



Roadmap to a Low Carbon Electricity System in the U.S. and Europe

Executive Summary

Electricity systems across the U.S. and Europe face significant challenges in the transition to low-carbon energy. While the transition provides plenty of opportunities for investors, businesses, and consumers alike, the current business and regulatory models of investor owned utilities (IOUs) and independent power producers (IPPs), which have mainly developed around competitive markets for fossil fuel generation, are particularly ill-suited to take advantage of these new opportunities.

Whereas small levels of low carbon investments were easily absorbed into the existing system, as the share of the new low-carbon investments grow – including renewable energy, distributed generation, related infrastructure build and energy efficiency and management – incompatible financing mechanisms, rate design, and market structure threaten to raise costs substantially. For example, our models show that existing financing models raise the cost of renewable energy by up to 20% above what could be achieved if financing models were better tailored to the risk profile of renewable energy projects and could accommodate the

needs of investor groups such as institutional investors and municipalities.

Innovations in business models across all subsectors of the industry are crucial to scaling-up renewable energy deployment. The businesses that have played the largest role to date – IOU and IPPs – are facing significant challenges. In both the U.S. and Europe, many of the most important players have been hard hit by slower demand growth, partly a result of a slowing economy, along with adverse trends that are emerging as a transition to a low-carbon system accelerates.

To create a clean, secure, and low-cost electricity system at scale, each of the main business segments of the existing electricity industry will need to evolve:

1. **Generation** – New business models are needed to reduce renewable financing costs and focus conventional generation on providing grid flexibility. New financing models should match the investment characteristics of renewable generation with investors, like institutional investors, that are looking for investments with the profile of renewable energy.

2. **Transmission** – Transmission systems must improve integration of renewable energy. Transmission grids should continue to consolidate to balance renewable resources across a greater area.
3. **System balancing and market operation** – Markets and business models need to adapt to promote investment in flexibility resources for a low carbon grid. Markets will need to be adjusted to value the differences between the flexibility services provided by fossil fuel generators and energy supply provided by renewables.
4. **Distribution** – Models for financing and operating distribution systems will need to adapt to changing demand patterns and new distributed energy and flexibility resources. Distribution grids will need to adapt to the greater levels of distributed generation,

- reducing load on local systems.
5. **Customer Management** – Customers will play an increasingly active role in the electricity sector. Customer management must bring in new models to finance and integrate the demand response, energy efficiency and electrification of the system, including, especially, integrating the electrification of energy services such as the charging of electric vehicles into the system in ways which reduce system costs.

When all of these changes are addressed, the new industry model could look very different, as in figure ES-1. The reorganized structure features new, more competitive, companies delivering, and valuing, precisely the services that are needed to facilitate the lowest-cost transition to low-carbon energy.

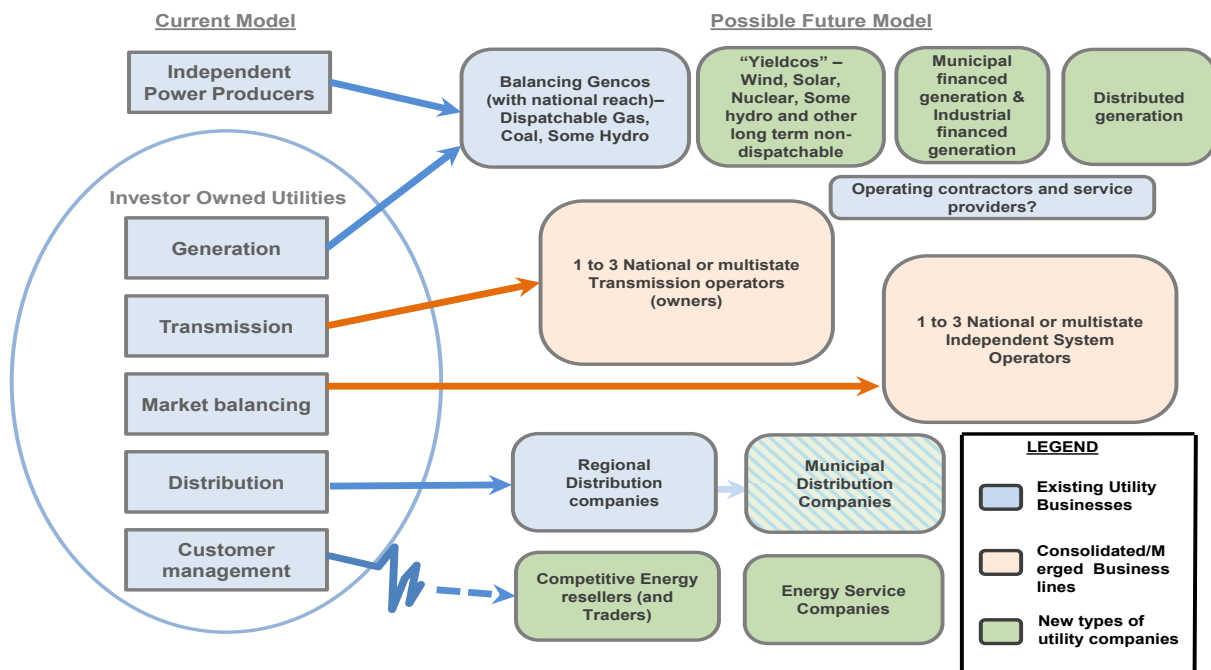


Figure ES-1 Current and potential future structure of the electricity supply industry

Moving away from existing models will involve major changes in the way of doing business. However, the first steps are already happening. As an example, financing models for renewable energy are emerging that can substantially lower costs and catalyze changes across the industry. These models, such as YieldCos, can be built to provide investors secure cash flows from renewable energy projects and other benefits such as the liquidity and diversification potential of exchange-traded stocks and bonds. While these models are already emerging, they are not yet in a form that will realize the full potential cost advantage available and still require adjustments and fine tuning to optimize their value to the system.

The industry needs creative thinking, careful design, and a regulatory, financial, and structural push to reduce the cost and improve the value and reliability of the electricity system. Policymakers can help accelerate this transition by working with investors, electricity companies, financial regulators, and consumers to enable the development of new financing vehicles, redefine markets, and build new institutional structures for a 21st century low carbon electricity system. With these changes, the costs of renewable electricity can be lowered by up to 20%, customers can benefit from the value they can lend to the system, and new markets can reduce the cost of integrating new energy sources, and uses, all while improving reliability and accelerating innovation.