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Modern Integrated Resource Planning
For a Low-Carbon Future

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Agenda

Overview of the planning problem

- History of resource planning
- Policy & market changes
- Current Situation – the role of carbon in resource planning

Lessons Learned and Planning Directions

- Planning as a conceptual framework
- Durable low-carbon options

The Historic Planning Problem

Until the 1970s, electric resource planning was straightforward:

- Franchised monopoly vertically-integrated suppliers
- Stable forecasts of load growth (high) and fuel prices (low)
- Limited but proven technology alternatives
- Local environmental constraints met with pollution controls
- Minimize cost (present value of revenue requirements - PVRR) to meet future load with conventional generation
- This would keep retail rates low while ensuring that future load growth is met

Key observation: when the future appears stable and certain, and there is only one objective, decisions are pretty simple – or so it seemed

Transition to Modern IRP

This paradigm changed radically over the past 30 years

- Fuel price shocks
- Technology cost uncertainties
- Load growth no longer stable or exogenous
- Market restructuring – wholesale & retail competition
- More ambitious and complex environmental policies

What was once "least-cost planning" (LCP) became "integrated resource planning" (IRP) when including the demand side – it is now "Modern IRP" when dealing with significant other complications relating to multiple markets (electricity, capacity, fuel, environmental) and multiple policy objectives

Impact of changes

Fuel prices became uncertain and volatile

- Long-run projections vary significantly, and they matter for generation costs, electricity prices (and demand), and emissions

Wholesale & retail market competition emerged

- Generation could be purchased (not just built) and competition for customers and load entered the picture

Technology costs became less stable

- Construction costs and temporary policy supports injected uncertainty

Future load uncertainty and endogeneity

- Load becomes responsive to large swings in prices and could be managed by programs such as DSM and innovative tariffs

Environmental policies became more flexible and complex

- Not just compliance with technology rules but market decisions based on future emission allowance prices

Impact on Planning

Planning now must meet *multiple* objectives:

- Attain low cost & keep customer prices reasonable & stable
- Reduce emissions and meet renewable targets
- Achieve fuel diversity, competitiveness etc.

These objectives must be balanced in an environment of severe uncertainty

- Future fuel & technology availability and prices unknown
- Policies can and do shift radically
- Risks are not well defined

And, increasingly potential resource "solution sets" include all industry segments – generation, transmission, distribution and even customer-side investments

Planning Environment: Uncertainty, Risk and Politics

Uncertainty dominates

- Multiple decade horizons for investments
- Major unknowns in all important parameters

Risks are prevalent

- Private risk of poor returns to investments and/or high customer costs
- Public risk of inappropriate subsidies and/or unacceptable environmental damage

Political influences

- Polarized, adversarial processes (even in markets)
- Parties express different views on uncertainty and risks

Low Carbon Planning

How do carbon emissions fit into resource planning?

- One of several important objectives – rarely the primary objective
- Uncertain future policy – injecting more risk
- Typically involves tradeoff of higher and/or accelerated cost
  - Most low-carbon investments – *e.g.*, nuclear, renewables, efficiency – are capital intensive compared with conventional investments
  - Some may have positive NPV under current market conditions (efficiency and nuclear/renewable supply when fuel prices are very high, and gas generation when gas price is low) – but many rely on carbon policy to provide returns on investment
- Carbon impact of many investments can be complicated to measure and value

Lessons learned for Low-Carbon Planning

Carbon has been a part of some, then many, then most IRPs in the U.S. for over two decades.

- Tracking CO_2 emission outcomes since 1980s and before – preference for lower emissions
  - CO_2 impact from other policies (renewables, efficiency, other emission controls) was routinely estimated and considered an unmeasured benefit when CO_2 emissions are reduced
- "Externality Values" for planning emerged in early 1990s
  - Emissions cost adders in plans, but not in real world dispatch price
  - CO_2 cost adders high enough to alter capital decisions often were very distortive and inefficient
  - Some efforts to introduce "environmental dispatch" without actual prices did not succeed either

Lessons learned for Low-Carbon Planning (cont.)

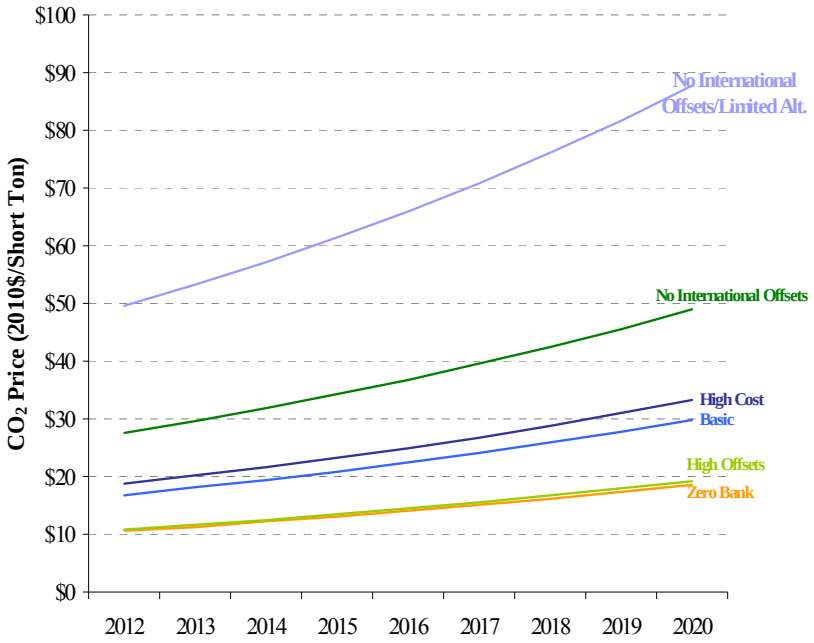
Interest in economy-wide CO_2 price policy (carbon tax or allowance cap-and-trade) began to get attention in 1990s

