Northwest Power and Conservation Council

July 1, 2009

MEMORANDUM

TO: Council Members

FROM: Terry Morlan

SUBJECT: Interpreting the Council's Power Plan

There has been a significant amount of discussion and questions about the meaning and interpretation of the Council's Power Plan. Questions have related to resource balances, power system costs and retail rates, carbon emissions, and the meaning of insurance against future cost risk obtained by resource options and choices.

Attached is a description intended to clarify the meaning of the Council's resource portfolio. It relates the Council's approach to planning to traditional load-resource planning, which most utilities have also moved beyond. Nevertheless new approaches can be complicated and confusing and this paper relates the two approaches. This paper is likely to become part of the Power Plan chapter on the resource strategy.

If you are confused about the Council's planning methods, I think this discussion will help. At the end, the paper draws the major implications of the plan for regional planning and utility resource decisions.

A Power Point presentation is also attached to summarize the points.

Attachments

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Interpreting the Council's Power Plan

Council Meeting

Portland, Oregon

July 14-16, 2009

NORTHWEST 6th POWER PLAN

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Introduction

- What is a plan resource portfolio?
- How is the Council's Plan different from traditional plans?
- What guidance does the resource portfolio provide to the region?

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Resource Plan Definition

- A plan consists of a set of resource options on resources of different types at different times in the future.
  - Options are sited, designed, and licensed power plants
- A plan also includes an option to pay a specific premium over market price for conservation resources

Picking a Specific Resource Plan

- The Regional Portfolio Model searches through thousands of potential plans for ones that minimize power system cost for given levels of risk
- The lowest risk least-cost plan typically provides the most reliable and stable power system, and identifies more potential resources for development

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Evaluating Potential Plans

- Each potential plan is evaluated against 750 different futures with different conditions for fuel prices, hydro conditions, capital costs, carbon penalties, etc.
- By exposing the plan to uncertain future conditions, the model can evaluate the risks faced by the power system and find the best strategy (Plan) to insure against the risks

Sixth Plan Resource Strategy

- Acquire lost opportunity conservation up to 50 percent above the market price of electricity
- Acquire discretionary conservation up to 10 percent above market price of electricity
- Acquire RPS required renewable resources, and option up to 169 MWa geothermal or comparable renewables
- Option up to 756 MWa of gas-fired CCCT
- Option up to 162 MWa of gas-fired SCCT

What the Plan is NOT

- The plan is not a traditional list of construction dates for specific types of resources to meet a specific load requirement.
  – The plan is assessed against 750 futures and in each future loads and resource construction schedules are different
  – Specific futures can be illustrated in the traditional manner, but may behave differently than if perfect foresight is assumed
  – It is not a plan for individual utilities, but contains important information on resource strategies and priorities

