


Engineering-Economic Challenges for North American Electric Power Markets



Presenter

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Engineering-Economic Challenges

❑ From Mid-1990s through present:

- In large parts of the U.S., successful moves from vertically-integrated control of wholesale power operations to **wholesale power markets**
- Uneven efforts to introduce markets at the retail customer level
- **Goal:** Efficient generation to satisfy retail customer energy demands

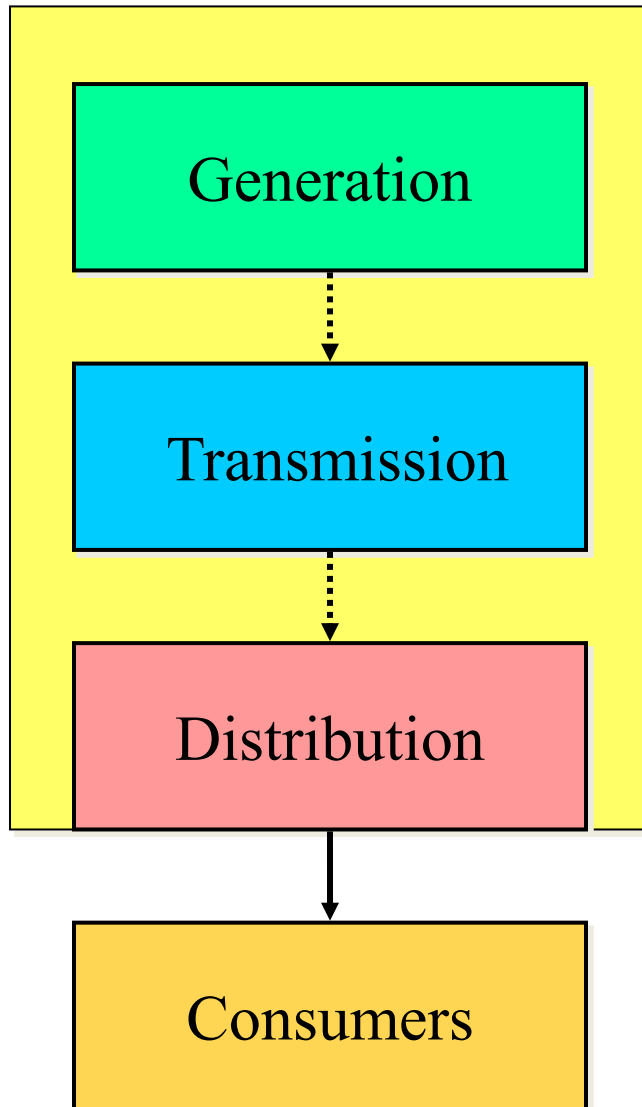
❑ Recent disruptive developments: **Transactive Energy**

“A set of economic and control mechanisms that allows the dynamic balance of supply and demand across the entire electrical infrastructure using value as a key operational parameter.” GridWise® Architecture Council

❑ Completely changes the originally envisioned form of an integrated & fully restructured wholesale-retail power system

- Emphasis on distributed control of devices owned by “prosumers” able to produce or consume power depending on local conditions

