Portfolio Standard (ORPS) organizational structure

HUMAN & FINANCIAL CAPITAL FOR SUCCESS

A new federal office will effectively execute the program design approaches just discussed. The federal office will work primarily in an oversight capacity to avoid inefficiencies of command and control functions in areas of policymaking, regulation, and operations (Banks, 2006). Consequently, the federal government will not exercise direct control over process and protocol of RPS implementation; it is the responsibility of concerned parties to establish respective best-fit practices to meet the requirements set forth by the RPS under H.R. 890.

Organizational Overview

The Office of the Renewable Portfolio Standard (ORPS) will be created and housed within the Department of Energy. This office is comprised of three departments: State Integration and Compliance, Agency Liaison, and Audit. These departments are responsible for building and maintaining a successful renewable portfolio standard. Figure 9 illustrates the organizational structure of ORPS.

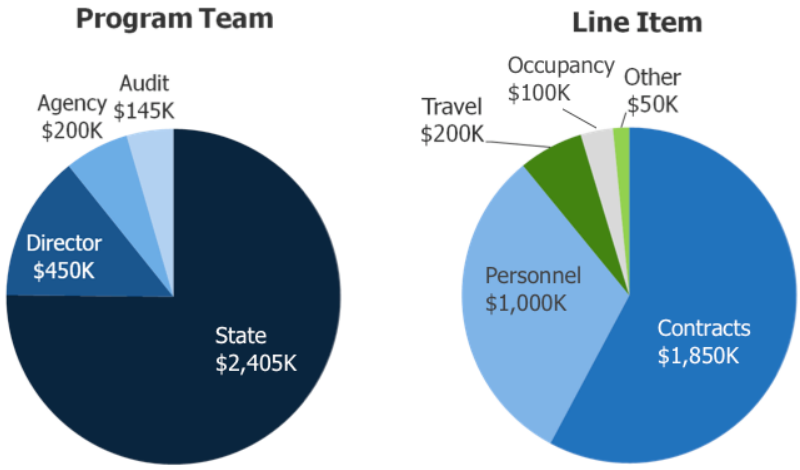


Figure 10
ORPS 2010 budget by team and line item

The ORPS is headed by one program director (senior executive service status) that will oversee all three departments and report directly to the Secretary of Energy. The following sections describe the roles and responsibilities, composition, and budget requirements of each department. For more information on individual job responsibilities, see Appendix 3: Job Descriptions.

The 2010 budget for this program is $3.2 million, which is broken down by team and line item in Figure 10. Salary estimates are based on the U.S. Office of Personnel Management's 2009 General Schedule (U.S. Office of Personnel Management, 2009). Additional detail on budget line items and assumptions can be found in Appendix 4: 2010 Program Office Budget.

H.R. 890 does not include a budget appropriation to cover program administration expenses. Therefore, funding to cover this $3.2 million dollar need must be identified in existing budgets and sources. Several possible sources could fill this funding gap. For example, the Department of Energy received $38 billion from the American Recovery and Reinvestment Act of 2009 (ARRA) (Recovery.Gov, 2009). A large segment of this funding will support renewable energy and could fund H.R. 890 implementation, which is just 0.008% of DOE ARRA funding.

STATE TEAM

Role & Function

The State Integration and Compliance department is responsible for transitioning states with existing RPS programs to ensure compliance with the requirements of the federal RPS established by H.R. 890. It is also responsible for providing assistance to states without existing RPS programs so that compliance may be cost-effectively executed within the timeframe of the 2012 RPS start date. As such, the State team is responsible for establishing and disseminating best practices and gathering on-going program data for analysis to further refine best practices of efficient and cost-effective RPS programs. Additionally, this department oversees the credit tracking system expansion and integration project.

The State Integration and Compliance department will have a department manager (GS-15 status) responsible for a staff of three employees:

- Contract Officer Technical Representative
- Program Analyst
- Information Technology (IT) Analyst

Department Priorities & Tasks

To effectively transition and establish state RPS programs, the State team must address these tasks in 2010:

- Creation of a web portal;
- Expansion of tracking systems;
- State RPS program assistance; and,
- Coordinate and plan the annual RPS convention for networking opportunities for public and private stakeholders.

A budget of $2,400,000 is required to support this department in completing the above priorities and tasks. This budget is primarily driven by IT contract and personnel funds.

AGENCY LIAISON TEAM

Role & Function

The Agency Liaison department is responsible for informing and cooperating with public and private entities in enforcing the RPS while ensuring a direct dialogue to address issues that concern the growth of renewable electricity sources in the U.S. The Agency Liaison department maintains open communication with entities such as the Public Utilities Commission (PUC), Federal Energy Regulatory Commission (FERC), National Association of Regulatory Utility Commissioners (NARUC), and regional and state transmission authorities to monitor developments that pertain to supply and transmission.

The Agency Liaison department is also responsible for expressing to the U.S. Securities and Exchange Commission (SEC) the goals of H.R. 890 for establishing the market exchange for RECs, but will not have an active role. It is the sole responsibility and jurisdiction of the SEC to establish a market exchange that is transparent and competitive so that all stakeholders (federal, state, and private) can invest with confidence in growing the nation's renewable energy infrastructure.

The Agency Liaison department is directly managed by the ORPS Program Director and consists of two analysts.

Department Priorities & Tasks

To ensure a robust dialogue regarding RPS compliance and growing the nation's renewable energy investments and infrastructure, the Agency Liaison department:

- Acts as representatives of the RPS to invoke a spirit of cooperation and mutual beneficence;
- Tracks and monitors development within supply and transmission; and,
- Monitors progress of the market exchange creation by the SEC.

A $200,000 budget is required to support this department in completing the above priorities and tasks. Personnel and travel costs primarily drive this budget.

AUDIT TEAM

Role & Function

The Audit department is responsible for establishing the audit checklist to ensure that utilities track and audit the baseline of renewable energy requirements. The Audit department at year one is only responsible for creating the renewable energy audit checklist, but will expand responsibilities after the market exchange goes online. Starting in 2012, the audit checklist will be used to maintain the integrity of renewable energy credits.

The Audit department, which consists of two analysts in the first year, is also directly managed by the program director.