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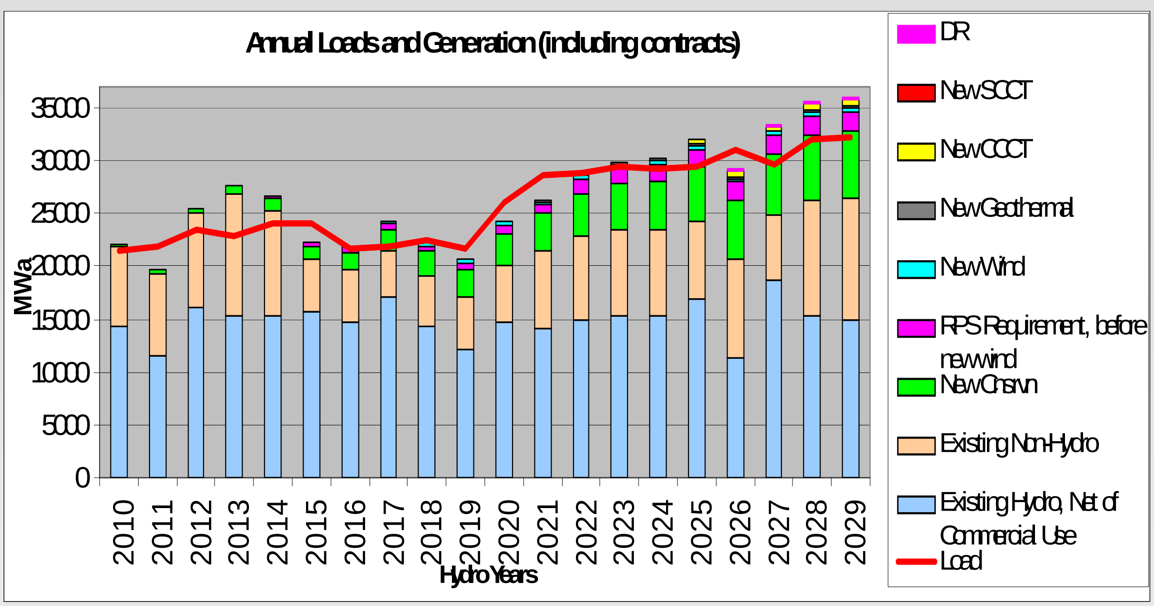
Example of a High Growth, High Cost Future



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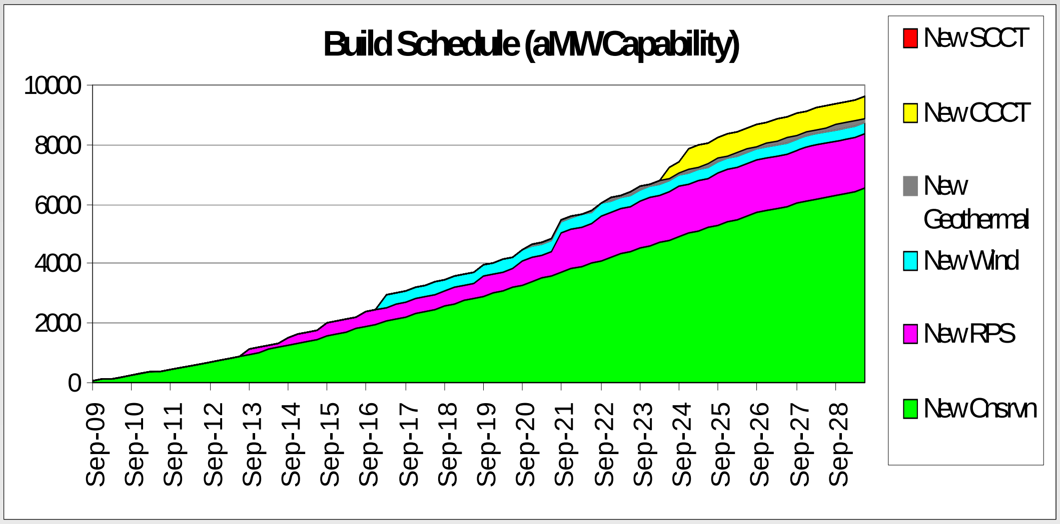
High Growth, High Cost Future Resource Development