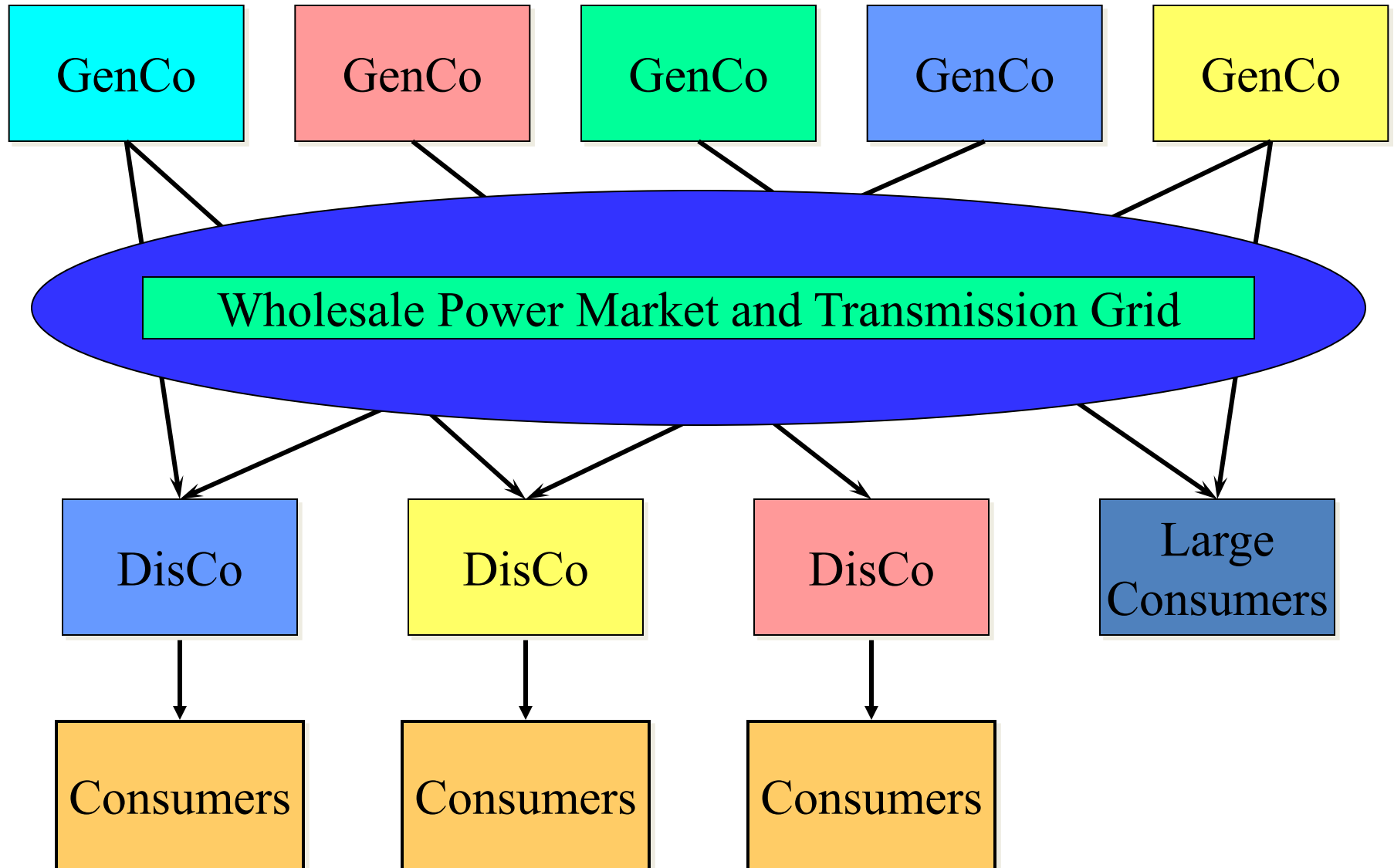
Traditional Vertically-Integrated Electric Utility



