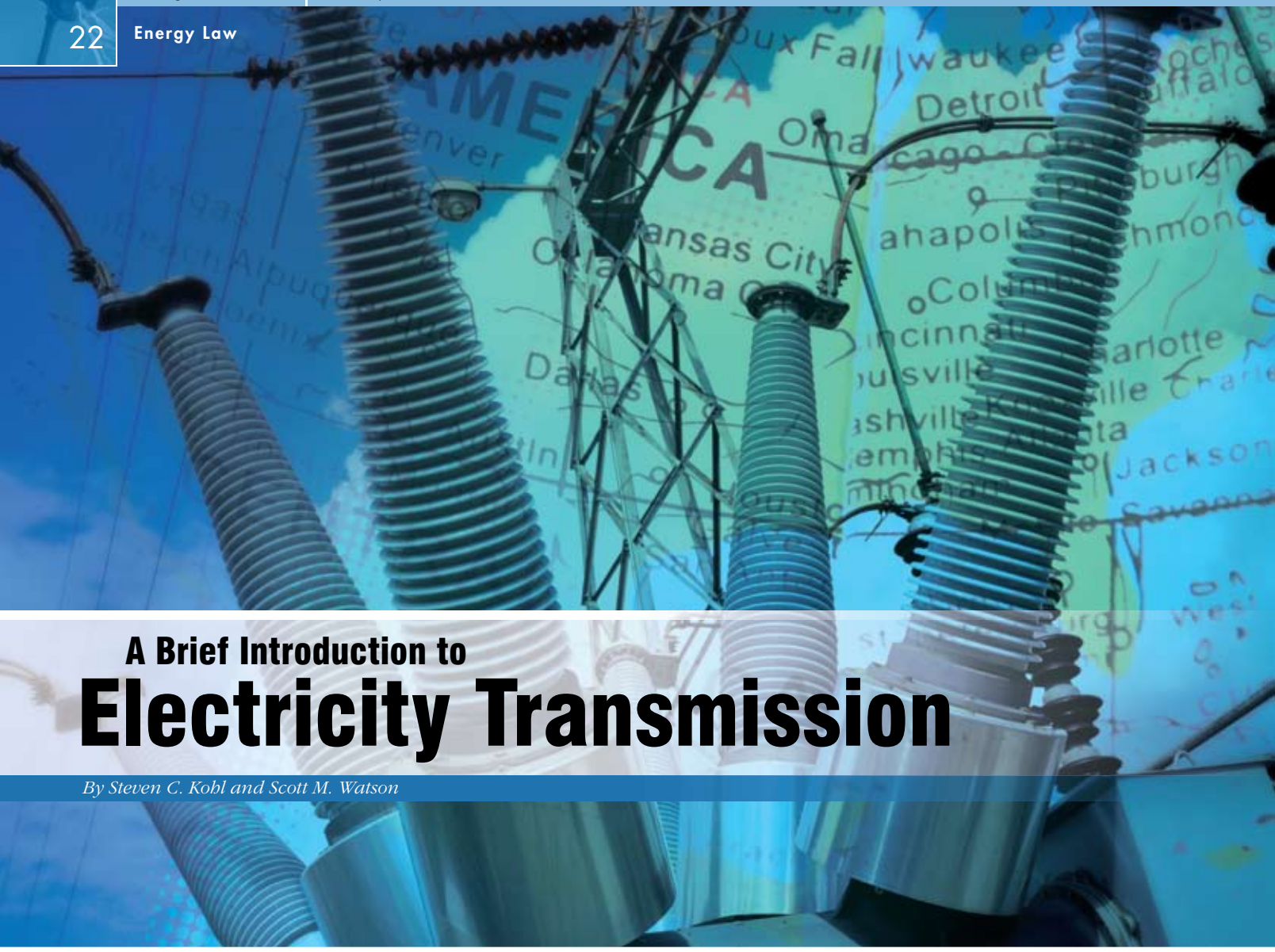


# A Brief Introduction to Electricity Transmission

*By Steven C. Kohl and Scott M. Watson*

There is more to keeping the lights on than choosing which fuel to use when generating electricity. Even with the recent prominence of the "smart grid," it is often easy to forget about the complex, expensive, and essential network of wires that connects our homes and businesses. This network is every bit as important to our economy and standard of living as the coal-fired boilers and wind turbines that occupy most of the public's current thoughts and attention when it comes to electricity. This article is a broad and general overview of that network. It is intended to help readers understand the fundamental physical, economic, and regulatory concepts and policies that pertain to the electric transmission system in the United States.

