Chapter 3

Analysis of the WCI

The Western Business Roundtable requested that this analysis of the WCI view the plan through the lens of these four basic questions:

1. Would the WCI contribute to increased reliability of the region's energy production and delivery infrastructure – would it help "keep the lights on" as the West works to pull itself out of economic recession?

2. Would the WCI stimulate new technology investment in the West, especially on carbon capture and sequestration technologies, so that our region can lead the nation and the world in the deployment of these technologies?

3. Would the WCI deliver measurable environmental benefits, in terms of future climate change, to the tens of millions of consumers who will be asked to pay the costs of such a program?

4. Does the WCI strengthen the West's bargaining position in the upcoming policy debates over national GHG mitigation measures?

As part of that assessment, the analysis specifically examined the WCI's economic model, project design and data integrity. This chapter provides an assessment of these topics.

3.A. The Economic Model

To examine the economic impacts of the WCI program, WCI contracted with ICF International and Systematic Solutions, Inc. to perform economic analyses using the ENERGY 2020 model.[19] The

[19] This is an integrated multi-region energy model that provides all-fuel demand and supply sector simulations. It can be linked to a detailed macroeconomic model to determine the economic impacts of energy and environmental policies, but a macroeconomic analysis was not conducted for the WCI study.

model simulates demand by three residential categories (single family, multi-family, and agriculture/rural), over 40 NAICS commercial and industrial categories,[20] and three transportation services (passenger, freight, and off-road). There are six end uses per category and six technology/mode families per end-use.[21] The technology families correspond to six fuels groups (oil, gas, coal, electric, solar and biomass) and 30 detailed fuel products, and the transportation sector contains 45 modes including various types of automobile, truck, off-road, bus, train, airplane, marine and alternative-fuel vehicles. The electricity load duration curves are dynamically constructed from the individual end-uses to capture changing conditions under consumer choice and combined gas/electric programs. The supply portion of the model is of special significance, and includes detailed electric supply simulation of capacity expansion and construction, rates and prices, and the impacts of regulation.

Each energy demand sector includes cogeneration, self-generation, and distributed generation simulation, including mobile-generation, micro-turbines, and fuel cells, and fuel-switching responses are determined. The technology families are aggregates that, within the model, change building shell, economic-process, and device efficiency and capital costs as price or other information changes. ENERGY 2020 utilizes the historical and forecast data developed for each technology family to parameterize and disaggregate the model.

The supply portion of the model includes endogenous electric supply simulation of capacity expansion/construction, rates/prices, load shape variation due to weather, and changes in regulation. The model dispatches plants according to specified rules and simulates transmission constraints when determining dispatch. Peak and base hydro usage is modeled to estimate hydro impacts on the electric system.

ENERGY 2020 supply sectors include electricity, oil, natural gas, refined petroleum products, ethanol, land-fill gas, and coal supply. Energy used in primary production and emissions associated with

[20] NAICS is the North American Industrial Classification System, which was developed jointly by the U.S., Canada, and Mexico to provide comparability in North American economic statistics.

[21] End-uses include Process Heat, Space Heating, Water Heating, Other Substitutable, Refrigeration, Lighting, Air Conditioning, Motors, and other Non-Substitutable. Detailed modes include small auto, large auto, light truck, medium-weight truck, bus, freight train, commuter train, airplane, and marine. Each mode type can be characterized by gasoline, diesel, electric, ethanol, NG, propane, fuel cell, or hybrid vehicles.

primary production and its distribution is included in the model. The supply sectors included depend on the characteristics of the area being simulated and the problem being addressed. The model includes pollution accounting for both combustion and non-combustion, and non-energy (by economic activity) for SO_2, NO_2, N_2O, CO, CO_2, CH_4, PMT, $PM_{2.5}$, PM_5, PM_{10}, VOC, CF_4, C_2F_6, SF_6, and HFC at the state and provincial level by economic sector.

To date, the modeling and analysis includes the area of the Western Electricity Coordinating Council (WECC), which includes eight of the WCI Partners: New Mexico, Arizona, California, Oregon, Washington, Utah, Montana, and British Columbia. Future analysis is expected to include the remaining WCI partners not in the WECC: Quebec, Ontario, and Manitoba. Two key exogenous factors required by the model are the population forecast for the period and the Gross Domestic Product (GDP) forecast. The current analysis includes forecasts of the population in the eight WCI Partners to range from an annual average growth of 0.9 percent in British Columbia to 2.5 percent in Arizona, with the weighted average of 1.4 percent over the 2006-2020 period. Forecasts of constant dollar regional GDP range from 2.5 percent per year in Montana to 3.6 percent in Oregon, with a weighted average of 3.1 percent from 2006-2020.