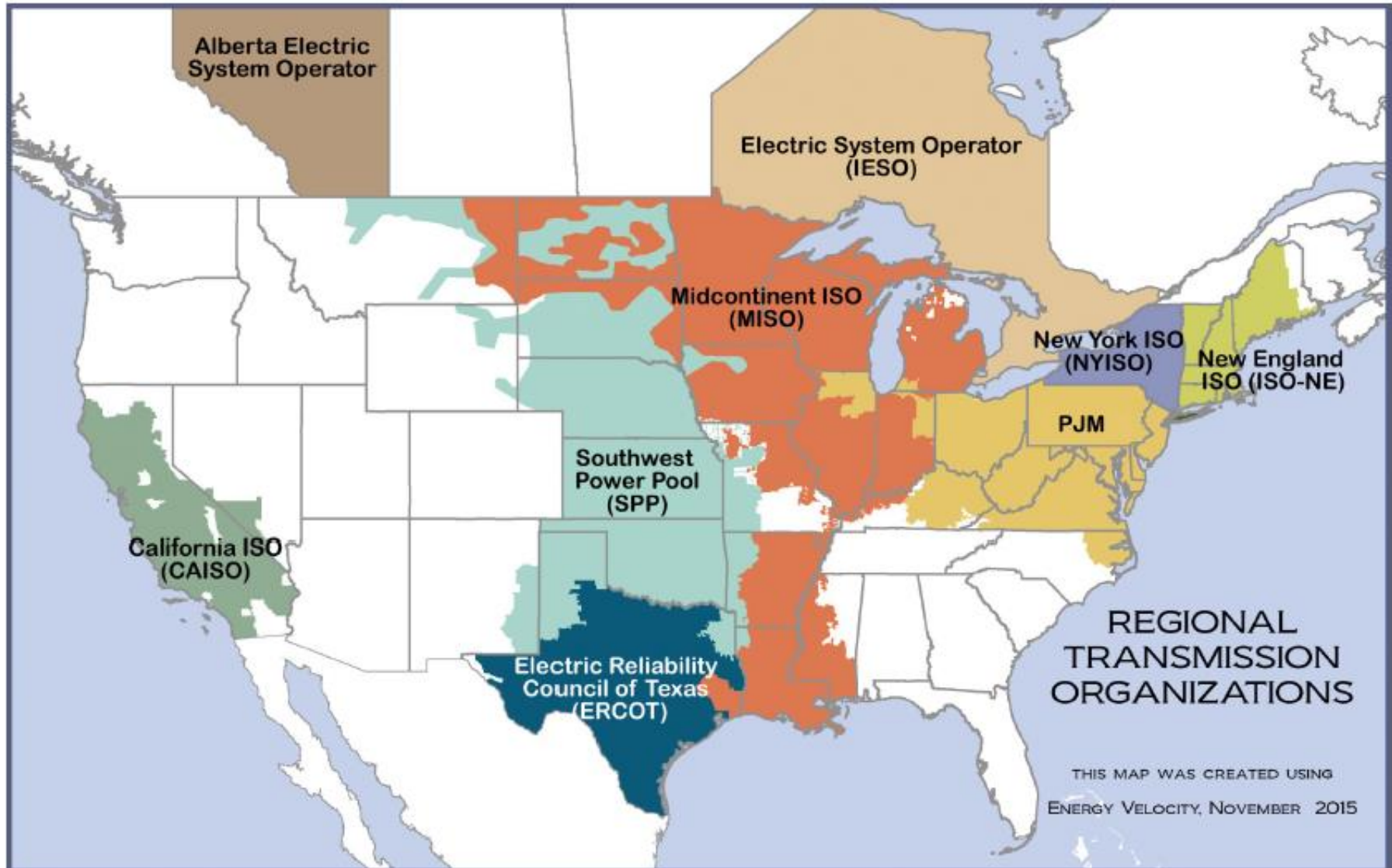
Utility exerts monopolistic control over generation, transmission, & distribution

Residential, commercial, and industrial buyers of electric power who “use up” (consume) their purchases

