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Summary of Draft Regional Energy Roadmap Objectives, Milestones and Strategies

Energy Efficiency Chapter

Efficiency Objectives:

- Determine how much cost-effective efficiency and conservation potential exists in each state and province through a comprehensive assessment.
- Set an efficiency and conservation goal for each jurisdiction based on results of the assessment.
- Design programs and policies that best fit each jurisdiction's goal and needs.
- Measure annual progress and the costs and benefits of efficiency investments.

Measurable Milestones for Efficiency:

- Establish numeric milestones for the years 2015, 2030 and 2055 in each state or province to achieve the potential identified in its comprehensive energy efficiency and conservation assessment.
- Re-evaluate these milestones every 2-5 years.

Efficiency Strategies:

- Strengthen existing state/provincial and federal energy efficiency programs.
- Support utility assessments of energy efficiency and conservation potential that quantify the amount of energy efficiency that would cost less per kilowatt hour than the next most expensive energy source.
- Require utilities to make energy efficiency a priority and to include it as a standard part of their integrated resource plans.
- Decouple utility revenues from sales.
- Adopt more aggressive building codes and appliance standards.
- Have the public sector lead by example.
- Strengthen efforts to encourage adoption of energy efficiency technologies by consumers.
- Identify and remove other existing disincentives for energy efficiency and encourage utilities to adopt creative rate design that encourages energy efficiency.
- Support research that accelerates the commercialization of new energy efficiency technologies.

Coal Chapter

Coal Objectives:

- Support the demonstration of large-scale carbon sequestration projects.
- Begin now to develop the considerable carbon dioxide (CO_2) management infrastructure that will be needed to permanently sequester CO_2 on a large scale, both geologically and terrestrially.
- Support demonstration and commercialization of new carbon capture technologies at existing coal facilities.
- Create a policy and regulatory environment that provides incentives for building coal plants with technologies that enable low- CO_2 coal use and permanent capture and storage of the resulting CO_2.
- Support state public service commission use of integrated resource planning to maximize cost-effective use of energy efficiency and load management programs and buy time for clean coal technologies with carbon capture and sequestration (CSS) to be demonstrated commercially.

Measurable Milestones for Coal:

- By 2015, the region should have at least two integrated gasification-combined cycle (IGCC) coal power plants with CCS.
- By 2015, the region should demonstrate commercial scale post-combustion capture of CO_2 at a pulverized coal plant.
- By 2020, the region will have operating at commercial scale multiple integrated gasification-combined cycle or pulverized coal combustion plants with CCS.
- By 2055, the region will obtain 80 percent of its coal-based electric power from plants that eliminate or capture CO_2 emissions.

Each state or province should also track the following:

- Percentage of total CO_2 from coal use that is captured and permanently stored underground or used for enhanced oil recovery.
- Percentage of total sulfur dioxide, nitrogen oxide, mercury emissions and fine particles avoided.
- Increase in energy efficiency of coal fleet due to technology retrofits or new coal plants.
- Percentage of new coal plant capacity installed with low-carbon technology and CCS.

Coal Strategies:

- Support the development of at least two commercial scale advanced gasification plants with CCS in the region, one with Powder River Basin sub-bituminous coal and another with lignite coal.
- Lay a foundation for CO_2 management through:
    - Development of the legal and regulatory framework needed for geologic storage of CO_2;
    - Comprehensive assessments of geologic reservoirs at state and federal levels to determine CO_2 storage potential and feasibility;
    - Feasibility assessment of CO_2 transport and "advanced sequestration" options for states and provinces with no documented geologic sequestration potential, such as Minnesota and Wisconsin;
    - Tax incentives for carbon capture and storage, including CO_2's use in enhanced oil recovery (EOR) in order to stimulate gasification projects that include CCS; and
    - Provide EOR project development assistance.
- Provide incentives to get commercial projects built through:
    - Support for Front-End Engineering and Design (FEED) packages (FEED packages are the (upfront studies needed to provide good cost estimates for power plant projects);
    - Direct state financial incentives (tax credits, loan guarantees, and performance coverage for EPC or engineering/procurement/construction);
    - Regulated utility cost recovery for appropriate demonstration projects;
    - Enhanced integrated resource planning policies by using them to encourage low-CO2 coal technologies;
    - Opportunities for state regulatory programs to favor IGCC and other advanced low-carbon technologies over conventional pulverized coal units (could include low-carbon electricity portfolio standards or objectives; long-term power purchase agreements to provide developers with higher rates of return and reduced risk for ratepayers; and market-based regulatory programs to provide incentives to invest in low emission technologies).
- Update workforce training and research and development programs and investments, with a focus on developing the gasification and carbon sequestration industries.