Department Priorities & Tasks

To create a coherent and effective renewable energy audit checklist that adheres to the requirements set forth by H.R. 890 and the RPS, the Audit department:

- Establishes a renewable energy audit checklist;
- Submits to Department of Energy contracting offices of the cost-effectiveness of hiring private party contractors or personal service contractors for year one department tasks with potential to hire to staff after the start date of the market exchange; and,
- Selects and convenes an advisory council of stakeholders to provide input for renewable energy audit guidelines.

Starting in 2012, this team is also responsible for:

- Desk reviews of independent audit reports submitted; and,
- Spot review of utilities for compliance.

A $145,000 budget is required to support this department in completing the above priorities and tasks. This budget is primarily driven by personnel, travel costs, and costs for the Advisory Council meeting.

OFFICE OF THE DIRECTOR

Role & Function

The Office of the Director has the overall responsibility for the development and on-going success of a national renewable portfolio standard. The Program Director will have an internal management role, with both the agency liaison and audit teams directly reporting to him or her, along with the State Integration and Compliance department managers. Externally, the Director is the program's face, regularly visiting key stakeholders throughout the United States, ranging from utilities to renewable operators, state program offices, and regulatory agencies, to include his or her superiors at the Department of Energy.

In order to support initial implementation and on-going success, the Office of the Director also includes funding for an executive assistant, a part-time human resources manager, and a part-time office assistant.

Department Priorities & Tasks

To provide end-to-end support and oversight, both internally and externally, for the implementation and on-going execution of H.R. 890, the Office of the Director:

- Manages all three departments in the ORPS;
- Hires, manages, and retains ORPS personnel;
- Regularly meets with key stakeholders across the country;
- Updates the DOE and/or Congress about ORPS progress and performance; and,
- Conducts annual budgeting.

A $448,000 budget is required to support this department in completing the above priorities and tasks. Personnel and travel costs primarily drive this budget.

PERFORMANCE MANAGEMENT

A robust performance management strategy is critical to ensure that the financial and human capital discussed in the previous section is effective and ultimately successful in achieving our program goal: 25% of electricity generation from renewable sources by 2025. Over the life of the program, performance management focus and measures will change. Broadly, we can view performance management in the first two years prior to the program's inception in 2012 as having a distinct set of performance criteria from the subsequent years as described in the following subsections.

MANAGING FOR SUCCESS IN 2010

Successful management relies on both comprehensive, action-oriented outcome planning and disciplined, on-going accountability to those plans. The next two subsections describe planning results and a mechanism with which the Director can hold each team accountable to achieving its goals, the Director's Dashboard.

Outcomes and Goals

Setting action-oriented initial, interim, and final goals for each team requires clarity on the ultimate outcome that each team is working towards. Final, interim, and initial goals necessary to the outcome's success can be determined once a team outcome is identified. Table 3, on the next page, shows the results of our 2010 goal-setting effort for each team.

Accountability in 2010

The value of setting goals is realized through rigorous performance assessment. Regular progress reviews allows the Program Director to shift and prioritize resources to increase team effectiveness and success. Each goal listed in Table 3 relies on a process of measuring, collecting, and reporting information to ultimately enable a performance review that generates feedback and course correction as necessary. The State Team largely focuses on managing IT contracts during 2010, and consequently this measurement to feedback process is performed in conjunction with its contract partners.

Team	Outcome	End of year goals	Initial and interim goals
State Team	Seamless transition of all fifty states to the national renewable portfolio standard.	Renewable portfolio standard web portal Linked national credit tracking system Annual conference	**Initial:** Hire the state team; start bidding process for hiring contractors **Interim:** hire contractors; track progress; assist as needed to ensure on-time completion
Agency Liaison Team	Program establishment as a resource and partner for key stakeholders including the credit exchange regulating body, the Securities and Exchange Commission (SEC).	Build communication on supply and transmission issues and advocate for market exchange Strategic director relationships	**Initial:** Hire the team's two analysts; establish contact with relevant public and private agencies **Interim:** Collaborate with other agencies to increase the program's influence over supply and transmission; update Congress with any recommended actions
Audit Team	A robust currency that can be traded with little concern for fraud or opacity.	Form and convene Advisory Council Establish audit guidelines	**Initial:** Hire the team's two analysts; perform research to identify Advisory Council **Interim:** conduct outreach to select Advisory Council members

Table 3
Outcomes and goals for 2010

The Director has end-to-end responsibility for the program's success. As such, we recommend using a dashboard to review performance and immediately spot and react to areas of concern. This dashboard will be populated with reporting information from the State Team manager and from the two teams directly managed by the Director. The dashboard will measure project performance relative to timelines, budget, and other key performance indicators. Once measurement, data collection, and dashboard reporting processes are determined, the Director can use this tool to regularly review performance against goals.

A general framework is in Figure 11 on the next page. Across the top are the three teams, each with sub-content of relevance. The color scheme is a simple three-tier system of green, white, and red, representing "strong", "adequate", and "requires improvement", respectively. Each team has a team bubble, intended to capture internal personnel issues or focus needs.

The detailed composition of the dashboard will change over the evolution of the program. As such, it will remain a relevant, valuable performance management tool as the program team moves from initial systems building and piloting to a fully functional, active program in 2012.

2012 AND BEYOND

After the office and the systems for information sharing and reporting are implemented, the scope of performance measurement will expand beyond internal focus to include external performance metrics and independent reviews.

External Performance Indicators

Once the renewable portfolio standard becomes binding in 2012 at 6% of total electricity generation, two important external performance indicators can be assessed. First, the program will review program compliance with the renewable portfolio standard. What percentage of electricity is actually being generated from renewable sources? Are utilities achieving and or surpassing the mandate? Further, the extent to which the compliance payment option is employed in lieu of renewable energy credits will be revealed. This type of external indicator indicates H.R. 890's success to its ultimate goal: 25% of all American electricity generation from renewable sources by 2025.

Second, the price and quantity of renewable energy credits can be monitored using market exchange data. These indicators reveal the short-term availability of renewable energy credits. In contrast to the program compliance indicator mentioned above, renewable energy credit pricing and availability can be measured on a day-to-day basis if need be. As the Agency Liaison team works to continually build relationships, this information will support efforts to partner with and influence supply and transmission projects for renewable electricity. Further, this data can inform progress updates to Congress.

