

A regulatory framework for an evolving electricity sector: Highlights of the MIT utility of the future study

Ignacio J. Pérez-Arriaga¹, Jesse D. Jenkins², and Carlos Batlle³

Executive summary

The electric power sector is once again evolving. A variety of distributed energy resources and improving computation, communication, and control technologies create an unprecedented degree of choice for electricity consumers, choices that are poorly guided by electricity rates and other incentives designed for a comparatively simpler era. These technologies also create new tools for regulated utilities, competitive suppliers, and other businesses to employ in the provision of electricity services. Regulation of distribution utilities, electricity industry structure, and wholesale market design must all adapt to these new realities.

For more than two years, an interdisciplinary team of researchers at the MIT Energy Initiative and the Institute for Technology Research (IIT) at Comillas Pontifical University has carefully studied the important changes now unfolding in the electricity sector. Our central conclusion: a set of proactive reforms to electricity regulation, policy, and market design are needed to enable the efficient evolution of the power sector over the next decade and beyond. While these reforms are discussed at greater length in the MIT Energy Initiative's Utility of the Future study, we present in this paper, in summary form, a regulatory framework for an evolving electricity sector.

This regulatory framework consists of four parts.

The first part of the framework presents a comprehensive and efficient system of prices and regulated charges (e.g. rates or tariffs) for electricity services that reflect, as accurately as possible, the marginal or incremental cost of providing these services and can efficiently guide the myriad decisions made by electricity consumers, distributed resource providers, aggregators, and other businesses.

Second, we build on best practices from across North America and Europe to propose a set of improvements to the regulation of electricity distribution utilities that reward cost savings, performance improvements, and long-term innovation.

Third, we carefully re-evaluate the structure of the electricity industry to minimize potential conflicts of interest. These recommendations build on experience with restructuring of the bulk power system and adapts these insights to the distribution end of the power system. In particular,

1 Corresponding author. Institute for Research in Technology (IIT), Comillas Pontifical University, Sta. Cruz de Marcenado 26, Madrid, Spain and Center for Energy & Environmental Policy Research, Sloan School of Management, Massachusetts Institute of Technology (MIT), 77 Massachusetts Ave, E19-370h, Cambridge, MA, USA. Tel: +(34) 91 540 61 57. Email: ipa@mit.edu

2 MIT Energy Initiative and Institute for Data, Systems & Society, Massachusetts Institute of Technology (MIT), 77 Massachusetts Ave., E19-307, Cambridge, MA 02139, USA.

3 Institute for Research in Technology (IIT), Comillas Pontifical University, Sta. Cruz de Marcenado 26, Madrid, Spain and MIT Energy Initiative, Massachusetts Institute of Technology (MIT), 77 Massachusetts Ave., E19-307, Cambridge, MA 02139, USA

we focus on carefully assigning responsibility for the core functions of distribution system operation, network provision, market platforms, and data management.

The fourth and final section of this framework recommends a series of improvements to wholesale market design to better integrate distributed resources, reward greater flexibility, and minimize distortions from policy supports for various technologies.

Our goal here is not to predict the future, nor to promote (or hinder) the deployment of distributed resources. Rather, the framework proposed herein is designed to establish a level playing field for the provision and consumption of electricity services and enable the integration of a cost-effective combination of centralized generation, conventional network assets, and emerging distributed resources, whatever that mix may be. With this framework in place, all customers and producers of electricity services can make efficient choices informed by accurate incentives that reflect the economic value of these services, established public policy goals, and individuals' own diverse personal preferences.