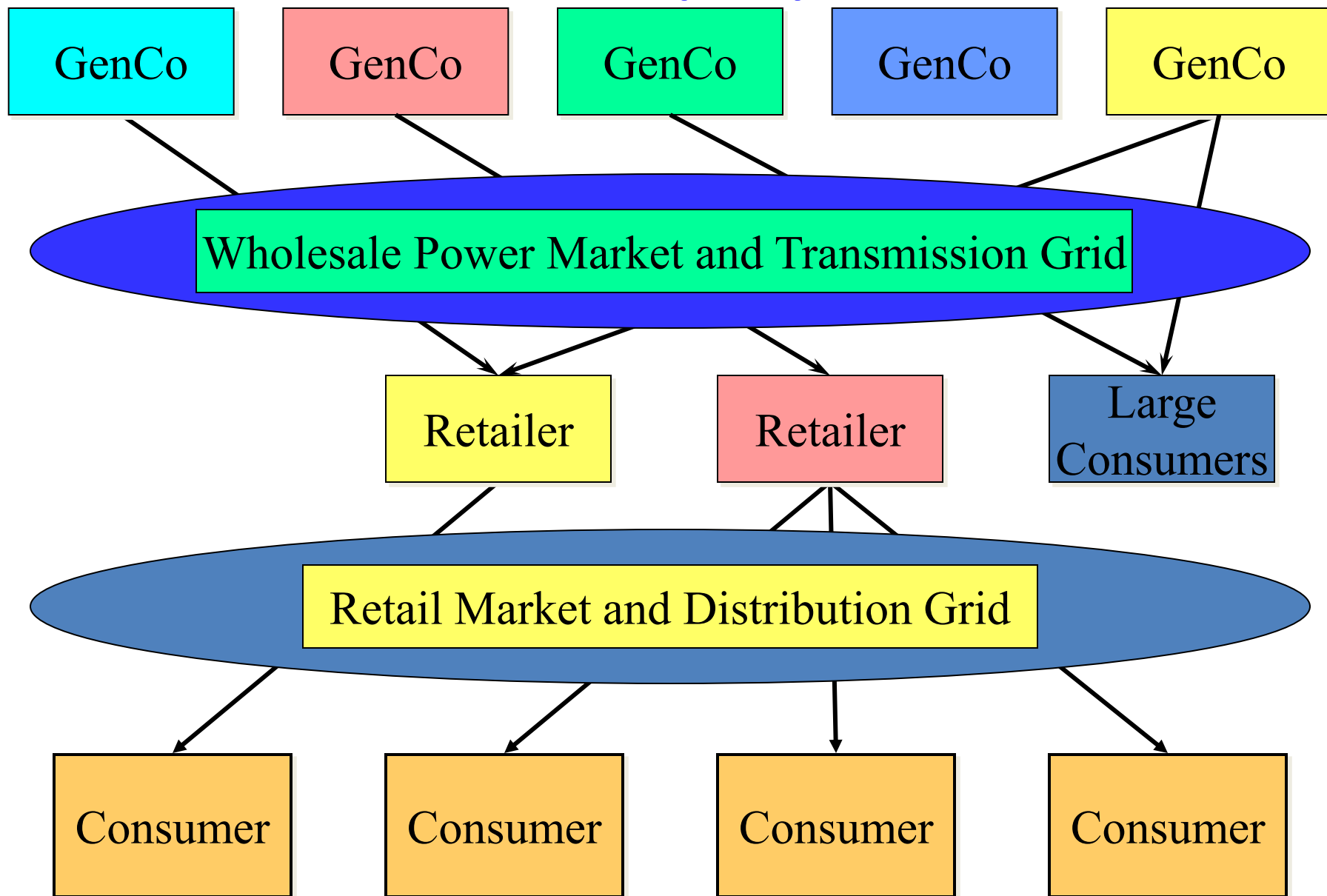
Restructured Wholesale Power Market



North American Restructured Wholesale Power Markets