National Academy of Sciences Review

As designated in H.R. 890, beginning in 2017 and continuing every five years thereafter the National Academy of Sciences (NAS) will conduct an unbiased strategic program review. This is a comprehensive evaluation of the status of the national program and serves as a formal performance report to Congress. This review will help identify if steps need to be taken in order for H.R. 890 to meet the overall goal of generating 25% renewable energy by 2025. Issues that may be identified through the process include expanding the number of eligible renewable technologies and the trajectory of percentage of renewable electricity mandated by H.R 890. The review will continue past 2025 to the sunset of the legislation in 2040 and will serve as an important component of the long-term performance management strategy.

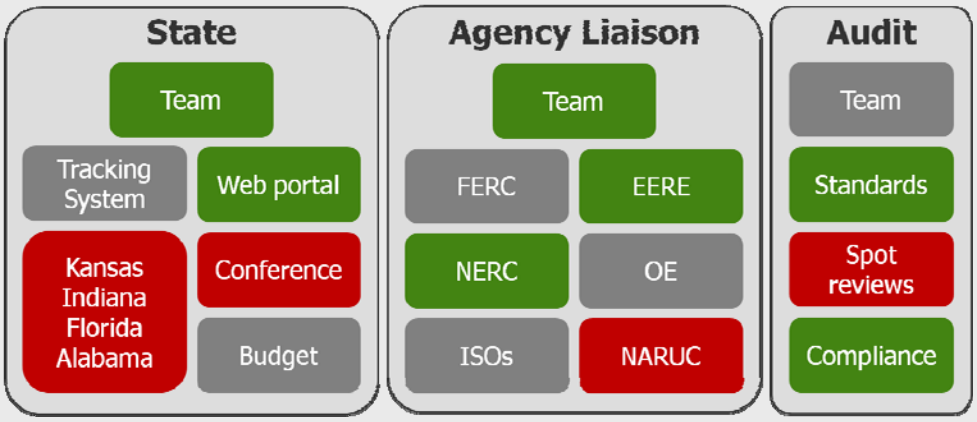


Figure 11
Sample Director's Dashboard

CONCLUSION

For the last 130 years, United States electricity providers relied on plentiful, cost-effective resources for electricity generation. By doing so, they provided opportunities for technical innovations that have contributed to a high quality of life accessible to the vast majority of Americans. But this progress is not without its impacts; dominated by fossil fuels, the current U.S. electricity generation portfolio creates significant adverse environmental and human health impacts: coal, with nearly 50% of the portfolio share, is the most environmentally damaging source. Stemming largely from the mining and combustion processes, the environmental and health impacts of coal range from increased short-term respiratory disease to long-term climate change.

Renewable technologies lack these impacts and have a significant environmental advantage over fossil fuels. Despite this advantage, renewable technologies continue to hold a small share of the electricity generation portfolio (3%). A policy solution is needed to mitigate this environmental problem. H.R. 890 reduces environmental damage caused by the U.S. electricity portfolio by establishing a renewable portfolio standard. This mandate requires utilities to provide a minimum percentage of electricity from renewable sources, starting with 6% in 2012 and steadily increasing to 25% by 2025. In addition, H.R. 890 creates a tradable currency, the renewable energy credit, to provide flexibility and minimize costs to achieve the mandate.

The road to achieve H.R. 890's goal is laden with opportunity and great promise, but also fraught with substantial obstacles and entrenched interests. It is a massive undertaking and a transformation in how we create the electricity that powers the American way of life. To achieve success, extraordinary renewable supply and transmission challenges must be met; utilities must exchange information and renewable energy credits with each other across new technology systems; and essential measures to maintain renewable energy credit integrity must be designed and implemented. This report recommends an implementation strategy and approach to effectively address these critical challenges and to achieve success. Through implementation and RPS mandate lifecycle, performance must be regularly reviewed and managed with a focus on results. This results-orientation is core to the fundamental design of H.R. 890; the policy is structured to track progress towards its ultimate goal of 25% electricity from renewable sources by 2025.

H.R. 890 does not attempt to solve all environmental and public health impacts of the current electricity generation portfolio in the United States. It is, however, a step in the right direction of shifting away from technologies that create long-term environmental costs to achieve short-term economic benefits, towards an electricity generation portfolio that balances economic needs with ideals of progress and sustainability for future generations.

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IMAGE SOURCES

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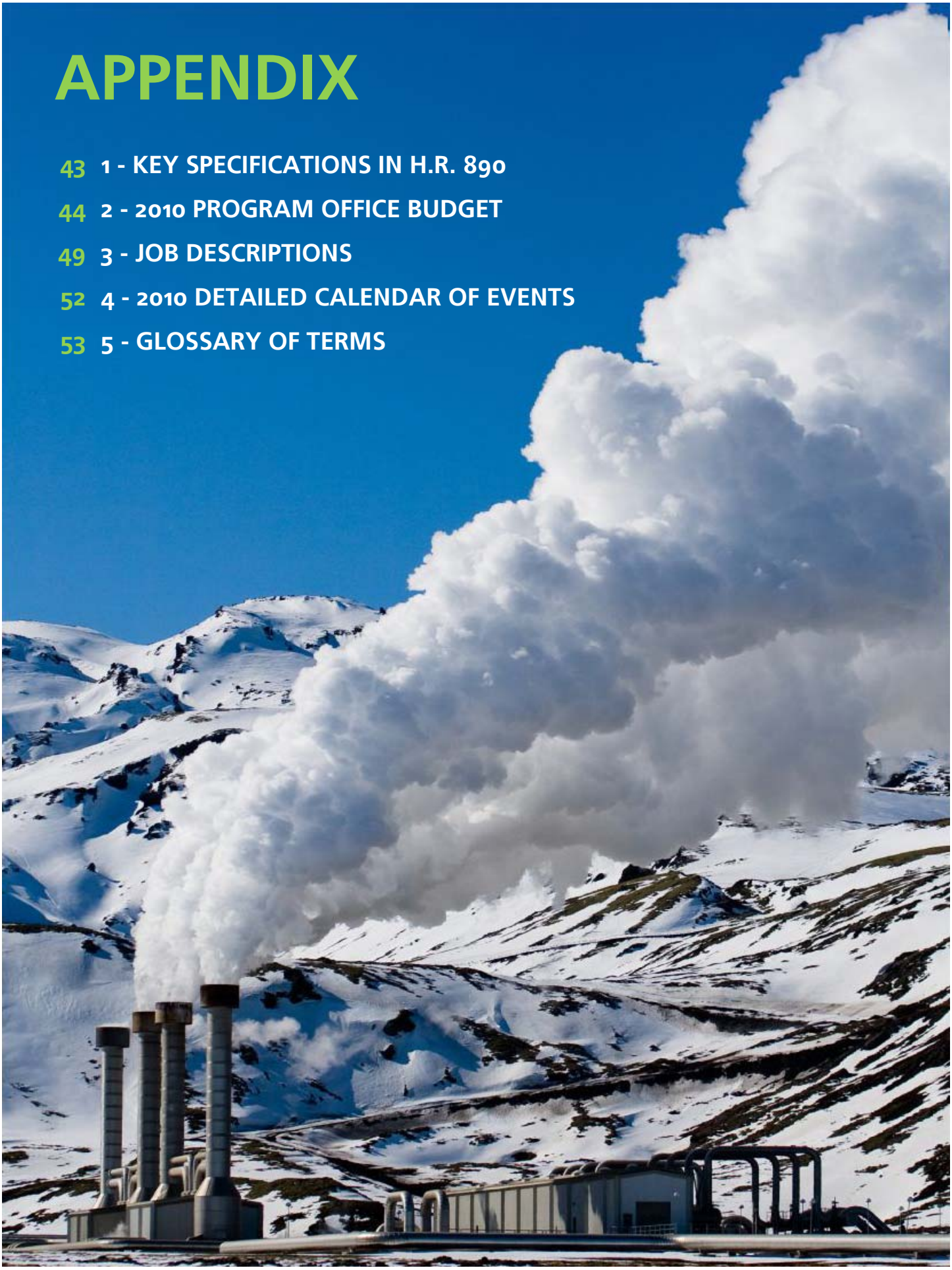
APPENDIX



