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# Some comments on 7th APERC *Energy Outlook* and suggestions for the 8th edition

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# Purpose of the research

- President Dr Irie: Provide analytical input, guidance and recommendations to member governments
- "Supply and Demand Outlook" is the key publication
  - How does an analysis of possible supply and demand developments provide value to decision makers?
- Ministerial objectives provide a framework for the analysis and the especially the scenarios
  - How can analysis contribute? Especially, are there useful analytical contributions beyond supply and demand projections?
- Should the analysis ask fundamental questions about the objectives?
  - What are the intended *underlying* goals?
  - Are there other ways of achieving *those* goals that might be superior?
  - Interaction between different policies – gas and electricity in Australia
  - Bias toward new policies to offset unintended consequences of old ones

# Energy efficiency and economic efficiency

- Increasing energy efficiency was one of the ministerial directives examined in the 7th edition
- While energy is important, it is not the only resource that matters
  - We care also about land, capital, labor, other scarce inputs, clean water, clean air, impacts on wildlife, and many other scarce resources
- Economizing on energy use comes at a cost in terms of other goals forgone
- At the end of the day, we are concerned about getting the most benefit for people, all things considered, from all the resources we use
- Maximize net benefits not minimize the use of one or other input
- At best, energy efficiency is a means to an end, not an end in itself

# Analogy between maps and economic models

- A map is an abstraction
  - For a start, it is a 2D representation of a 3D surface
- Different maps are used for different purposes
  - Different types of projections
  - Geological maps, ecosystem maps, climate zones maps, weather maps
- Maps useful precisely because they abstract from some details
  - But it is also possible to get lost when crucial detail is left out!
  - What is critical to include depends on the purpose
    - Possible example: Our discussion of European Russia “in or out of APEC aggregate”?

# Using the equilibrium framework

- What are the main advantages of equilibrium modeling?
  - Keeps the reasoning internally consistent, for example by imposing budget constraints
  - Emphasizes the availability of substitutes along many dimensions: Fuels, technologies, locations of activities, trading partners etc
  - Shows how current *actual* choices affect future opportunities, and how anticipated future choices affect current *optimal* choices
- Use the framework to integrate the case studies
  - Example from discussion yesterday: Mexican policy
  - How would improved pipeline capacity to Mexico affect North American gas prices and trades and the availability of natural gas for LNG exports?
  - What further effects would any changes in US/Canadian exports have?

# Other possible examples

- Direct and indirect Canadian natural gas exports
- US-China trade dispute
- How domestic infrastructure developments can affect LNG trade
  - Canadian and US northeast pipelines
  - Australian bans on onshore gas production, with pipeline and storage infrastructure constraints, as east coast LNG exports started
  - Chinese pipeline infrastructure and the market for LNG imports
  - Implications for an Asian pricing hub for LNG
- Electrification of transport in different countries
  - How do the inputs to electricity production affect implications for energy markets?
- Autonomous vehicles: Distances driven, the demand for public transport

# Relevance of the anticipated long run

- Past choices limit what we can do in the short term
- Investment problems also require that we look forward along the path at what is likely to happen in the future
- Such problems have to be solved by looking at likely long-run situations and solving backwards to match the situation we are in now
  - Taking account of likely future developments is especially important in the energy sector where investments tend to have very long lives

# Economists always have at least two hands!

- There are always opportunity costs from using scarce resources
- Renewables are not the only feasible largely non-fossil fuel future
  - What are the other necessary inputs for renewables energy production – especially land, new transmission links, and critical minerals?
- A complete analysis would examine realistic alternatives
- A feasible alternative has nuclear as the base of the energy supply system
  - Energy density is critical
  - The scale of the current energy supply system is not appreciated by most people, including decision makers!
  - Energy use is critical to economic development and we are likely to have 9 or 10 billion people desiring a modern lifestyles by the end of the century
- How large are the external as well as explicit costs of nuclear compare with those of renewables ?

# What technologies might be available?

- The “horse” crisis
- Roger Pielke Jr at last year’s IEEJ conference emphasized the role of BECCS in making analyses of extreme scenarios feasible
  - If you have BECCS, you also have CCS
  - Can BECCS then compete with coal if other policies have made coal cheap?
- Possible alternative or enabling nuclear technologies: Laser separation of isotopes; small modular plants; thorium reactors; ITER and controlled fusion, and fusion of boron or other reactions
  - New element: Private firms working on fusion and other new nuclear
- Unconventional oil and gas revolution
  - Incumbent technologies with sunk costs have an advantage in that revenue only needs to cover O&M costs for them to keep operating
  - New technologies have to be promising enough for investors to believe they are likely to earn a competitive rate of return on their investment

# Prices matter

- A cure for high (low) prices is high (respectively, low) prices, *but only if markets are allowed to work*
  - Price movements induce substitutions on both the demand and supply sides of markets that tend to reverse the initial move → *stabilizing feedback*
- Policies that try to work against markets are unlikely to succeed
  - When markets deliver undesirable outcomes it is often *because* policy has previously restricted markets from operating
- Role of prices: Convey information as well as provide incentives
- Economic instruments in environmental policy
  - Taxes, or marketed emission permits, give incentives to use lowest cost methods of control and invent new control technologies etc
  - Contrast to mandated technologies as a form of command and control
  - Equimarginal principle – *efficient* reductions in emissions would mean larger reductions where the costs are lower

# Other pricing issues

- Oil prices as key exogenous energy price
  - What are reasonable forecasting models for oil prices?
  - Modelling the behavior of OPEC
- Spot and contract natural gas prices: Reduced financing costs versus lost optionality in spot markets
- Destination clauses – when do they matter?
  - Portfolio traders versus one-on-one trades
- More general issue: Price arbitrage in natural gas markets
- Temporary versus permanent shocks and quantity versus price response
  - Lessons from the LNG market after the 2011 Great East Japan Earthquake
- Negative prices from renewable production mandates and subsidies
  - More generally, the tendency for renewables to drive down prices at the time they generate means subsidies may be difficult to eliminate

# Pricing *structure* is also important

- If prices do not correctly signal costs, mistakes are made
- Example: Current retail electricity prices have fixed and variable components vastly different from fixed versus variable supply costs
  - If customers can alter the amount they buy, they can avoid paying some of the fixed costs
  - Unstable feedback loop instead of a stable one as in a normal market
  - Higher demand customers have the strongest incentive to partially opt out, leading to consequences for equity
- As noted yesterday, this also applies to EV's avoiding fuel taxes
  - A major reason for imposing taxes is the congestion externality
  - Fuel taxes are also a "user charge" for paying the fixed costs of the road, policing etc infrastructure
- LCOE calculations for different types of generating technologies
  - What non-renewable capacity is displaced by renewable capacity?

# Some suggestions for 8th edition study

- Explicitly discuss *alternative* long-run futures
- Examine how different long-run futures affect interim investments
  - What else – like storage – needs to be developed in the interim?
  - In what sense is natural gas a "bridge fuel"?
  - How much technical progress is learning-by-doing, how much is explicit R&D (a critical issue discussed by Nordhaus)?
  - How long-lived are energy infrastructure investments?
  - How do you marry these considerations with the inherited legacy technologies?
- Use variations from the base case to illustrate important factors constraining policy choices and the, often largely hidden, indirect and longer-run consequences of policy decisions