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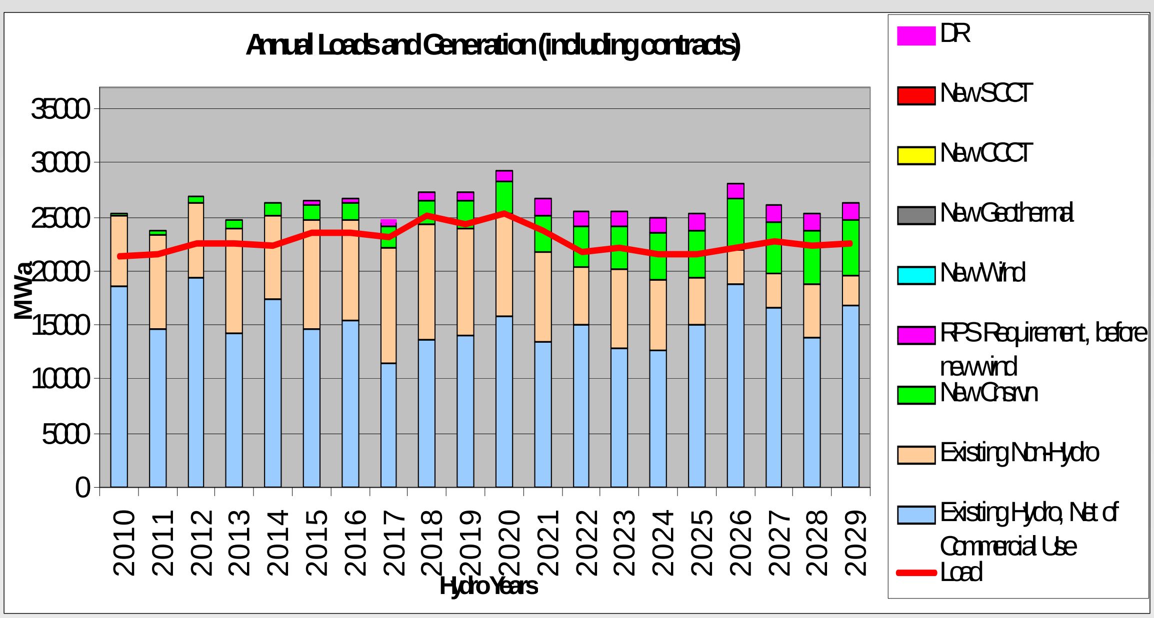
Example of a Low Growth, Low Cost Future



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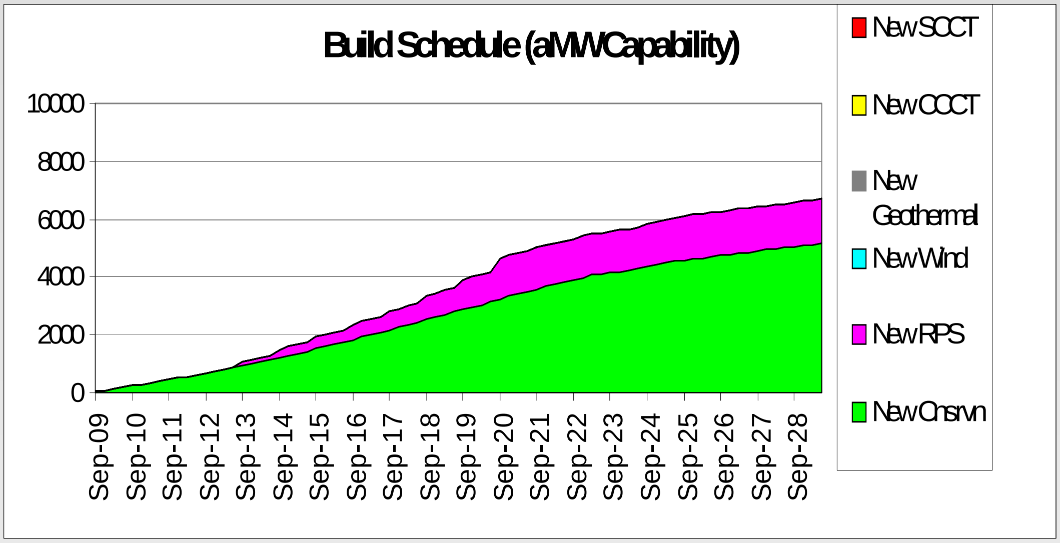
Low Growth, Low Cost Future Resource Development



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What Guidance Does This Plan Provide?