## Background

### How We Got Here

Before we had our current electric transmission system, we were faced with a few fundamental choices: Did we need transmission at all, or would it be better to rely on "distributed generation," which is generation that connects to the local distribution network rather than a far-reaching transmission network? A related question was whether we wanted to rely on alternating current or direct current. Direct current has many benefits, but it cannot be efficiently transmitted over long distances. Alternating current, on the other hand, can be stepped up to high voltages for long-distance transmission and then stepped back down to lower voltages for use in homes and businesses.

Once the choice was made to generally avoid distributed generation and adopt alternating current, generators quickly became larger. They centralized. Transmission lines rapidly increased in voltage to allow large, central generation to efficiently serve both local and faraway load. Monopolies were the natural end point. And America's overall response to monopolized electric utilities has been to encourage and regulate.

## FAST FACTS

The U.S. transmission network is a complex, expensive, and essential network of wires comprised of more than 150,000 miles of high-voltage transmission lines connecting approximately 3,500 utilities and serving more than 250 million people.

The 2003 blackout in the northeastern and midwestern United States was caused by a breakdown in the transmission system.

A key obstacle to current transmission projects is cost allocation.

By the time regulation of electric utilities became a public priority, many states were already equipped with a regulatory agency ready for the task. The first statewide regulatory commissions had been set up to regulate railroads, and the purview of those commissions was expanded to encompass electric utilities.

As electric utilities outgrew state lines, they began to successfully exempt themselves from individual state regulation. A call for federal regulation was heeded, and President Franklin D. Roosevelt started down the path of federal regulation of electric utility holding companies.

With the exponential growth of electricity use, the electric transmission system blossomed from a distribution system to a true interstate network. This in turn subjected the transmission system to not only state and local regulation, but also federal regulation. The federal agency with regulatory authority over the electric transmission system is the Federal Energy Regulatory Commission (FERC).

The federal laws and FERC orders pertaining to transmission are various, voluminous, and complex. The important point for this discussion is that, as a general rule under federal law, transmission is subject to open access. As a practical matter, this means that in deregulated states like Illinois and quasi-deregulated states like Michigan where generators other than regulated electric utilities may generate and sell power onto the grid, the owners and operators of transmission must allow those generators access to their wires at rates and terms comparable to those that they would charge themselves. This open access and unbundling of generation and transmission is what allowed the development of our current wholesale electricity market.

### Transmission's Role in the Electric System

So why is transmission important enough to justify separate consideration? Isn't it just a bunch of wires stretched across the country? The U.S. transmission system—three interconnected grids comprised of approximately 3,500 utilities serving more than 250 million people—is a critical piece of our electricity infrastructure. The 2003 blackout that blanketed the Northeast and the 2006 blackout in Queens, New York were entirely caused by transmission issues. Those blackouts are just two examples of the importance of the transmission system in this country.

Transmission keeps the lights on by doing more than just connecting generation to load. It improves the overall reliability of the electric system, diversifies the generation mix, and fosters competition by giving generators access to customers and connecting low-cost generation to high-value load.

The electric transmission system ensures that the electric system as a whole is adequate and secure. It improves the reliability of the system by helping to keep the lights on when demand shifts or the system is affected by some physical disturbance. For example, it allows faraway generation to come online on a hot summer afternoon when air-conditioning demand peaks and cannot be served by local generation. Similarly, it reroutes power to help the system recover from sudden and unexpected disturbances such as wind storms or short circuits. A complex and multifaceted transmission network also allows the system to tolerate increasing amounts of intermittent generation, such as wind and solar, which operate only when the wind blows or the sun shines.

Transmission allows load to be served with the least-cost generation available. An ideal transmission system allows system operators to dispatch wind, biomass, coal, and natural gas regardless of where those resources are located relative to the people and businesses that will use the power. This is worthwhile because the best and lowest-cost resource is not always located near load. The wind might not blow consistently where the power is needed. Coal plants are not always welcome near large cities, and it is usually more cost effective to locate them near mines anyway. Transmission provides flexibility both in the type of generation that can be used and where it can be located. In short, a robust transmission system allows low-cost power to serve high-cost areas.