Wind Chapter

Wind Objectives:

- Maximize wind power integration on the grid.
- Expand transmission capacity to accommodate more wind energy.
- Reduce capital and other costs of wind development.
- Encourage greater local equity (ownership) participation in wind farms.
- Demonstrate new technologies for very large-scale wind energy development.

Measurable Milestones for Wind:

The regional shall obtain from wind energy:

- By 2015, 10 percent of total retail sales;
- By 2020, 20 percent of total retail sales;
- By 2030, 30 percent of total retail sales;
- By 2040, 30 percent of total energy production (includes using wind energy for uses other than electricity such as manufacturing hydrogen and fertilizer).

Wind Strategies:

- Support a long-term extension of the U.S. federal production tax credit or comparable new long-term federal incentive.
- Consider new policy approaches to wind energy development in the Dakotas, which currently lack renewable energy standards or objectives.
- Incorporate transmission development requirements into existing state and provincial renewable energy objectives and standards.
- Encourage a diversity of approaches to wind development, including projects that have significant components of local ownership.
- Expand collaborative regional transmission planning efforts to help develop the infrastructure for future wind energy development.
- Consider development of a U.S./North American transmission development initiative to facilitate large-scale wind integration and other energy priorities.
- Define and support a large-scale, multi-jurisdictional wind energy project that incorporates synergies with other low-carbon generation options.
- Demonstrate technology and engineering strategies for achieving greater than 20 percent of total electricity generation from wind.
- Develop policies to attract wind energy component manufacturers and service providers to locate their operations within the region.

Biomass Chapter

Biomass Objectives:

- Maximize the economic and environmentally sustainable use of biomass.
- Reduce the carbon and water-intensity of biomass production and conversion.
- Demonstrate and commercialize a wide range of technologies to allow biomass to compete with fossil fuels in multiple markets.
- Facilitate increased use of terrestrial carbon sequestration through research, demonstration projects, and establishment of market rules and policy incentives.

Measurable Milestones for Biomass:
The region will:

- By 2015, demonstrate key biomass technologies, including:
    - Biomass combined heat and power systems to utilize waste heat for power production;
    - Biomass integrated gasification-combined cycle (IGCC) to produce power, either with or without coal;
    - Cellulosic ethanol production from a broad range of materials (native grasses, wheat straw, corn stover, etc.);
    - Synthetic natural gas from biomass, especially manure; and
    - Pyrolysis based utilization of biomass (heat and pressure) to produce bio-oil.
- By 2025, replace 10 perc;ent of total regional energy consumption with biomass.
- By 2055, replace 25 percent of total regional energy consumption with biomass.

Biomass Strategies:

- Support demonstration and commercialization of advanced biomass technologies by:
    - Providing capital through cost share, loan guarantees, revolving loan funds, and bonds;
    - Production and purchase incentives for bio-based energy production;
    - Reduction of regulatory barriers through streamlining and new permitting rules and other procedures for emerging technologies; and
    - Supporting local ownership while recognizing the role that outside investment will play in the industry.
- Develop a perennial biomass supply through a range of incentives and programs.
- Establish uniform bio-based product procurement rules in each state and province of the region that are consistent with current federal rules and product lists.
- Implement policies that help increase the penetration of biofuels in the marketplace such as renewable fuels standards (including for cellulosic biofuels), promotion of biofuel powered vehicles, state purchasing, and retail tax incentives.
- Provide technical assistance and support through state and provincial funding of front-end engineering and design studies, business planning and assistance, and expansion of technical assistance capabilities and services.
- Support basic and applied research on crops and conversion technologies.
- Expand state/provincial workforce development programs and cooperation with the private sector to ensure a new generation of trained personnel to build and operate the new bio-economy.
- Increase public education about the bio-economy through schools, government agencies and private organizations.
- Establish a regional entity to foster collaboration among state departments of agriculture, land grant universities and extension systems to advance bio-economy goals, policies and initiatives.