Other key assumptions of the modeling effort include:

- Total incorporation of the Energy Independence and Security Act of 2007 (EISA) in the U.S. partner jurisdictions including the CAFE standards, appliance and lighting energy efficiency standards, and the renewable fuels standard.

- Incorporation of the individual Partners' adopted renewable portfolio standards (RPS).

- Using EIA forecasts of primary fuel prices (high price series) with the electricity prices determined endogenously.[22]

- Estimates of embodied emissions in imported fuel by First Jurisdictional Deliverer.

[22] Constant 2007 dollar prices rise to $97.90 per barrel for oil in 2020, natural gas wellhead price to $7.29 per million Btu, and coal to $24.29 per ton.

- Ability for the banking of allowances.
- No new coal plants to be built in the WECC beyond those already planned and committed through 2020.
- No new nuclear plants to be built in the WECC through 2020.
- No new hydropower capacity built in the WECC through 2020.
- No plug-in hybrid and electric vehicles available in significant numbers through 2020.
- Electric generation capital costs, operating costs, and heat rates are the latest estimates used by the California Public Utilities Commission.

The model output variables include:

- A GHG emission accounting system to document compliance, offsets, allowances, etc.
- Total energy use by fuel type and major sector.
- Electric generating capacity as affected by additions over the period, but not retirements.
- Electric generating output and electricity sales.
- Transportation indicators, including vehicle miles.
- Fuel prices for six primary fuels and electricity.
- A category of "Costs and Savings" variables that relate the annual stream of fuel expenditures to the annualized investment costs.

The most recent published results of the model display the reference case forecast for the entire eight-Partner area with no state or provincial detail. The results conform to the assumptions used in the model and show annual average changes overall:

- GHG emissions rising 0.5 percent.

- Total energy use rising 0.4 percent.
- Electric generating capacity rising 2.0 percent.
- Electric generating capacity rising 1.2 percent.
- Electric sales rising 1.4 percent.
- Vehicle passenger miles rising 1.4 percent.
- Oil and petroleum products prices rising 1.7 percent in constant dollars.
- Electricity prices rising 0.1 percent in constant dollars.
- Natural gas prices rising around 1.0 percent in constant dollars.
- Total fuel expenditures rising 1.0 percent.

Three cap-and-trade policy cases were modeled including cases with and without offsets and three sensitivity cases were modeled.

3.B. Assessment of the Modeling Effort

While the process being employed to design a cap-and-trade system is an extensive and open process, the WCI economic analysis does not measure up to many of the minimum standards of a professional economic analysis, and, therefore, should not be seen as a reliable indicator to policymakers or the public of the economic impacts of the WCI cap-and-trade system.

First, it should be noted that it was never the design of the WCI initiative to produce economic impacts – neither at the Partner level nor at the state or provincial level. The plan calls for each of the jurisdictions to take the outputs of the current effort and to use them as input to Partner-level economic models. Physical outputs and fuel prices are currently determined by the model, but thus far, published versions of the output are at the eight-Partner level and not available for each jurisdiction. In addition, three more Canadian provinces have to be added to the entire analysis. Therefore, much still needs to be done by the WCI economic modeling team and their contractor, ICF.

As with all modeling efforts, the target continues to change and sensitivity needs to be built into the cases to account for major economic changes. A case in point is the three percent annual average increase in the Partners' economies through 2020. Another would include a greater number of cases available for differing oil prices.

The cap-and-trade scenarios place a cap on power sector activities throughout the WECC and include an accounting for imported power and emissions tied to the power imported by the Partners. Substantial effort has been devoted to defining the First Jurisdictional Deliverer of the power, however this must be monitored correctly and accurately.

Half of the GHG reductions are forecast to come from the "Complimentary Policies" that are supposed to be instituted:

- Energy efficiency programs that reduce rate of demand growth by one percent per year.
- California Pavley I and II clean car standards in all partner jurisdictions (with a parallel standard in the Canadian provinces).
- Additional programs aimed at reducing passenger vehicle miles traveled by two percent in 2020.

Aside from questions about the feasibility and effectiveness of these policies, there is a potential modeling measurement problem here when all three are modeled simultaneously.