- Conservation is cost-effective and protects against risk in all kinds of futures and scenarios
- Renewable energy is required by RPS, but will be valuable in high carbon cost futures
- If energy, capacity, and flexibility are needed by utilities, natural-gas offers the best generating option in current conditions
  - Flexibility needs may be reduced more cost-effectively with operational and storage strategies
- Small scale, local, renewable resources should be pursued if they are competitive

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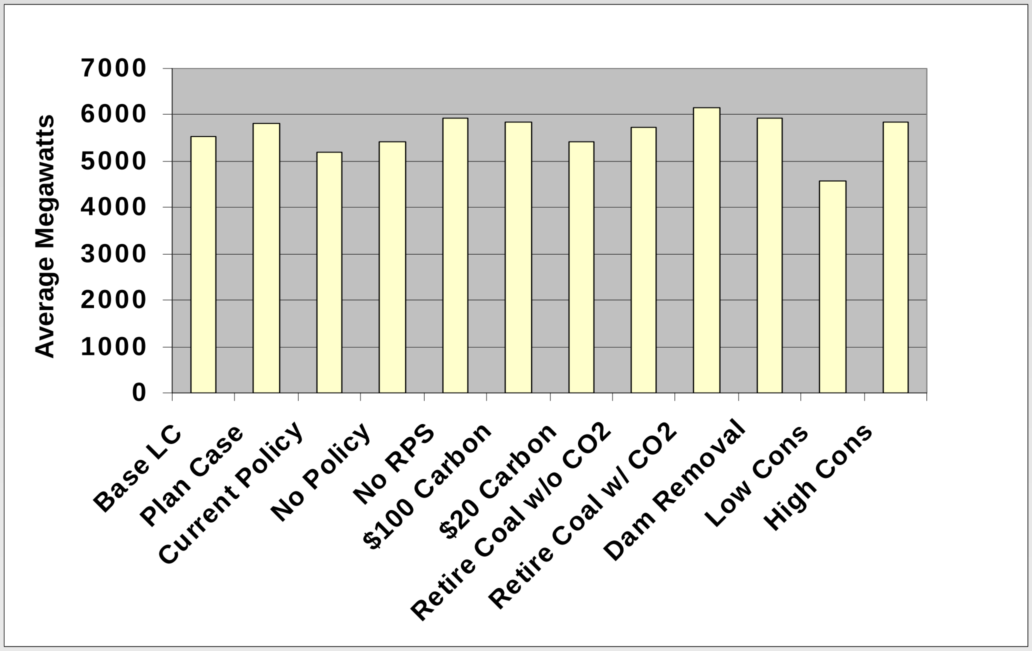
Conservation is Consistently Cost-Effective



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Interpreting the Resource Portfolio

In traditional planning, new resources were stacked up against growing loads so that new resources were scheduled at a particular date to meet requirements. Uncertainty about requirements was considered by looking at different levels of load growth. Uncertainty about hydro conditions was addressed by planning for only critical water conditions. These plans did not consider uncertainty about the cost of resources, the value of hydroelectric generation beyond the critical water level, the price of market power, or changing policies that could dramatically affect the cost of different strategies.

The resource portfolio in the Council's Power Plan does not resemble a traditional firm resource plan to meet firm electricity demand. For example, it does not contain completion dates for new resources that will just meet load growth when needed. Instead, the Council's definition of a resource portfolio consists of dates by which to option specific types of generating resources. A resource is optioned when the design, siting, and licensing have been completed and it is ready for construction to start. The resource portfolio also includes premiums that should be paid over market price for conservation acquisitions. The option dates and conservation premiums are both determined through a search for resource portfolios that minimize the cost of the power system at different levels of risk. The resulting resource plan is one that addresses the risks inherent in the future, not one that is minimum cost for one specific future.

The resource portfolio model does not have foresight about future conditions modelBecause decisions that are made in the future can turn out to be mistakes or good decisions depending on unknown future conditions, the Council's portfolio analysis can identify risks posed by alternative resource strategies and how they are affected by future changes in fuel price, carbon policies, demand growth, changing technologies, water conditions, and other unknowns. A traditional resource plan cannot address such risks. Alternative scenarios can be tested in a traditional sense and give the planner an idea of how plans might change if the future turns out different, but that won't tell the planner how to prepare when he doesn't know which future will occur.