Hydropower Chapter

Hydropower Objectives:

- Pursue environmentally responsible development of hydropower projects for both new and upgraded facilities.
- Develop new hydropower projects with the involvement of locally affected communities.
- The timing and delivery of new hydropower must be coordinated with a broader regional energy strategy so that the necessary transmission infrastructure is in place if and when needed.
- Hydropower in the region should, whenever possible, complement the development and delivery of other low- and zero-CO_2 energy resources in the region.

Measurable Milestones for Hydropower:
In accordance with the above objectives, the region shall bring in service:
- 2,000 MW of new hydropower by 2025.
- 5,000 MW of new hydropower by 2055.

Hydropower Strategies:
- Explore potential synergies among hydro, wind and other renewable and near-zero emission energy technologies, including their ability to share new transmission capacity (getting agreement about what goes on the wires will facilitate the siting, permitting and construction of those wires).
- If a market evolves for the tracking and trading of CO2 emissions, allocate emission reduction credits to new hydro generation at a level at least comparable to combined-cycle gas turbines.
- Consider new hydropower production in any regional, state and provincial renewable energy policies.
- Include new hydro generation in any incentives established, or revised, for other zero-CO2 energy production.

Nuclear Chapter

Nuclear Objectives:
- Development of new nuclear power in the region would require:
- Agreement on safe and permanent storage options for nuclear waste;
- Concerns over terrorism and nuclear proliferation to be adequately addressed;
- That new, simpler and more efficient power plant designs be proved out; and
- That nuclear power out-competes energy options with a natural advantage in the region.

Measurable Milestones for Nuclear
- None at this time and until above conditions are met.

Nuclear Strategies:
- No specific strategies recommended at this time.

Hydrogen and Fuel Cells Chapter

Hydrogen Objectives:
- Identify and build early niche markets for hydrogen, fuel cells and related technologies.
- Establish hydrogen infrastructure to support those markets.
- Stimulate consumer demand via education and incentives.
- Expand the region's industrial base in fuel-cell and hydrogen technologies.
- Explore hydrogen's potential for bringing renewable energy sources to market.
- Help each state and province in the region to capitalize on its renewable and low-carbon hydrogen production strengths.

Measurable Milestones for Hydrogen:
The roadmap chapter includes a range of technical and performance measures and timeframes for hydrogen production and fuel cell development in the following areas:

- Hydrogen production from natural gas and liquid fuels, biomass, direct water-splitting and large-scale central electrolysis.
- Demonstration of hydrogen delivery from central production to fueling station, on-site moving and handling, and on-board storage systems.
- Development and reduction in the cost of automotive and distributed generation fuel cells;
- Validation of an integrated biomass, wind or geothermal electrolyzer-hydrogen system at certain price points.
- Adoption of codes and standards and publication of a best practices safety manual.
- Comprehensive and coordinated public education campaign about the hydrogen economy and fuel cell technologies.

Hydrogen Strategies:

- Develop a hydrogen roadmap for each state and province.
- Implement a range of policy incentives and initiatives from among the following options:
    - Accelerated depreciation on hydrogen-related equipment.
    - Matching funds for strategically important deployment projects.
    - Hydrogen production incentive.
    - Inclusion of hydrogen in renewable and low-carbon energy standards or objectives.
    - Government purchasing in support of hydrogen production and technologies.
    - Uniform codes, standards and siting requirements.
    - Education and outreach to key audiences.
    - Cost recovery mechanisms for regulated utilities.
    - Basic and applied research at regional research institutions.
    - Special benefits to owners/purchasers of hydrogen-powered vehicles.