**So why is transmission important enough to justify separate consideration? Isn't it just a bunch of wires stretched across the country?**

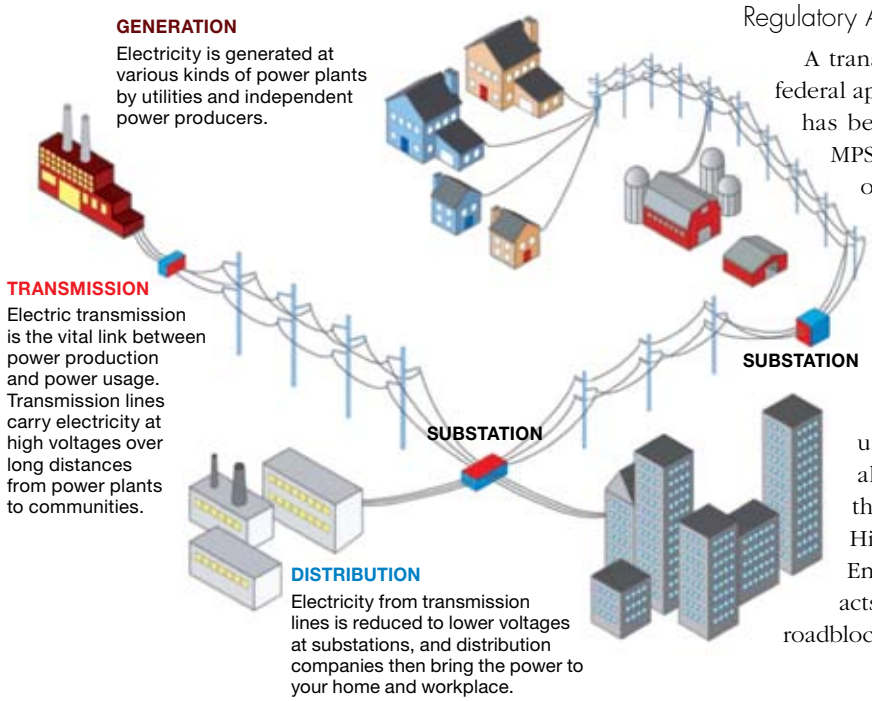
One important and related feature of transmission is that it can sometimes be a better cost option than additional generation. It is, in other words, sometimes interchangeable with—and cheaper than—generation. If an area needs to meet growing electricity use, it might not need to build a new power plant. Some areas that need more power are "transmission constrained." This means that the real issue for these areas is not a need for more generation. Rather, the real issue is that these areas need a power line to allow them to import low-cost power from outside areas. Without adequate transmission, these areas suffer from congested wires that can make it more expensive than necessary to serve load. Transmission can open up these areas and help low-cost generation serve otherwise high-cost areas.

## Developing and Siting Transmission Projects

Siting transmission is difficult at every level. Even at the earliest conceptual point in the process, it is difficult to come to an agreeable policy approach. And the increasingly ossified web of local, state, and federal regulations regarding who can build what, where, when, and at whose expense can be a stopping point for ambitious and otherwise necessary transmission projects. A detailed discussion of siting issues associated with transmission is obviously beyond the scope of this introductory article; the long and often-contentious siting process is very briefly described in this section.

### Plans

Transmission is more than wires. Transmission always has a local impact that must be considered together with its overall system benefits. Before a new transmission line is constructed, the multiple functions it will serve in the broader electric system are weighed and considered against other options such as energy efficiency, demand response, distributed generation, and additional local generation. Of course, the expected need for additional transmission and generation capacity is also a factor at this stage of the process.




### Costs

Transmission is essential to a reliable, flexible, and cost-effective electric system. But it is not sexy and it is not cheap. It is, in other words, a tough sell. It is even more expensive if it needs to cross the Rockies or the Everglades, and it is not easy or inexpensive to acquire easement rights to cross high-value property.

### Routes

Landowners do not always respond favorably to new projects in their backyards. Whether it is a housing project, a nuclear plant, or a wind farm, the response from neighbors is almost always the same: "Not in my backyard," otherwise known as NIMBY. The situation with transmission is no different. Planners often have a preferred route for proposed transmission projects, but that preferred route is frequently subject to NIMBY opposition. Thus, planners will often include alternate routes for comparison at the planning stage. For construction of major transmission lines in Michigan, applications to the Michigan Public Service Commission (MPSC) must include a description and evaluation of at least one alternate route and a statement explaining why the proposed route was selected.[1]

### Regulatory Approvals

A transmission project generally requires state, local, and federal approval. In Michigan, the siting and approval process has been consolidated into the primary authority of the MPSC.[2] Certificates granted by the MPSC take precedence over conflicting local laws regulating location or construction of transmission lines.[3] At the federal level, FERC approval is usually needed. There may still be some room to argue that FERC has the authority to serve as a backstop to preempt state or local refusal to permit and authorize transmission lines, but that authority has been called into serious question.[4]

In addition to the regulatory approvals they uniquely require, transmission projects can (and usually do) trigger a host of environmental laws including the National Environmental Policy Act, the National Historic Preservation Act, the Clean Water Act, and the Endangered Species Act. The requirements under those acts can be onerous and costly and set many traps and roadblocks for the unwary.