APPENDIX 1: KEY SPECIFICATIONS IN H.R. 890

Program Participants

Utilities that sell at least 1,000,000 megawatts (MW) of electricity to end-use consumers are required to comply with this policy.

Eligible Renewable Sources

H.R. 890 specifies as eligible sources: wind energy, solar energy, geothermal energy, combustion of biomass or landfill gas, qualified hydropower, and marine and hydrokinetic energy. Qualified hydropower is defined as electricity generated from increased efficiency, capacity additions, or new facilities established since January 1, 2001.

Banking of Renewable Energy Credits

Renewable energy credits may be sold, exchanged, transferred, banked, or submitted by utilities for compliance for three years after the year of issuance. After three years, credits are retired and cannot be submitted for compliance. This mechanism is designed to promote near-term renewable energy generation and provide additional temporal flexibility to utilities.

Distributed Generation

Renewable electricity generation from small-scale power projects (less than 2 MW capacity and serving local consumers) is particularly encouraged by the issuance of three renewable energy credits for each kWh generated. As the cost-competitiveness of distributed generation facilities increases due to future technological advances and industry development, this credit multiplier will be periodically reviewed by program administrators and adjusted downward as appropriate.

Compliance Requirements

Rather than submitting renewable energy credits, utilities can meet a portion or all of their required percentage by making an alternative compliance payment. For each credit owed, a payment that is the lower of 200% of the average market value of a Federal renewable energy credit for the previous compliance year or $0.05, adjusted yearly to account for price changes, can be made.

Renewable Electricity Deployment Fund

Compliance payments and civil penalties made by utilities will be deposited into the Renewable Electricity Deployment Fund established under this policy. The fund will redistribute the money collected to utilities that submitted renewable energy credits for compliance. The money paid to each utility will be calculated according to the number of credits submitted by that utility as a proportion of the total number of credits submitted that year.

Enforcement

For noncompliance, utilities are required to pay civil penalties equivalent to double the normal amount required to satisfy the alternative compliance payment, plus the total quantity of renewable energy credits owed by the utility in violation.

Program Review

The National Academy of Sciences will conduct a comprehensive evaluation of the program's structure and effectiveness and make recommendations for the program's future. Their first review will be submitted by July 1, 2017 and subsequent reviews will occur every five years through 2032. The Department of Energy will take the National Academy of Sciences review into account and submit a first report by January 1, 2018 and every five years afterward through 2033 to the Senate and House Committees with their final recommendations for modifications and improvements to the program.

APPENDIX 2:
2010 PROGRAM OFFICE BUDGET

		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Director's Office						
Personnel						
	Director	$49,790	$49,790	$49,790	$49,790	$199,160
	Executive Assistant	$12,052	$12,052	$12,052	$12,052	$48,209
Shared DOE	Office Manager (0.5 GS 6)	$6,026	$6,026	$6,026	$6,026	$24,105
	HR (0.25 GS 12)	$5,939	$5,939	$5,939	$5,939	$23,758
Supplies						
	Office	$2,000	$350	$350	$350	$3,050
	IT	$6,000				$6,000
Occupancy costs						
	Occupancy costs	$25,000	$25,000	$25,000	$25,000	$100,000
Travel						
	Travel	$10,000	$10,000	$10,000	$10,000	$40,000
Miscellaneous						
	Miscellaneous	$1,000	$1,000	$1,000	$1,000	$4,000
Subtotal		**$117,808**	**$110,158**	**$110,158**	**$110,158**	**$448,281**
State Transition and Tracking						
Personnel						
	Manager (GS 15)	$39,270	$39,270	$39,270	$39,270	$157,079
	IT (GS 13)	$28,251	$28,251	$28,251	$28,251	$113,005
	Staff member 1 (GS 12)	$23,758	$23,758	$23,758	$23,758	$95,030
	Staff member 2 (GS 12)	$23,758	$23,758	$23,758	$23,758	$95,030
Supplies						
	Office	$2,000	$350	$350	$350	$3,050
	IT	$8,000				$8,000
Contracts						
	Tracking System			$750,000	$750,000	$1,500,000
	Web Portal			$150,000	$150,000	$300,000
	Event Planning			$25,000	$25,000	$50,000
Travel						
	Travel	$20,000	$20,000	$20,000	$20,000	$80,000
Miscellaneous						
	Miscellaneous	$1,000	$1,000	$1,000	$1,000	$4,000
Subtotal		**$146,036**	**$136,386**	**$1,061,386**	**$1,061,386**	**$2,405,194**

