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# Distributed Energy Resources: Back to the Future and More

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# DISTRIBUTED ENERGY RESOURCES: BACK TO THE FUTURE AND MORE

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## INTRODUCTION

The purpose of this chapter is to lay out some of the policy issues that are beginning to be addressed in earnest in some countries and that will have to be addressed in other countries around the world in the coming decades surrounding the evolving restructuring of electric systems, from production to end use, towards the development and use of distributed energy resources (DER).

When Thomas Alva Edison opened the first commercial electric power plant at Pearl Street in lower Manhattan, New York on 4 September 1882, and for some years after, the production of electricity was a local affair conducted by small companies located close to electricity consumers. For example, in 1892, Chicago, Illinois had some thirty small electric companies serving a total of about 5,000 local customers who used electric lights out of a Chicago population of around 1,000,000.[2] Some electricity users also had self-contained, in-house electric generation and some businesses used combined heat and power facilities (CHP or cogeneration) to produce the electricity they used. Within a

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[2] J. E. Hickey, Jr, 'Regulation of electric rates in the US: federal or state competence', *Journal of Energy and Natural Resources Law* (8) (1990), 105–19, at 107–8.

few decades, advances in technology (especially for transmission of electricity over longer distances), economies of scale in having large central service power plants, falling electric prices and policy decisions by government regulators all combined to evolve a dominant model for the electric industry. That model, which has endured for over a century, is characterised by natural monopoly utilities of one sort or another, building and operating large power plants with associated high-voltage transmission lines and low-voltage distribution lines to deliver electricity to large numbers of residential, commercial and industrial consumers over a wide geographic territory. Under this model, electricity flows only one way from the large central station to the end-user.

Today, there is a substantial movement under way in many places around the world (like China, Denmark, Germany and the United States) towards a potentially new model for the production and use of electricity in which, once again, an emphasis is being placed on small, local electric power production facilities operated more often than not by consumers themselves with any excess sold or provided to others. Instead of reliance solely on large central station service, electricity under this model comes from many small generators. Here, the considerations are similar to those in Edison's day but also go further to involve a complex set of policy considerations for the electricity business in the decades ahead.

The shift back to the future is due to many factors. In part, it is due to advances in technology, to concerns about climate change, to falling costs of renewable and clean energy, and to a movement towards competition that all make DER more attractive than it has been in the past.

## DISTRIBUTED ENERGY RESOURCES DEFINED

DER is defined as follows:[3]

> a range of smaller-scale and modular devices designed to provide electricity, and sometimes also thermal energy, in locations close to [electric]consumers. They include fossil and renewable energy technologies (e.g., photovoltaic arrays, wind turbines, microturbines, reciprocating engines, fuel cells, combustion turbines, and steam turbines); energy storage devices (e.g., batteries and flywheels); and combined heat and power systems [cogeneration].

This definition does not restrict the scope of DER generation to renewable sources only but rather includes fossil fuel DER too. Viewed expansively, the definition also includes energy-efficiency measures, conservation and demand-response behaviour.[4] DER encompasses an array of electricity technologies

[3] http://energy.gov/oe/technolgy-development /smart-grid/distributed-energy

[4] See, for example, DNV-GL, 'A review of distributed energy resources', a 2014 study commissioned by the New York Independent Service Operator, available at www.nyiso.com/public/webdocs/media_room/publications_presentations/Other_Reports/Other_Reports/A_Review_of_Distributed_Energy_Resources_September_2014.pdf

associated with electric generation or with savings realised near the point of use or 'behind the meter' of the customer. DER may include rooftop solar panels, micro-wind turbines, small diesel or natural gas generators and even electricity stored in electricity-powered vehicles. Electricity that is generated but not used may flow back into the electric grid to be used by others. Thus, a DER model requires accommodating electricity that flows both ways and not just one way as in the large central station model.