Source: U.S. Department of Energy, *Benefits of Using Mobile Transformers and Mobile Substations for Rapidly Restoring Electric Service: A Report to the United States Congress Pursuant to Section 1816 of the Energy Policy Act of 2005* (2006), available at <www.oe.energy.gov/DocumentsandMedia/MTS_Report_to_Congress_FINAL_73106.pdf>.

## Paying for Transmission: Cost Allocation

Perhaps the most important issue apart from planning that transmission projects currently face is cost allocation. FERC does not have the authority to allow transmission developers to require utilities to pay for transmission from which they derive no benefit.[5] Thus, there is no ability to share costs with all users along the lines if not all users derive a benefit from the new lines. There has also been tension and uncertainty when transmission owners seek to charge users who benefit only indirectly. For example, participant funding principles adopted in many areas under FERC Order 890 have sometimes made cost sharing difficult, even among parties who directly benefit from new transmission. This uncertain allocation scheme has been viewed by many as chilling transmission development.

Seeking to thaw transmission development, FERC has issued a notice of proposed rulemaking that would require regions to develop transmission plans and cost-allocation methods in accordance with the general framework set out in the proposed rule.[6] In essence, FERC is responding to the critical need for transmission infrastructure to meet new policy goals, such as renewable electricity standards, by establishing planning and cost-sharing policies at the federal level that are designed to facilitate new regional transmission development. The rule leaves the critical question of who pays to the various regions to decide for themselves, and only if a region does not decide on a cost-allocation method would FERC step in.

The cost-allocation framework under FERC's proposed rule is designed to allocate costs in a way that is "roughly commensurate" with the benefits of the transmission. So purely pass-through areas that truly derive no benefit from the transmission will not pay. But there can be no free riders. FERC's view under the proposed rule is that those who build the transmission should not have to pay the entire cost when the benefits will be shared by many. All who benefit must pay in rough proportion to the benefit they receive, and no party may be required to pay an excessive portion of the entire cost.

The six key cost-allocation provisions in the proposed rule are as follows:

(1) Costs must be allocated in a manner that is at least roughly commensurate with benefits. Benefits include system reliability, cost savings, congestion relief, and other requirements (such as the ability to meet a renewable electricity standard) established by state or federal laws.

(2) Entities and regions that receive and will receive no benefit from a transmission project may not be required to pay a share of the costs.

(3) All facilities with significant positive net benefits must be included in the cost allocation.

(4) For intraregional projects, costs may not be involuntarily assigned to out-of-region entities. For interregional projects, costs may be assigned only to regions in which the facility is located.

(5) The cost-allocation method and data requirements must be transparent and suitably documented.

(6) Regions may use different cost-allocation methods for different types of transmission projects in the regional plan.

FERC's proposed rule does not prohibit voluntary participant funding, but one of its most significant potential benefits is that a transmission developer whose project would benefit others would be able to propose the project in the regional planning process and identify its beneficiaries for cost-sharing purposes. Of course, even if the proposed rule becomes final, it will still be necessary for transmission projects and their cost-sharing proposals to be approved; utilities will still bear the risk that costs associated with transmission development will be disallowed notwithstanding claims under FERC's proposed rule.

## Conclusion

Electric transmission is receiving an increasing amount of attention as its critical and unique role in the overall electric system becomes more universally understood. The developing regulatory framework reflects this attention and seeks to advance an underlying desire to serve increasing energy demand with diverse sources at the least overall cost. ■

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## FOOTNOTES

1. MCL 460.567.
2. MCL 460.570 through 460.575.
3. MCL 460.570.
4. *Piedmont Environmental Council v FERC*, 558 F3d 304 (CA 4, 2009).
5. *Ill Commerce Comm v FERC*, 576 F3d 470 (CA 7, 2009).
6. Transmission Planning and Cost Allocation by Transmission Owning and Operating Public Utilities, 131 FERC ¶ 61,253 (2010); 75 Fed Reg 37,884 (June 30, 2010), available at <http://bit.ly/aDRkom> (accessed November 27, 2010).