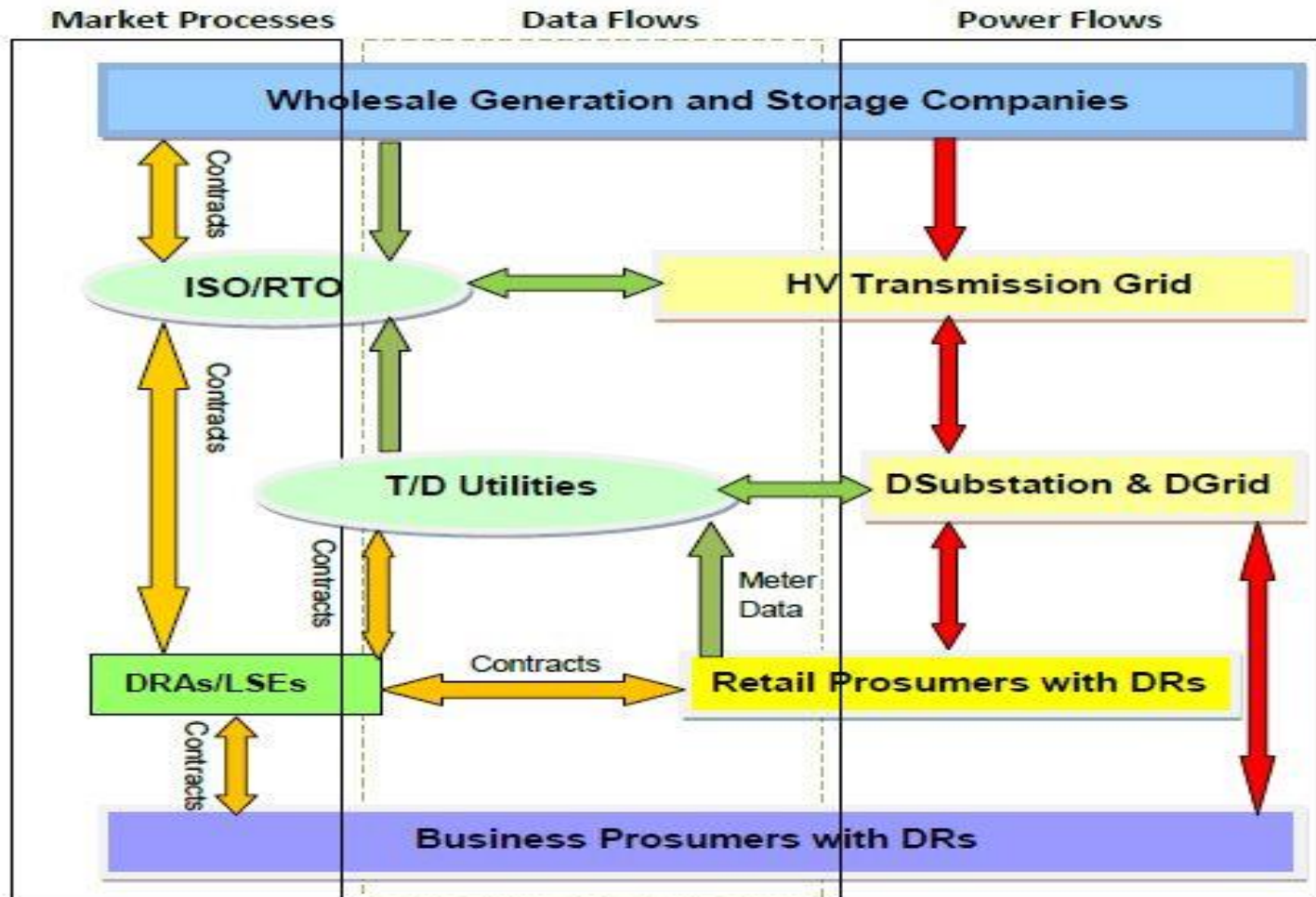


Original Vision for Fully Restructured Wholesale and Retail (W-R) Power Markets



Recent efforts to achieve a “Transactive Energy”