The Council's plan is developed from a regional perspective and includes energy and capacity available from wholesale power markets. However, that market power carries price uncertainty risk. In addition, for some utilities, access to the market may be limited by transmission access or by short-term unavailability under extreme market conditions. It is not possible to model these local transmission constraints, or market imperfections. However, individual utilities must consider these conditions. The usual approach to this problem is to hold contingency and planning reserves. These reserves are included in the Council's planning assumptions.

The actual construction of generating resources and the acquisition of conservation will depend on how the future unfolds. Candidate resource plans are tested against 750 possible futures consisting of random draws from a list of uncertain conditions. The objective is to find a plan that provides the lowest cost and lowest risk for the region's power system. The conservation acquired and the generating resources constructed in a given plan will be different in each of the 750 futures.

The resource portfolio model does not have foresight about future conditions as it works through a specific future. Therefore decisions that are made can turn out to be mistakes or good decisions depending on unknown future conditions. Because the Council's portfolio model does incur the costs of its simulated resource decisions, the analysis can identify risks posed by alternative resource strategies and how they are affected by future changes in fuel price, carbon policies, demand growth, changing technologies, water conditions, and other unknowns. A traditional resource plan cannot address such risks. Alternative scenarios can be tested in traditional planning and give the planner an idea of how plans might change if the future turns out different, but that won't tell the planner how to prepare when he doesn't know which future will occur.

Because the Council's power plan directly addresses risk, some aspects of its resource strategy may look contrary to a traditional approach to resource plans. For example, it may be advantageous to change the region's resource portfolio to address a significant new risk. The Sixth Power Plan contains a good case study for this. Carbon control policies are being proposed at the state, regional, and national levels that would impose a cost on carbon emissions. In the face of a risk of significant carbon emission costs, the economic value of electricity generation that emits carbon will change. The model will develop additional resource options as insurance against future cost risks. In some futures, those options will be developed and provide reduced carbon costs. When viewing average results, these resource options and the fact that they are constructed in some futures may appear as a surplus of future resources. A resource strategy that provides insurance against potential future costs may option additional resources or conserve electricity even though from a traditional load-resource balance perspective the region does not need additional resources.

The resource portfolio should be interpreted as a general plan for the most cost-effective and risk averse resources the region should consider. The priority of resource development will vary depending on the types of resources, the timing of their optioning, and their particular role in the portfolio. For example in the Sixth Power Plan, conservation is cost-effective regardless of future conditions. It meets electricity needs at a fraction of the cost of new generation and also mitigates fuel price and carbon cost risks. It is a clear priority in all of the scenarios the Council investigated.

Renewable resources are required by renewable portfolio standards and next to conservation they also protect against possible carbon costs. However, unlike conservation, renewable resources would be of less value if the future turned out to have low or no carbon pricing policies. Beyond conservation and renewables natural gas-fired generation is optioned after the 5-year action plan period. While natural gas appears to be the most desirable generation resource currently, other technologies may become available in the future. If development of generation is needed for meeting firm loads or providing capacity and flexibility in the near term, then natural gas is the most attractive priority today.

Interpreting costs

Future costs of the power system in the Council's Resource Portfolio Model are expressed in traditional planning terms. They are the net present value of future power system costs that can vary with resource choices made in the plan. They include the operating cost of existing resources and the capital and operating costs of future resources. The capital costs of existing resources are sunk cost, and therefore are not affected by future resource choices.

The Council's resource strategy is based on options to be in place at certain points in time. These options have siting and licensing costs that are included in the cost, but the actual construction costs will depend on the particular future that occurs. Thus, because we look at 750 futures for a plan, there will be 750 different costs. When we describe the costs of a plan, we are reporting the average of those 750 future costs.

The Council also is concerned about the futures in which costs turn out to be high. To address this issue, we also report the average cost of the 75 highest cost futures. This is reported as a risk measure in the Council's plan.

