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

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Energy transition as an economic issue

- ❖ A comment made yesterday: “To look forward it makes sense to look back”
 - ❖ The past indeed limits what we can do in the short term and suggests constraints on what may be feasible
- ❖ But 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!

- ❖ Fossil fuels cannot provide the bulk of our energy requirements forever
- ❖ Electrification of (much of) transport and industry with the electricity largely provided by renewables is one long-run vision
- ❖ But it is not the only feasible largely non-fossil fuel future
- ❖ Another feasible alternative has some form of nuclear energy (but not necessarily current reactors) as the base of the energy supply system
 - ❖ Energy density is critical for many energy uses
 - ❖ There was much discussion of storage as an enabler for renewable energy sources but it is also complementary for low operating cost baseload power
- ❖ A discussion of energy transition needs to start by making a case for some vision of where we are likely headed



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
- ❖ Comment made yesterday: “When markets behave in ways we do not find palatable, policy responds”
 - ❖ However, markets often deliver undesirable outcomes *because* policy has previously restricted markets from operating
- ❖ Implication for forecasting:
 - ❖ Forecasts often continue recent trends for too long because we do not take account of the endogenous effects of price changes



Some examples we discussed yesterday

- ❖ The role of prices could be important for fuel choices with CCS
 - ❖ Under high CO₂ taxes, demand for coal falls and so does its price
 - ❖ High CO₂ taxes also stimulate investment in improving CCS
 - ❖ But low cost CCS can make low-priced coal competitive again
- ❖ Negative prices resulting from renewable subsidies and mandates where the subsidy applies to energy output supplied
 - ❖ More generally, it underlies the tendency for renewables to drive down prices at the time they generate, including the “duck curve”
- ❖ The damage from energy subsidies in the GCC economies
- ❖ The superiority of economic instruments (taxes and marketable permits) over command and control (including choosing “winning technologies”, fuel efficiency mandates etc) for handling environmental issues



Pricing *structure* is also important

- ❖ If prices do not signal costs, mistakes are made
- ❖ Example: fixed as well as variable costs, but only variable charges
 - ❖ If customers then can alter the amount they buy, they can avoid paying some of the fixed costs
 - ❖ Unstable feedback loop instead of a stable one
 - ❖ Higher demand customers have the strongest incentive to partially opt out, leading to consequences for equity
 - ❖ Also applies to EV and fixed costs of the road, policing etc infrastructure
- ❖ If we value the stability of the power system, we should have a price to encourage measures that increase it
- ❖ Long-term contracts can reduce financing costs by reducing risk in cash flows
 - ❖ But there is a cost in terms of forgone ability to take advantage of buying or selling opportunities in spot markets



Energy is more critical than it looks

- ❖ Energy is in inelastic demand
- ❖ The marginal value of energy may be low, but the inframarginal value is very high
 - ❖ Costs of blackouts and other reductions in power quality
 - ❖ Reduced energy supply to industry can have high costs
 - ❖ Modern agriculture is a small share of the the energy market, but diesel fuel is critical to its ability to feed today's global population
 - ❖ Hence, “energy security” as a goal
- ❖ Where there are close substitutes (eg passenger vehicles), demand will fall to zero at a high enough price and the inframarginal value is less
- ❖ Subsidizing basic R&D in the energy industry directly rather than via patents



Energy poverty and development as drivers

- ❖ Access to modern energy is critical to the difference between developed and under-developed economies
- ❖ A priority for governments of developing economies is making access to modern energy sources as widely available as possible
 - ❖ Hence, the focus in the first instance on the cost of modern energy
- ❖ Implication for forecasting:
 - ❖ Per capita economic growth is a critical driver to energy demand
 - ❖ Multiply by high populations and we get large increases in total demand



Energy efficiency and economic efficiency

- ❖ While energy is important, it is not the only resource that matters
 - ❖ We care also about land, capital, labor, other scarce inputs, water, 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 from all the resources we use
 - ❖ Maximize net benefits not minimize the use of one or other input



Scale and incumbency are important

- ❖ High growth rates are easy when initial values are low
- ❖ In the end, though, levels matter in terms of replacing one resource or technology by another
- ❖ 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
- ❖ Long lives of energy technologies exacerbate the “valley of death” for new entrants
- ❖ Why is this more of an issue for energy than, say IT or drugs?
 - ❖ In the latter cases, almost all the investment is up front in R&D
 - ❖ In the case of energy much investment may also be required in new infrastructure to deliver the energy services from new technologies



Flexibility and uncertainty

- ❖ Reiterate another point made by Ross Lambie yesterday:
- ❖ In an uncertain environment, flexibility has an option value
- ❖ The up-front cost of a more flexible technology is higher, but allows for faster responses to take advantage of changed circumstance
- ❖ Nevertheless, the cost of the option may be too high – what may be technically feasible may not be economically desirable



Some suggestions for 8th edition study

- ❖ Explicitly discuss alternative long-run futures
- ❖ Examine how the favored long-run future affects interim investments
 - ❖ What are the implications of future paths for investments today?
 - ❖ 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 the investments?
 - ❖ How do you marry those considerations with the inherited legacy technologies?
- ❖ Clearly state all critical assumptions underlying the base case
- ❖ 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