A number of choices were made during the modeling effort that either make no sense or are not in the current budget allocated for the project. For example:

- There is no significant PHEV penetration modeled.
- There is no forecast of the power company investments required.
- Electricity rates are forecast to barely increase, because the cost of the allowances have not been internalized in the cost.

> Without a serious analysis of economic impacts, it is difficult to understand how any policymaker can come to informed conclusions about whether his or her state should adopt the recommendations contained in the WCI plan.

3.C. Design of the Project

There are numerous problems with the design of the WCI project itself, and many derive from the limited size and non-contiguous nature of the Partner jurisdictions. Designing air emissions regulations must be done at a country, continent, or global level. The WCI effort may serve a purpose in going through the process of designing a regulatory system, but it should not be implemented until all North American governments are under the same standards and regulations. While many heads of state and provincial governments have agreed to proceed with the project, there remain many decisions that must be made and future agreements that must receive unanimous approval.

The results to date show that a regional cap-and-trade program can be designed and may be able to function. However, the most important analysis required before implementation concerns the economic impacts on the state, provincial, and local regions. The WCI project is seriously deficient in that it fails to adequately forecast and analyze those impacts. Further, the current project is not planning to estimate those impacts on a whole host of critical economic indicators such as jobs, employment, unemployment rate, personal income, disposable personal income, taxes, revenues, consumer and wholesale prices, etc.

Such impacts analysis is obviously necessary for any public policymaker to make an informed judgment on the relative merits or failings of the WCI's proposed plan. Without a serious analysis of such impacts, it is difficult to understand how any policymaker can come to informed conclusions about whether his or her state should adopt the recommendations contained in the WCI plan.

Each Partner is obligated to complete the modeling effort to estimate those impacts within their own boundaries. This is critical and is where it will become clear that the states and provinces will suffer severe impacts if a cap-and-trade system is instituted. It is fully expected that prices to consumers and businesses will increase, many businesses will leave the areas under the cap-and-trade program, and the state and provincial governments will be severely affected.

3.D. Failure to Assess Economic Impact of GHG Controls

Numerous studies have found that the impact on the U.S. economy of mandatory GHG emissions controls at the national level will be severe.[23] Estimates of these impacts have been made for a number of states and the effects of nationwide controls on individual states were estimated to be significant – see the discussion in Section II.I.[24] The question that must be addressed in the WCI initiative is the impact on specific states and Provinces of the imposition of unilateral GHG emissions controls in those states and provinces, as well as the expected climate benefit that would result from such a program.

If the WCI Partners act on their own, the impacts on their economies and labor markets would be more severe than in the case of nationwide GHG controls:

- The costs of electric power and natural gas to the WCI Partners' commercial, industrial, and residential consumers will likely increase significantly by 2020 and will increase further thereafter.

- Industries and firms will relocate to other states and Provinces, thus causing a loss of jobs to in the WCI region beginning in 2010.

- New firms will hesitate to locate in the WCI states and Provinces, thus causing a reduction in the number of new jobs created, beginning in 2010.

- Electrical power will be wheeled in from states that have not imposed mandatory GHG controls.

Residents in the WCI Partner states and Provinces will face increased costs for energy, utilities, and for other goods and services

[23] See, for example, *Analysis of the Lieberman-Warner Climate Security Act (S. 2191) Using The National Energy Modeling System (NEMS/ACCF/NAM)*, a report by the American Council for Capital Formation and the National Association of Manufacturers Analysis Conducted by Science Applications International Corporation (SAIC), 2008; Arthur Laffer and Wayne Winegarden, "The Adverse Economic Impacts of Cap-and-Trade Regulations," Arduin, Laffer, and Moore Econometrics, September 2007.
[24] William W. Beach, David Kreutzer, Ben Lieberman, and Nicolas Loris, "The Economic Costs of the Lieberman-Warner Climate Change Legislation," Heritage Foundation, Center for Data Analysis Report # 08-02,May 2008.

and will experience an increased cost of living, beginning in 2010. The significant increase in energy prices that would result from the WCI unilateral imposition of GHG controls would reduce the purchasing power of households and decrease sales and profits of firms in the Partner states and Provinces, thereby reducing both consumer spending and business investment. In addition, the level of productivity in the WCI region is likely to remain lower than it otherwise would have been, as firms use less energy per worker.