One little understood problem with reporting costs of future energy plans is the fact that decisions made during the 20-year planning period will incur obligations that extend beyond the planning period. For example, if a gas-fired turbine is built in 2028 and has an assumed 30 year life, its costs will continue for 28 years beyond 2030. In another plan, the turbine might be built in 2015 and its costs would extend 15 years beyond 2030. The costs of these two plans cannot be directly compared unless some adjustment is made to the costs. This so called "end-effects" problem is addressed by extending the costs of all resources into perpetuity. Plans can then be compared to determine the least cost and risk plans, but the resulting cost measures are difficult to describe in more familiar terms related to revenue requirements or rates. Even though the costs beyond the planning horizon are discounted and carry decreasing weight over time, they still increase the measure of cost significantly.

The Council does translate the portfolio cost into rate effects in order to make the results more meaningful to consumers and others. There are several steps necessary to convert average net present values of costs as described above to something similar to a consumer's rates or typical monthly bills. First, of course, the "end effects" need to be removed to more closely approximate the actual costs incurred during the planning period. Second, the fixed costs of the existing power system (generating resources, transmission, and distribution) need to be added because these are still being recovered in rates. Third, portions of cost included in the planning power system costs that aren't recovered through consumer rates need to be subtracted. This is primarily the portion of conservation cost that is not paid by utilities and carbon pricing costs that are not incurred by utilities or are reimbursed in some form. These adjusted costs are divided by electricity sales to get an estimate of electricity rates.

[Table?]

Interpreting carbon emissions

A new measure of power system performance is the emissions of carbon dioxide. It is important because of various greenhouse gas reduction targets and proposed policies to price carbon emissions through a tax or a cap and trade system. Measurement of regional carbon emissions is more difficult than one might think because of electricity trade among regions. Estimating the emissions from an individual power plant is relatively straightforward. But electricity trading creates a variety of options for counting emissions. One option is to count only the emissions of power plants actually located in the Pacific Northwest. Another is to count, in addition, the emissions of power plants that are located outside the Pacific Northwest, but whose output is contractually committed to serve Northwest loads. A third is to count the carbon content of all electricity used to serve Northwest loads, which requires adding an estimated carbon content to imported power and subtracting the estimated carbon content of exported power from Northwest emissions.

The rules for such accounting have not been established firmly, and proposed rules often vary by state and region. Such calculations are further complicated by the fact that electricity that is traded in wholesale markets is not typically identified as coming from a particular plant or technology. For example, should power exported from the Northwest be counted as hydroelectricity with no carbon emissions, or as coal-fired generation with large carbon emissions?

The RPM reports carbon emissions in two different ways. One is based on generation located within, or contracted to, the Pacific Northwest (generation based). The other is based on the consumption of electricity within the region (load based).

Specific Futures Examples

The Council's plan, which is expressed in terms of option dates for resources, can be expressed in fairly traditional format by picking individual futures that include specific conditions for load growth and all of the other uncertain future conditions. For example, Figures 1a and 1b show a future with high load growth, varying hydro conditions, moderate fuel prices, and $100 carbon prices beginning in 2015. In this case, the cost of the power system is very high. Carbon emissions fall initially, but increase toward the end of the planning period as loads grow rapidly, new gas-fired resources are brought on line, and existing resources are operated more frequently.

Figure 1b shows the resources developed under this high load case. Conservation and renewables are the dominant resources. High growth increases the amount of lost opportunity conservation available and also increases the RPS requirements. New natural gas-fired combined-cycle combustion turbines are built in the second half of the planning period.