APPENDIX 2:
2010 PROGRAM OFFICE BUDGET

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Agency Liaison					
Personnel					
Staff member 1 (GS 11)	$19,821	$19,821	$19,821	$19,821	$79,286
Staff member 2 (GS 10)	$18,041	$18,041	$18,041	$18,041	$72,166
Supplies					
Office	$1,000	$200	$200	$200	$1,600
IT	$4,000				$4,000
Travel					
Travel	$10,000	$10,000	$10,000	$10,000	$40,000
Miscellaneous					
Miscellaneous	$1,000	$1,000	$1,000	$1,000	$4,000
Subtotal	**$53,863**	**$49,063**	**$49,063**	**$49,063**	**$201,051**
Auditing					
Personnel					
Analyst 1 (GS 12)		$23,758	$23,758	$23,758	$71,273
Analyst 2 (GS 12)				$23,758	$23,758
Supplies					
Office	$1,000	$100	$100	$100	$1,300
IT	$4,000				$4,000
Travel					
Travel			$10,000	$10,000	$20,000
Advisory council		$20,000			$20,000
Miscellaneous					
Miscellaneous	$1,000	$1,000	$1,000	$1,000	$4,000
Subtotal	**$6,000**	**$44,858**	**$34,858**	**$58,615**	**$144,330**
Total	**$323,707**	**$340,464**	**$1,255,464**	**$1,279,222**	**$3,198,857**

APPENDIX 2:
2010 PROGRAM OFFICE BUDGET

BUDGET ASSUMPTIONS

Note: all salary estimates are informed by U.S. Office of Personnel Management salary schedules.

DIRECTOR'S OFFICE

Personnel

The Director's Office of the ORPS consists of the Director (Senior Executive), the Executive Assistant (GS-6), the Office Manager (GS-6), and the Human Resource Manager (GS-12).
The Office Manager (GS-6) will only be paid with half of the salary, the Human Resource Manager (GS-12) will only be paid a quarter of the salary, since the workload will be shared with other programs housed at the Department of Energy.

Supplies

Expenditures on hardware and furniture for office and IT supply will mostly occur in the first quarter. We are assuming approximately $2000 per person for IT hardware and software expenses and we are leasing all supplies in the first quarter so that the IT person can set-up all the computers at once even though some personnel come on in later quarters.

Travel

We will give the Director's Office a total travel budget of $40,000 for the first year ($10,000 each quarter). We assume that each trip will cost around $2,000. Therefore this travel budget will allow the office enjoy about 20 person-trips in the first year.

Miscellaneous

A budget of $1,000 per quarter will be assigned to the Director's Office to cover unexpected and miscellaneous expenditures.

STATE INTEGRATION AND COMPLIANCE TEAM

Personnel

The State Integration and Compliance department includes the Program Manager (GS-15), IT Technician (GS-13), one Program Analyst (GS-12), and one Contract Officer (GS-12).

Supplies

Office supplies will be similar to the Director's Office considering their similar size.
IT supplies will be the most among all programs and offices. We assume this program will be the most IT intense.

Contracts

The department will contract to third party programmers for expanding the tracking system to the six states. We assume that the bidding and negotiation will take about six months, and it will take anther six months to carry out the program with a total cost of $1,500,000. Therefore, we amortize the total cost to the third and fourth quarter of the year. Given the importance of a linked tracking system we are willing to pay more upfront to make sure it gets completed in a timely fashion. We assume approximately $200,000 annually for one programmer, with 2 programmers for each of the 6 different tracking systems and an extra $300,000 for any additional programmer needs in order to finish within six months.

APPENDIX 2:
2010 PROGRAM OFFICE BUDGET

The department will contract to a third party programmer to create a Web Portal to provide a platform for the sharing of information and best practices. The negotiation will also take about six months and the program will be finished within the rest of the year with a total cost of $300,000 amortized to the third and fourth quarter.
The department will contract to an event planner to organize the Annual Renewable Energy Conference at the end of the year. We assume that the contract would cost about $50,000 and will occur in the third and fourth quarters of the year. To minimize the impact on public state and local budgets, all participants of the conference will pay for their hotel room and airfare, but only private sector attendees will pay a fee for the conference itself. This approach will cover direct expenses associated with the conference itself excluding the aforementioned and budgeted event coordinator.

Travel

The travel budget for this department is the most (more than doubled) compared with the other programs and offices. They have the largest personnel among all programs and their job will require them travel frequently to coordinate different state RPS programs.

Miscellaneous

A budget of $1,000 per quarter will be assigned to the State Integration and Compliance team to cover unexpected and miscellaneous expenditures

AGENCY LIAISON TEAM

Personnel

The Agency Liaison department includes two analysts, one GS-11, the other GS-10.

Supplies

Office and IT supplies are similar to State Integration and Compliance program but with a much smaller budget (half), given their smaller size of personnel.

Travel

The department will be given the same travel budget as the Director's Office. Although their job requires frequent communication with different agencies, most agencies have their headquarters in Washington D.C.

Miscellaneous

A budget of $1,000 per quarter will be assigned to the Agency Liaison department to cover unexpected and miscellaneous expenditures.

APPENDIX 2:
2010 PROGRAM OFFICE BUDGET

AUDIT TEAM

Personnel

The Audit department includes two analysts (GS-12). The first analyst will not be onboard until the second quarter of the year. We assume that it will take about four months for AICPA to determine the necessary accounting and auditing principles for Renewable Energy Credits. The second analyst will come on in the fourth quarter to help set up systems for handling incoming audits.

Supplies

The IT and Office supplies will be a little less than the Agency Liaison program given that the office only has one staff member for most of the year.

Travel

We assign a quarterly travel budget of $10,000 to Audit department, which is the same as Agency Liaison department and Director's Office. This budget starts in the third quarter.

We also assign a budget of $20,000 for the program to coordinate an advisory council on the auditing standards at the second quarter to bring utilities and relevant stakeholders to consent. The budget will be used for representation from small utilities. Larger stakeholders will pay their own way.

Miscellaneous

A budget of $1,000 per quarter will be assigned to the Auditing department to cover unexpected and miscellaneous expenditures.

