Docket #: S17-502

ReMatch: data-driven software for planning distributed energy resources infrastructure

A team of Stanford researchers has developed ReMatch, an efficient, data-driven DER (distributed energy resources) planning and decision support framework that accounts for a range of complexities to optimize energy resource planning. Unlike previous frameworks, which rely solely on engineering simulations, ReMatch combines engineering, data science and real-world consumer behavior to systematically analyze DER construction and deployment. This approach enables ReMatch to capture socio-technical complexities related to infrastructure and human dynamics – uncertainty in supply and demand, synergistic effects of demand-side management programs, diversity in consumer behavior and deployment dynamics of infrastructure. The algorithm accounts for individual consumers, generation infrastructure and storage infrastructure to calculate the lowest cost system to meet all consumer demand (including capital and operational costs). Furthermore, ReMatch uses smart grid data to match groups of consumers with different kinds of distributed resources based on customer's actual energy use and the ability to construct resources in that area. In summary, ReMatch can be used to enable utilities to determine what kinds of energy resources and targeted incentive programs will have the most economic and environmental impact.

Stanford Engineering News, 9/6/17
Could 'power from the people' cut electric bills in half?

Stage of Development
The inventors demonstrated the ReMatch algorithm in a case study using real hourly data from smart meters of 10,000 energy customers in California. By accounting for a wide range of consumer profiles and infrastructure solutions, their analysis showed that constructing DER infrastructure could reduce levelized cost of electricity (LCOE) nearly 50% over the lifetime of the infrastructure.

Applications

- **Planning smart grids/distributed energy resource (DER) networks**, including:
    - designing infrastructure, such as sizing of solar panels and battery capacity
    - developing incentive programs
    - devising efficient operation strategies

Advantages

- **Reduced cost of electricity** by designing systems with substantially reduced operational costs:
    - planned DER infrastructure could reduce LCOE nearly 50% compared to status quo, conventional systems
    - synergy with demand-side management could yield additional savings
- **Optimizes matches for consumers and infrastructure:**
    - can be utilized to develop targeted incentive programs/policies and designing energy markets
    - ReMatch models infrastructure that can be progressively deployed and constructed (previous approaches only analyze infrastructures that are built simultaneously)
    - cross-disciplinary approach accounts for socio-technical complexities (e.g., intermittent supply, heterogeneous demand and operating costs)
- **Data-driven model** - relies on real world energy consumption data rather than simulations to more accurately estimate demand
- **Computationally efficient analysis**
- **Advantages of DER** - dynamic control of system for environmental, economic and resiliency benefits

Publications

- Jain, R. K., Qin, J., & Rajagopal, R. (2017). Data-driven planning of distributed energy resources amidst socio-technical complexities. *Nature Energy*, 2(8), 17112.

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