Figure 1a: Loads and Resources in Future 720

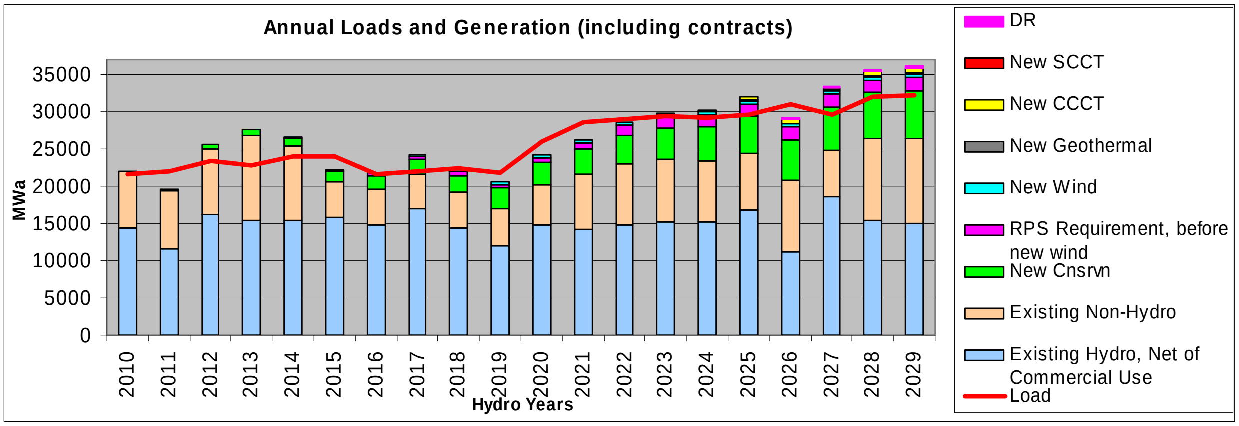
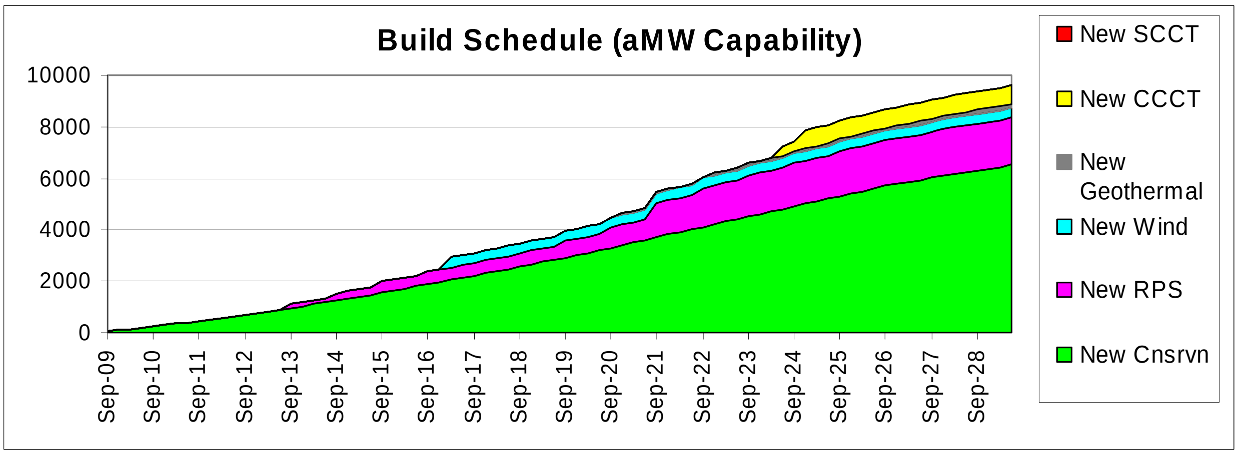


Figure 1b: Resource Development in Future 720



An alternative future is shown in Tables 2a and 2b. This is a future with very low load growth and low electricity and natural gas prices. It also has no carbon pricing policy implemented. As a result this represents a very low cost future. Only conservation and RPS resources are developed, and even that development results in an enduring surplus over the planning period.

This future also has very low carbon emissions even though there is no carbon pricing policy implemented. The reason can be seen in the second bar segment from the bottom of each bar. As the future unfolds, the surplus grows and results in less dispatch of existing coal and gas-fired generation.