APPENDIX 3: JOB DESCRIPTIONS

GS-STATUS & POSITION DESCRIPTION	ROLE AND RESPONSIBILITIES
Program Director	
Senior Executive Service Personnel (annual salary max of $177,000) The Program Director is the head of the Office of the Renewable Portfolio Standard and is responsible for the implementation of the federal renewable portfolio standard and delivery of its goals to grow the renewable energy market in the United States	- Oversee program departments - Work closely with State team to efficiently transition states to federal RPS - Personally manage the Agency Liaison team to establish and maintain relationships with pertinent agencies - Personally manage the Audit team to establish auditing guidelines with task force of public and private auditor firms - Report to Department of Energy on progress of RPS implementation progress and development - Promote Office of RPS goals and programs with public and private entities to ensure growth of renewable energy through the RPS
Manager	
GS-15 (annual salary of $110,000-$140,000) The State team manager is responsible for ensuring a smooth transition of all state RPS programs to meet the mandates set forth by the federal RPS	- Manage State team department deliverables and report to the Program Director of state RPS program transition progress - Work with State team to draft request for proposals to interested parties to create web portal - Ensure relevant data collection to establish best practices - Ensure timely expansion of tracking systems to cover all states
Contract Officer	
GS-13 (annual salary of $75,000-$100,000) The State team contract officer is responsible for ensuring timely delivery of contract outputs as agreed upon with third-party contractors	- Work with State team manager to draft request for proposal for web portal creation - Draft request for proposal to interested third-parties to plan and host the annual RPS convention - Draft request for proposal for the tracking system expansion - Monitor progress of third-party contract work and report to manager

