A New Energy System Coming to a Location Near You

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The deployment of renewable energy will continue its blistering growth for the foreseeable future. Initially powered by policy incentives and changes in social attitudes, the growth rate in renewable energy over the next decade will be driven mostly by the combination of technology improvements and declining costs. The challenge now lies in increasing the growth rate of renewables even faster: given their tiny share in the current energy mix, current growth rates will still leave renewables as the infant child of energy production beyond 2030 (see the recently published Energy Outlook by BP).

Globally, the energy sector requires massive investments over the medium term. In OECD countries (where energy demand will stagnate over the medium term) these investments are required to replace ageing systems; and in non-OECD countries (where energy demand will rise rapidly over the next three decades) these investments are required to install new systems. The currently dominant paradigm for the design of these energy systems is based on steady baseload generation at centralized plants, but increasingly demand patterns are variable, with substantial differences in the level of consumption during on-peak and off-peak periods. The result of this mismatch of production and consumption profiles is a reduction in the efficiency of centralized energy systems, with recent estimates pegging the level of efficiency of the US energy system at 44% (in other words, in the US, energy assets tend to run at only 44% of full capacity; as confirmed recently by the head of NREL in the US) – with heavy losses incurred during both transmission and distribution.

Notwithstanding growing obfuscation by the entrenched special interests, the policy arguments in favour of promoting a faster growth rate in renewables are strong:

1. Renewable energy systems have four crucial advantages: they have a much shorter deployment cycle; they are truly scalable; they can be utility scale and distant producers, or they can power a single home and be local producers; and their marginal cost of production is lower (and very close to zero for solar photovoltaic).
2. Decentralized power production (which can only occur effectively with renewables) will save substantial sums on upcoming investments, particularly on the required build-up of transmission systems. “In a growing number of cases around the world, renewable distributed technologies are more cost-effective than centralized installations that require transmission” (as indicated by Pike Research in a recent industry profile).
3. Not only are solar and wind at, or near, grid parity, but their costs will continue to decline. For renewables, there are many dimensions to possible savings, including lower material costs from improved manufacturing practices, lower installation costs from better and more efficient methods, and lower overhead costs from fewer regulatory hurdles. Best of all, the sun and the wind are free

fuels for the lifetime of the system. On the other hand, the costs of fossil fuels will continue to rise; or, at best, they will remain prone to substantial price swings.

4. The growing inefficiency of centralized power production has a strong drag on economy-wide productivity. If businesses in other sectors had such low levels of efficiency, they would be out of business quickly. Decentralized power production (particularly solar with its production profile closely matching the peak demand profile) in combination with a smarter and more-responsive grid would substantially raise the efficiency of the energy system. The focus of design would then shift to the concept of the flexibility of generation assets (rather than a choice between baseload and peaking assets) and a better match between the production and consumption profiles. The feasibility of such an energy system has been confirmed by scenarios for 80-100% renewable energy systems already drawn up for most of the OECD countries.

In the immediate term, the new reality of renewable energy (in particular, solar photovoltaic) is being implemented at break-neck speed in both emerging and developed markets. Thus, China, South Africa and Saudi Arabia are set to "become solar powers" largely on the basis of utility-scale generation; India is on a similar path on the basis of both centralized and distributed generation projects (the latter primarily for rural electrification); and Germany and Italy have a "strong preference for rooftop systems … and distributed generation" (as concluded in a recent study by Lux Research).

Moreover, cheap shale gas will not replace renewables, contrary to recent information campaigns. The outlook for shale gas remains clouded in environmental concerns and uncertainty on future costs of production. In any case, as the world is weaned away from its fixation on baseload models of energy production, natural gas and renewables are increasingly complementary instead of competitors. Additionally, utility-scale renewables will be competitive with gas-fired power in the 'short to medium term'. In the longer term, as lower costs of 'disptachable' forms of renewable energy come into play, and as the inevitability of rising costs of production for natural gas come into view, natural gas will also be driven out of the market (as concluded recently by a Citigroup study). Finally, while gas-fired power emits less than half as much carbon dioxide as coal-fired power on a life-cycle basis, it still emits approximately 15 to 40 times more than renewable energy sources (as noted recently by the same Citigroup study on the basis of calculations by the World Energy Council).

At present, raising the rate of adoption of renewables requires strong support from the regulatory agencies and from the general population. The only possible losers in the coming upgrade to the energy system are the special interests of the centralized-baseload power generation model, and overcoming their resistance will require that the regulatory agencies chart a clear course for implementation of the next generation of the energy system. Already, the need for a change in the business model of the energy system has been recognized by some of the larger independent power producers in the US (which are quickly becoming the largest holders of renewable energy assets), but we need to shorten the transition as much as possible in order to effectively capture this new source of economic growth and productivity. The guidance from the regulatory agencies could take the form of: more effective monitoring of the allocation of grid capacity (which is mostly controlled by large utilities), allowing utilities to rate-base distributed generation assets, and counting distributed generation towards energy-efficiency goals of utilities.

In addition, we need a movement among the general population to demand haste from both the regulatory agencies and the financial sector. For faster adoption of distributed generation (both at the residential and commercial level), the regulatory agencies must continue to simplify the process of installing generation devices on the consumer's side of the energy meter, and the financial sector must provide innovative financing solutions so that installation of such systems is truly within the grasp of the majority of the population.

To conclude, the incentives created by Feed-In-Tariff Programs around the world (including Germany and Ontario) have changed the energy landscape so that renewable energy is at, or near, grid parity in an increasing number of locations (without fiscal subsidies). To shorten the inevitable transition to a modern energy system, we now need the combined effects of regulatory acuity (to bring existing utilities into profitable co-existence with the new reality) and a popular movement (to hasten the transition and ensure that we can quickly capture the benefits of both a more efficient energy system and reduced carbon emissions).