RICE UNIVERSITY

THE UNIVERSITY OF WESTERN AUSTRALIA
Achieving International Excellence

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

Peter R. Hartley

George & Cynthia Mitchell Professor of Economics, and
Rice Scholar in Energy Studies, James A. Baker III Institute for Public Policy
Rice University

and

BHP Billiton Chair in the Business of Resources
University of Western Australia

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