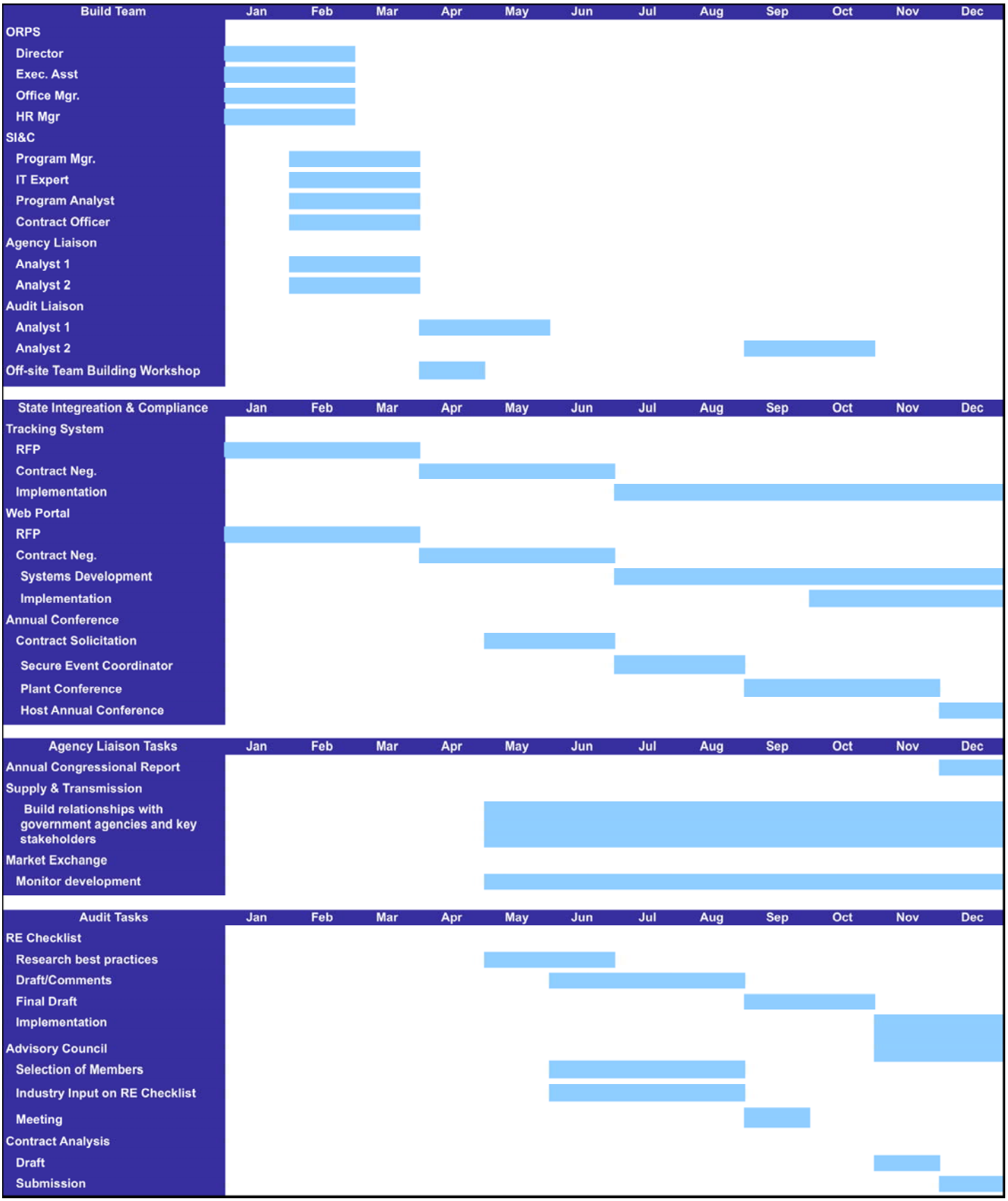
APPENDIX 3: JOB DESCRIPTIONS

GS-STATUS & POSITION DESCRIPTION POSITION DESCRIPTION	ROLE AND RESPONSIBILITIES
Analyst	
GS-13 (annual salary range of $75,000-$100,000) The State team analyst is responsible for collecting and disseminating data for analysis to establish RPS implementation best practices	- Work with state RPS agencies to assist with compliance of the federal RPS - Collect data from state agencies and conduct analysis to establish best practices
IT Resource	
GS-13 (annual salary range of $75,000-$100,000) The State team IT resource analyst is responsible for ensuring long-term ownership of the web portal and tracking system from the third-party contractors	- Monitor web portal creation - Work with the State team analyst to ensure the web portal is updated with timely and relevant information - Maintain the web portal and address any access problems - Ensure and address any issues with tracking systems access and transparency
Analyst (2)	
GS-13 (annual salary range of $75,000-$100,000) The Agency Liaison team analysts are responsible for establishing and maintaining dialog with relevant third-party entities to address issues regarding RPS implementation and compliance	- Act as representatives of the Office of the RPS to ensure an environment of cooperation with public and private entities - Establish relationships with public and private entities to address issues such as supply and transmission and collect any recommendations for pertinent legislative action - Submit to Congressional members any requested progress reports - Monitor the creation of the renewable energy credit (REC) market exchange by the Securities and Exchange Commission (SEC)
Analyst (2)	
GS-13 (annual salary range of $75,000-$100,000) The Audit team analysts are responsible for establishing a relevant audit checklist to monitor and ensure compliance of RPS	- Work with task team to create audit checklist to track renewable energy credits (REC) - Perform desk reviews of submitted independent audit reports by utilities - Perform spot inspections to ensure integrity of the RECs as stipulated in the RPS - Submit to Department of Energy cost-effectiveness report of private party / personal service contractors with potential to hire after RPS year one infrastructure is established

APPENDIX 3: JOB DESCRIPTIONS

GS-STATUS & POSITION DESCRIPTION	ROLE AND RESPONSIBILITIES
Program Director	
Senior Executive Service Personnel (annual salary max of $177,000) The Program Director is the head of the Office of the Renewable Portfolio Standard and is responsible for the implementation of the federal renewable portfolio standard and delivery of its goals to grow the renewable energy market in the United States	- Oversee program departments - Work closely with State team to efficiently transition states to federal RPS - Personally manage the Agency Liaison team to establish and maintain relationships with pertinent agencies - Personally manage the Audit team to establish auditing guidelines with task force of public and private auditor firms - Report to Department of Energy on progress of RPS implementation progress and development - Promote Office of RPS goals and programs with public and private entities to ensure growth of renewable energy through the RPS
Manager	
GS-15 (annual salary of $110,000-$140,000) The State team manager is responsible for ensuring a smooth transition of all state RPS programs to meet the mandates set forth by the federal RPS	- Manage State team department deliverables and report to the Program Director of state RPS program transition progress - Work with State team to draft request for proposals to interested parties to create web portal - Ensure relevant data collection to establish best practices - Ensure timely expansion of tracking systems to cover all states
Contract Officer	
GS-13 (annual salary of $75,000-$100,000) The State team contract officer is responsible for ensuring timely delivery of contract outputs as agreed upon with third-party contractors	- Work with State team manager to draft request for proposal for web portal creation - Draft request for proposal to interested third-parties to plan and host the annual RPS convention - Draft request for proposal for the tracking system expansion - Monitor progress of third-party contract work and report to manager

APPENDIX 4:
2010 DETAILED CALENDAR OF EVENTS



APPENDIX 5: GLOSSARY OF TERMS

All definitions are sourced directly from the Energy Information Administration (EIA) of the United States Department of Energy (DOE) or from the North American Electric Reliability Corporation (NERC). The respective glossaries can be accessed at: http://www.eia.doe.gov/ and at http://www.nerc.com/. If another source is used, it is noted in parenthetical citation.

Base Load: the minimum amount of electric power delivered or required over a given period at a constant rate (NERC).

BTU (British thermal unit): The quantity of heat required to raise the temperature of 1 pound of liquid water by 1 degree Fahrenheit at the temperature at which water has its greatest density (approximately 39 degrees Fahrenheit) (EIA).

Billion kilowatt-hours (BkWh): see kilowatt-hour, below. The equivalent of one billion kilowatt-hours (EIA).

Carbon dioxide (CO_2): a colorless, odorless, non-poisonous gas that is a normal part of Earth's atmosphere, comprised of two oxygen double bonded to a central carbon atom. Carbon dioxide is considered a greenhouse gas as it traps heat (infrared energy) radiated by the Earth into the atmosphere and thereby contributes to the potential for global warming (EIA).

Capacity: The maximum output, commonly expressed in megawatts (MW), that generating equipment can supply to system load, adjusted for ambient conditions (EIA).

Distribution: the delivery of energy to retail customers (EIA).

Distributed generation: generation located close to the load the load it is intended to serve (EIA).

Distribution provider (electric): provides and operates the "wires" between the transmission system and the end-use customer. For those end-use customers who are served at transmission voltages, the Transmission Owner also serves as the Distribution Provider. Thus, the Distribution Provider is not defined by a specific voltage, but rather as performing the Distribution function at any voltage (NERC).

Electric power grid: a system of synchronized power providers and consumers connected by transmission and distribution lines and operated by one or more control centers. In the continental United States, the electric power grid consists of three systems: the Eastern Interconnect, the Western Interconnect, and the Texas Interconnect. In Alaska and Hawaii, several systems encompass areas smaller than the State (e.g., the interconnect serving Anchorage, Fairbanks, and the Kenai Peninsula; individual islands) (EIA).

Electric power plant: A station containing prime movers, electric generators, and auxiliary equipment for converting mechanical, chemical, and/or fission energy into electric energy (EIA).

Electric utility: any entity that generates, transmits, or distributes electricity and recovers the cost of its generation, transmission or distribution assets and operations, either directly or indirectly, through cost-based rates set by a separate regulatory authority (e.g., State Public Service Commission), or is owned by a governmental unit or the consumers that the entity serves. Examples of these entities include: investor-owned entities, public power districts, public utility districts, municipalities, rural electric cooperatives, and State and Federal agencies. Electric utilities may have Federal Energy Regulatory Commission approval for interconnection agreements and wholesale trade tariffs covering either cost-of-service and/or market-based rates under the authority of the Federal Power Act (EIA).

APPENDIX 5: GLOSSARY OF TERMS

Electricity: a form of energy characterized by the presence and motion of charged particles. The charge is generated by friction, induction, or chemical change (EIA).

Electricity distributor: see distribution and distribution provider, above.

Electricity generator: a facility that produces only electricity, commonly expressed in kilowatt-hours (kWh) or megawatt-hours (MWh). Electric generators include electric utilities and independent power producers (EIA).

Electricity retailer: firm that sells the electricity product directly to the consumer (EIA).