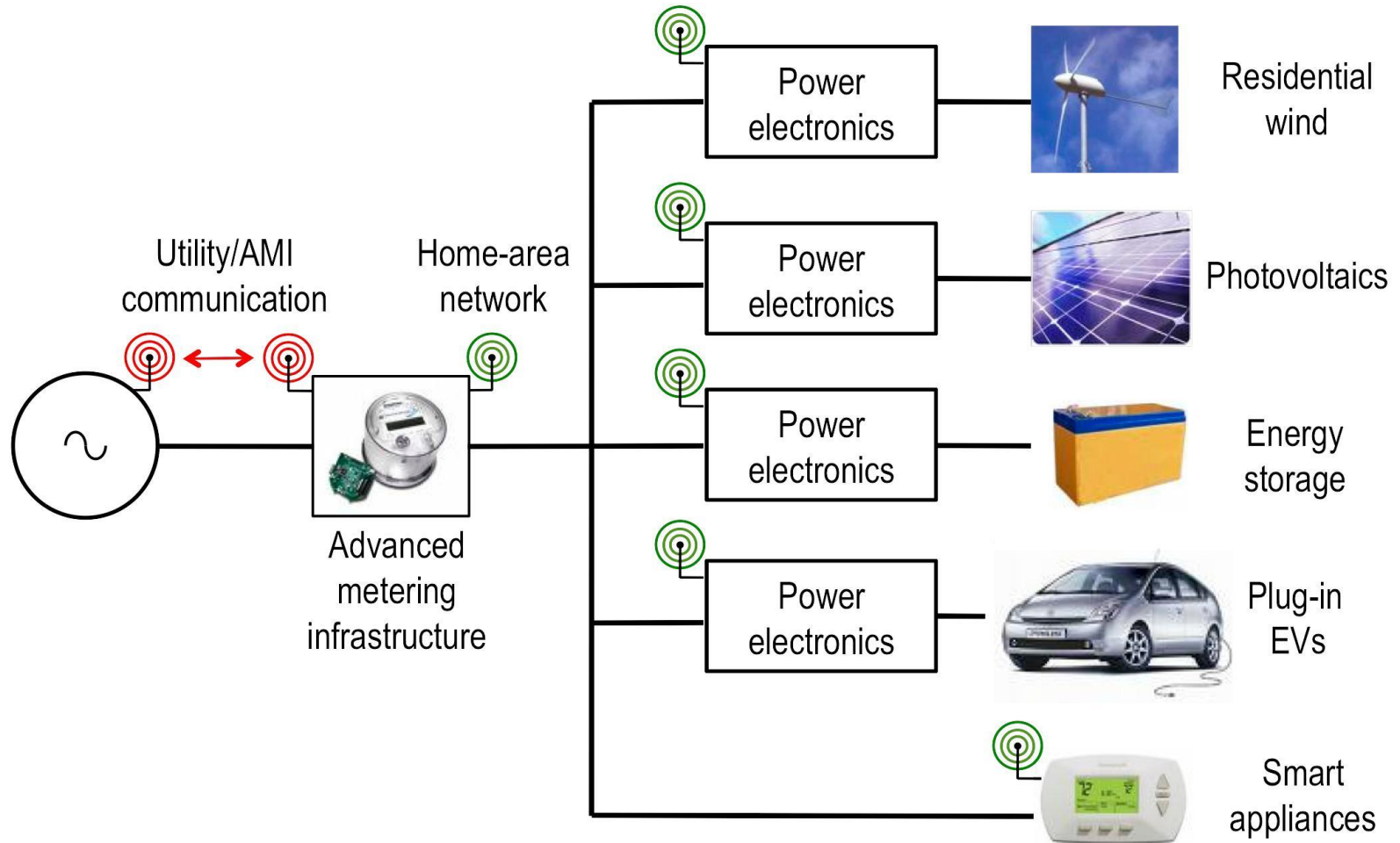
W-R Restructuring: *Emphasis on Distributed Control*



DR = Distribution Resource (wind, rooftop solar, ...) DRA = DR Aggregator
Prosumer = Producer or consumer depending on local conditions

Prosumer-Owned Distributed Resource Devices

Source: Slide by Prof. Dionysios Aliprantis (Purdue U)



References

- Special issue on Transactive Energy
 - IEEE Power & Energy Magazine, Vol. 14, No. 3, May/June 2016
- Transactive Energy Webinar
 - Presented by Steve Widergren (PNNL), Koen Kok (TNO), and Leigh Tesfatsion (Iowa State U), 10 March 2016, sponsored by IEEE SmartGrid
 - <http://smartgrid.ieee.org/resources/webinars/past-webinars>