Energy is the lifeblood of the economy and, while energy as an input to GDP is decreasing, it remains crucial for industrial societies. The use of energy in the U.S. continues to increase, but at a lower rate than growth in GDP. Continued energy price increases in recent years have had significant impacts on industrial and commercial businesses across the U.S. The successful companies are those that have been able to adapt, downsize, or shift their operations to other states or offshore; the unsuccessful companies are those that have gone out of business. However, in either case, local area economic devastation has been left in the wake of this price volatility.

The energy price increases resulting from the WCI-mandated GHG emissions reductions would continue to work their way through the region's economy. An example is the cost effect of higher natural gas prices in the typical value chain, where a 150 percent increase in natural gas prices would lead to:

- A 65-percent price increase in ethane.
- Then to a 90 percent price increase in ethylene.
- Then a 65 percent price increase in HDPE.
- Followed by a ten percent price increase in a plastic bottle.
- And ultimately to a three percent increase in the cost of milk.[25]

A factor that should have been examined in the WCI analysis is whether or not there is a relationship between the level of business energy prices in a state and that state's rate of economic growth. Other things being equal, one would expect that states with relatively low business energy costs will tend to grow more rapidly than those with relatively high business energy costs. Research has addressed this thesis and analyzed the rates of growth of the 10 states with the highest business energy costs with the growth rates of the 10 states with the lowest business energy costs. It was found that there is a

[25] See American Chemistry Council, *Higher Natural Gas Prices Impact Manufacturing*, 2005.

strong relationship between business energy costs in a state and that state's rate of growth[26]

While there are factors other than business energy costs that can influence a state's or Province's rate of growth, those with low business energy costs tend to grow significantly faster than ones with high business energy costs. The major finding of the previous study on this topic was that, in an era of rapidly increasing energy costs and significant energy cost differentials among states, there is a strong relationship between business energy costs in a state and that state's rate of economic growth and of job creation, and states with the lowest business energy costs tend to grow more rapidly and to create more jobs than those with the highest business energy costs.[27]

3.E. Questionable Baseline Data

Some of the WCI baseline 2006 data are questionable, and this casts serious doubt on all of the WCI scenarios and forecasts. For example, as shown in Table II-1, the WCI data for actual 2006 electricity generation in the U.S. Partners' and British Columbia jurisdictions differ appreciably from U.S. Department of Energy EIA data:[28]

- According to EIA, 2006 electricity generation in the WCI Partners' jurisdictions totaled 642,858 GWh, whereas WCI estimated that generation totaled 598,825 GWh – a seven percent difference.

- According to EIA, in 2006 coal accounted for 21 percent of electricity generation in the WCI Partners' jurisdictions, whereas WCI estimated that coal accounted for 16.6 percent of generation – a 27 percent difference.

- According to EIA, in 2006 hydro accounted for 36.7 percent of electricity generation in the WCI Partners' jurisdictions, whereas WCI estimated that hydro accounted for 42.8 percent of generation – a 17 percent difference.

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[26] Management Information Services, Inc., *The Impact of Increased Energy Costs on Businesses and Jobs*, report prepared for Americans for Balanced Energy Choices, November 2006.
[27] Ibid.
[28] The U.S. data are contained in U.S. Energy Information Administration, "Net Generation by State by Sector," November 17, 2008; the Canadian data are contained in "National Inventory Report, Greenhouse Gas Sources and Sinks," November 2008.

These discrepancies have implications for the WCI scenarios and forecasts. For example, as shown in Table II-1, the WCI reference case projects that in 2020 coal will comprise 14.4 percent of the jurisdictions' electric power generation. If coal's share of 2006 jurisdictions' electricity generation is, as WCI estimates, 16.6 percent, then this implies a 13 percent reduction in coal-fired generation by 2020. However, using the EIA estimate of 21 percent for 2006 coal-fired generation implies that electricity generation from coal will have to be reduced by nearly one-third by 2020.

The discrepancies also have serious implications for hydropower generation. WCI estimates that hydro provided 42.8 percent of the jurisdictions' electric power in 2006, whereas EIA estimates that hydro provided 36.7 percent of the jurisdictions electric power in 2006. In the forecasts, WCI assumes that no new hydro capacity will be added by 2020. Thus, the decline in hydro's share of electricity generation (according to WCI's estimate) from 42.8 percent in 2006 to 38.2 percent is plausible. However, using EIA's estimate, hydro's share of electricity generation is forecast to increase from 36.7 percent in 2006 to 38.2 percent in 2020. This is clearly impossible, since total electricity generation is increasing by 18 percent over the period and no new hydro capacity is being added.