Electricity transmission: power is generated at power plants and then moved to distribution substations by transmission lines. The nearly 160,000 miles of high voltage transmission lines is known as the grid. Transmission systems are unique because they transfer electricity at the speed of light as there is no long-term storage capability for electricity. There are three major transmission grids: 1) Eastern, 2) Western, and 3) Texas Interconnects (EIA).

Generation: the process of producing electric energy by transforming other forms of energy; also, the amount of electric energy produced, expressed in kilowatt-hours (DOE EIA).

Generator: a generator is a device that converts mechanical energy into electrical energy. The process is based on the relationship between magnetism and electricity. A typical generator at a power plant uses an electromagnet—a magnet produced by electricity—not a traditional magnet. The generator has a series of insulated coils of wire that form a stationary cylinder. This cylinder surrounds a rotary electromagnetic shaft. When the electromagnetic shaft rotates, it induces a small electric current in each section of the wire coil. Each section of the wire becomes a small, separate electric conductor. The small currents of individual sections are added together to form one large current. This current is the electric power that is transmitted from the power company to the consumer (EIA).

Gigawatt (GW): see watt, below. One billion watts or one thousand megawatts (EIA).

Greenhouse gas: those gases, such as water vapor, carbon dioxide, nitrous oxide, methane, hydro fluorocarbons (HFCs), per fluorocarbons (PFCs) and sulfur hexafluoride, that are transparent to solar (short-wave) radiation but opaque to long-wave (infrared) radiation, thus preventing long-wave radiant energy from leaving Earth's atmosphere. The net effect is a trapping of absorbed radiation and a tendency to warm the planet's surface (EIA).

Kilowatt-hour (kWh): a measure of electricity defined as a unit of work or energy, measured as 1 kilowatt (1,000 watts) of power expended for 1 hour. One kWh is equivalent to 3,412 Btu (DOE EIA).

Kinetic energy: the energy of motion. Energy available as a result of motion that varies directly in proportion to an object's mass and the square of its velocity (EIA).

Load: An end-use device or customer that receives power from the electric system (NERC).

Megawatt (MW): one million watts of electricity (EIA).

APPENDIX 5: GLOSSARY OF TERMS

Natural gas: a gaseous mixture of hydrocarbon compounds, the primary one being methane. *Note*: The Energy Information Administration measures wet natural gas and its two sources of production, associated/dissolved natural gas and non-associated natural gas, and dry natural gas, which is produced from wet natural gas (EIA).

Nitrogen oxides (NO_x): compounds of nitrogen and oxygen produced by the burning of fossil fuels (EIA). In the atmosphere, nitrogen oxides can contribute to smog, can decrease visibility, and have bad consequences for health such as lung disease.

Renewable energy credit (REC): an intangible asset or property right, issued by an appropriate government authority (i.e. Federal or State government), that represents the nonpower environmental benefits of producing renewable electricity. A REC is created at the same time that the electricity is generated. It separates the environmental benefits of renewable electricity generation from the actual electricity generated by bundling those benefits into this item called a REC. This lets people buy RECs and be able to claim the rights of using clean energy. In H.R. 890, the Federal government will issue 1 REC for every 1 kWh renewable electricity generated (except in the special case of distributed generation). Important note, this may be different from other existing programs like state programs where the rules or equivalent amounts may be different, but this won't matter if the policy is passed because they will only be able to submit the government-issued RECs in this program (i.e. they can't submit state-issued RECs to fulfill H.R. 890's requirements). They've also been called renewable energy certificates, tradable renewable certificates (TRCs), and green tags, but the concept is all the same. (US EPA, 2009d).

Renewable: see renewable energy source, below.

Renewable energy source: an energy source that can be replaced within a short time frame and will not run out (EIA).

Renewable portfolio standard (RPS): a renewable portfolio standard is a policy that requires that utilities obtain a minimum amount of their retail electricity from qualified renewable sources. Policies are typically structured by setting a minimum percentage of total electricity but can also be structured by setting a minimal amount irrespective of total electricity. Each policy defines what sources qualify as renewable. Finally, these policies specify how utilities can obtain electricity from renewable sources and typically include an option to purchase renewable energy credits in lieu of purchasing actual electricity that was derived from renewable sources. (Wiser & Barbose, 2008).

Sulfur dioxide (SO_2): a toxic, irritating, colorless gas soluble in water, alcohol, and ether. Used as a chemical intermediate, in paper pulping and ore refining, and as a solvent; is also a by-product in fossil fuel combustion (EIA). Sulfur dioxide pollution can cause respiratory disease and lead to premature death in humans (US EPA, 2009b).

Transformer: transformers transfer electrical energy from one circuit to another. The transformer allows electricity to be efficiently transmitted over long distances. The electricity produced by a generator travels along cables to a transformer, which changes electricity from low voltage to high voltage. Electricity can be moved long distances more efficiently using high voltage. Transmission lines are used to carry the electricity to a substation. Substations have transformers that change the high voltage electricity into lower voltage electricity. From the substation, distribution lines carry the electricity to homes, offices and factories, which require low voltage electricity (EIA).

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Transmission: an interconnected group of lines and associated equipment for the movement or transfer of electric energy between points of supply and points at which it is transformed for delivery to customers or is delivered to other electric systems (NERC).

Volt: the International System of Units (SI) measure of electric potential or electromotive force. A potential of one volt appears across a resistance of one ohm when a current of one ampere flows through that resistance. Reduced to SI base units, 1 V = 1 kg times m^2 times s^{-3} times A^{-1} (kilogram meter squared per second cubed per ampere) (EIA).

Wind turbine: Wind energy conversion device that produces electricity; typically three blades rotating about a horizontal axis and positioned up-wind of the supporting tower (EIA).

Watt (W): the unit of electrical power equal to one ampere under a pressure of one volt. A Watt is equal to 1/746 horsepower (EIA).

Wind energy: kinetic energy present in wind motion that can be converted to mechanical energy for driving pumps, mills, and electric power generators (EIA).

Wind farm: a group of wind turbines interconnected to a common utility system through a system of transformers, distribution lines, and (usually) one substation. Operation, control, and maintenance functions are often centralized through a network of computerized monitoring systems, supplemented by visual inspection. This is a term commonly used in the United States. In Europe, it is called a generating station (EIA).