Figure 2a: Loads and Resources in Future 185

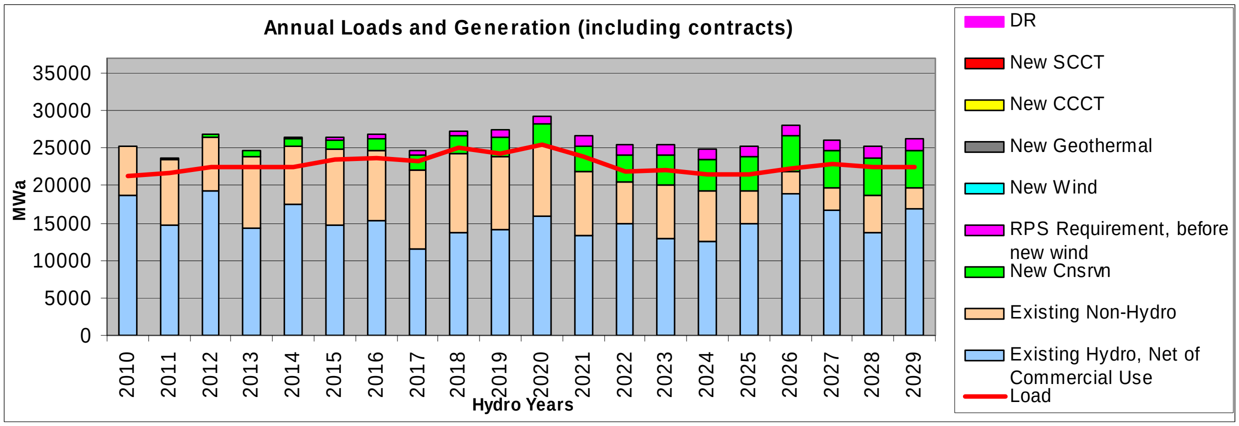
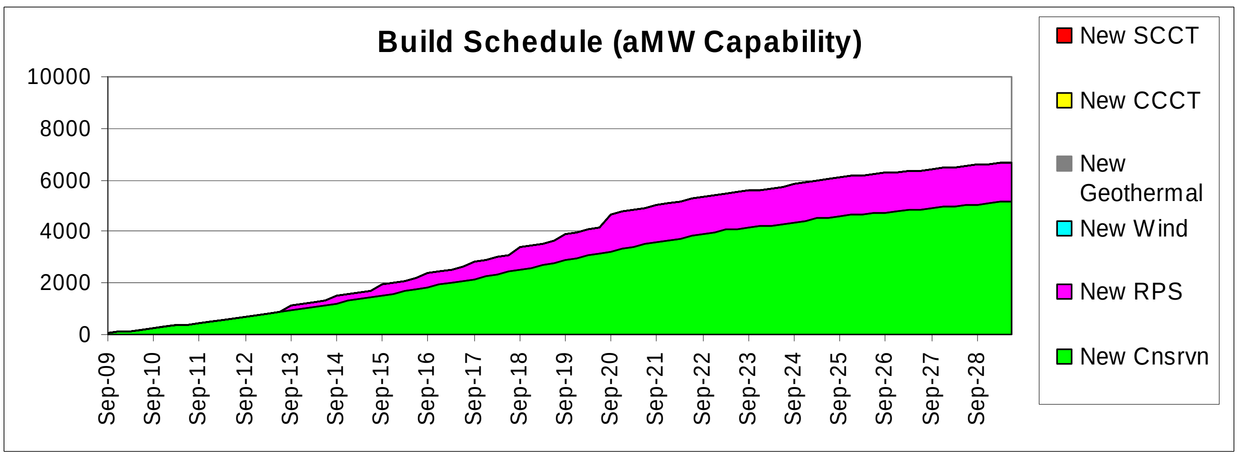


Figure 2a: Resource Development in Future 185



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