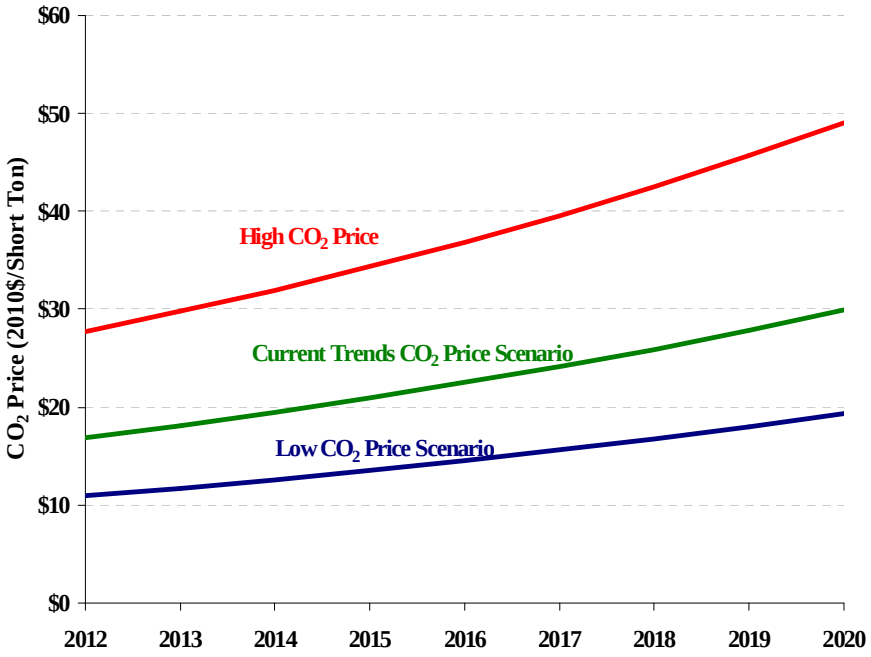
- First Clinton budget proposal (1993) featured "Btu tax" which was chosen over a carbon tax but had similar properties
  - Politics derailed the proposal, but industry planners put on notice
- Cap and trade bills in 1990s began to appear in Congress and seemed inevitable at some point in the future
  - This required electricity planners to speculate about policy, since CO_2 price could radically alter fuel prices and investment decisions
  - Some states required future CO_2 prices in IRPs to reflect eventual policy
  - Generally imposed at modest levels about 5-10 years out, and range of values used

Lessons learned for Low-Carbon Planning (cont.)

During late 2000s, CO_2 cap and trade bills advanced in Congress, and IRPs adopted widely divergent values

- Below are those from Waxman-Markey proposal (left) used in Connecticut IRP 2010 (right):





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Lessons learned for Low-Carbon Planning (cont.)

There are three basic lessons to learn from the experience:

- We are not very good at low-carbon planning (or any planning, for that matter) if judged by accuracy of results
- We are not likely to get much better (technique has its limits) but progress made in scenario-based planning
- We still need to do it and it has value

The value from IRP is understanding the implications of choices across a wide range of potential future outcomes

- Still need to make investment decisions, but not necessarily "optimal" ones in single scenarios
- Modern IRP incorporating carbon can guide one to "robust second-best" outcomes – durable across range of futures

Robust Low-Carbon Options

Viewing previous and current IRP activity, there are several low-carbon options that have durable benefits that don't depend on future outcomes:

- Remove subsidies for high-carbon options
  - Just good policy, regardless of carbon
  - Politically difficult in most cases, requires transitional assistance
- Invest in efficiency where positive returns are likely
  - Carbon benefits secondary, but significant
- Encourage renewable energy with appropriate policy
  - This can be an expensive way to deal with carbon on a $/ton removed basis, but a viable path to energy and economic development
- Evaluate "big bets" *e.g.*, nuclear, carbon capture, but don't make them central to strategy

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Mr. Chupka provides expertise on the market impacts of both domestic and international energy and environmental policy. He assists energy market clients and counsel in a broad span of management analysis, regulatory proceedings, and litigation support. Mr. Chupka has focused on integrated resource planning, electricity and fuel procurement policies, renewable energy policy design, and climate change policies.

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