## THREE POLICY ISSUES AND CONSIDERATIONS.

A host of public and private interests – some complementary, some competitive and some conflicting – are vying to one degree or another to influence, shape, advance or deter DER energy evolution. These interests are represented variously by local and national governments, lobbyists, consultants, corporations, NGOs, academics, think tanks, communities, taxpayers and consumers.

DER, of course, is implicated in pursuing broad energy-policy philosophies beyond the scope of this chapter such as growth, no growth and transition growth energy policies. In addition, DER also implicates several specific intertwined difficult policy issues and considerations which ought to be addressed in the short and long term as DER evolves and advances. Three of those issues involve stranded costs, net metering and climate change.

### Stranded costs

The shift to a DER model of electric service inevitably will result in stranded costs. Central station system facilities (power plants, transmission lines, substations, distribution lines and so on) are typically financed, built and maintained on the predicate that costs will be recovered over several decades from electric consumers in the form of rates. The development of DER may result in less central station demand for electricity and fewer consumers to pay for overbuilt and underused facilities. Those costs now become 'stranded'. Depending on one's policy stance (fairness, equity, efficiency and so on) and energy political viewpoint (growth, no growth, transition growth and so on), those stranded costs will be borne by some or all involved. Taxpayers could pay using a variety of methods. Shareholders could pay through lower dividends and stock prices. Remaining central station system customers could pay through higher electric rates. In addition, DER consumers could pay a fee or premium of some sort to defray stranded costs.

### Net metering

Net metering takes into account that under the DER model electricity flows two ways and not one way as under the central station electricity model. That is, DER consumers not only purchase electricity which is registered by the traditional one-way meter but also they may generate electricity at other times that offsets their use 'behind the meter'. Net metering allows DER consumers/generators in some way to net the electricity that comes to them and the electricity they generate that flows back to the electric grid by measuring the electricity flow both ways with two-way meters.

Several issues arise here that are controversial from a policy perspective. One issue involves a 'free rider' perception held by some that a DER generator may be able to pay nothing for the electricity they take from a central station provider if, during a billing period, they also generate the same amount of electricity and send it into the grid, thereby having a zero net use of electricity. The free rider perception is that by netting zero the DER generator/consumer does not pay for the value of the grid for which other non-DER consumers pay. DER supporters stress that the electric grid benefits by having less need for central station generation and purchased power to meet system demands, by reducing demand for transmission line space and by other savings and benefits.

A different – although related – issue from net metering is the price to be paid to the DER generator if there is an overall net excess of electricity generated beyond the DER generator's own electric use that is sent into the central station system.[5] Should those DER generators receive payment from the central station provider for that excess? If so, should payment be at the same rate that the central station provider charges to its customers; that is, a price that bundles all generation, transmission and distribution costs together? Or should they get a lower price that reflects the value of the DER generation only? In any event, how is that value to be calculated?

## Climate change and DER6

One of the biggest incentives to embrace the DER electricity model is its substantial reliance on renewable energy sources and clean energy policy – rooftop solar panels, wind turbines, conservation, efficiency and so on. It also has less electricity line loss than central station power experiences through transmission and distribution. To the extent DER relies on renewable sources and clean energy policies, it displaces fossil fuel sources like coal and natural gas that fuel most large central station power plants. Fossil fuel use to make electricity, of course, is a major source of greenhouse gases (GHG) which contribute to climate change. DER is not a pure GHG-free undertaking. Some DER uses diesel fuel and natural gas in small generators and DER also still relies on central station service when renewables are not available – when the sun does not shine or the wind does not blow.

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[5] See, in a US regulatory context, David B. Raskin, 'The regulatory challenge of distributed generation', *Harvard Business Law Review Online* 38 (2013), 4.

[6] See, generally, Sonia Aggarwal and Hal Harvey, 'Rethinking policy to deliver a clean energy future', *The Electricity Journal* 26(8), 7–22; Robin Kundis Craig, 'Energy system impacts', in M. B. Gerard and K. F. Kuh (eds), *The Law of Adaptation to Climate Change* (ABA, 2012), pp. 133, 140–2.