

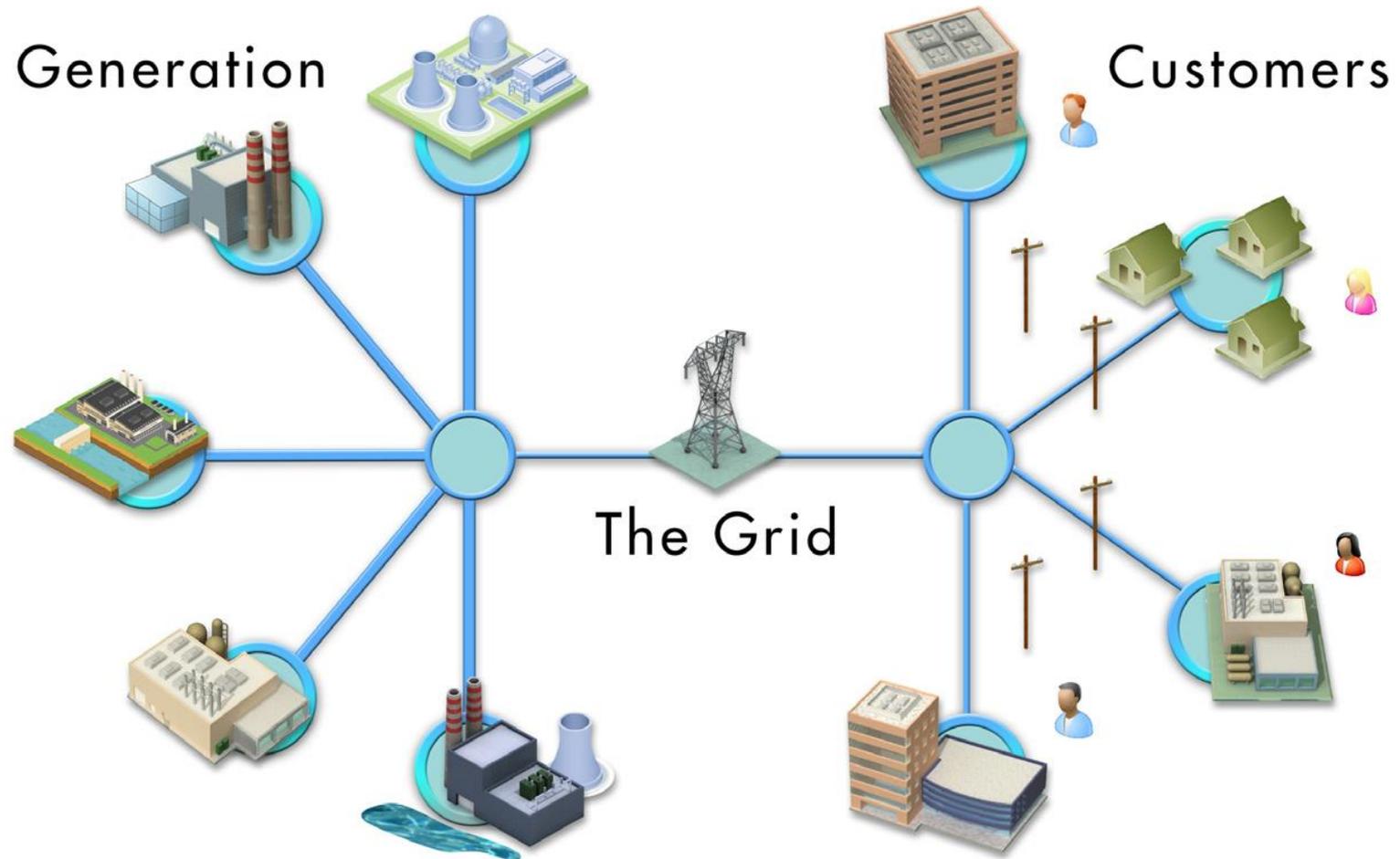
Transactive Energy

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DOE EAC Workshop
June 2016



NORTHWESTERN
UNIVERSITY

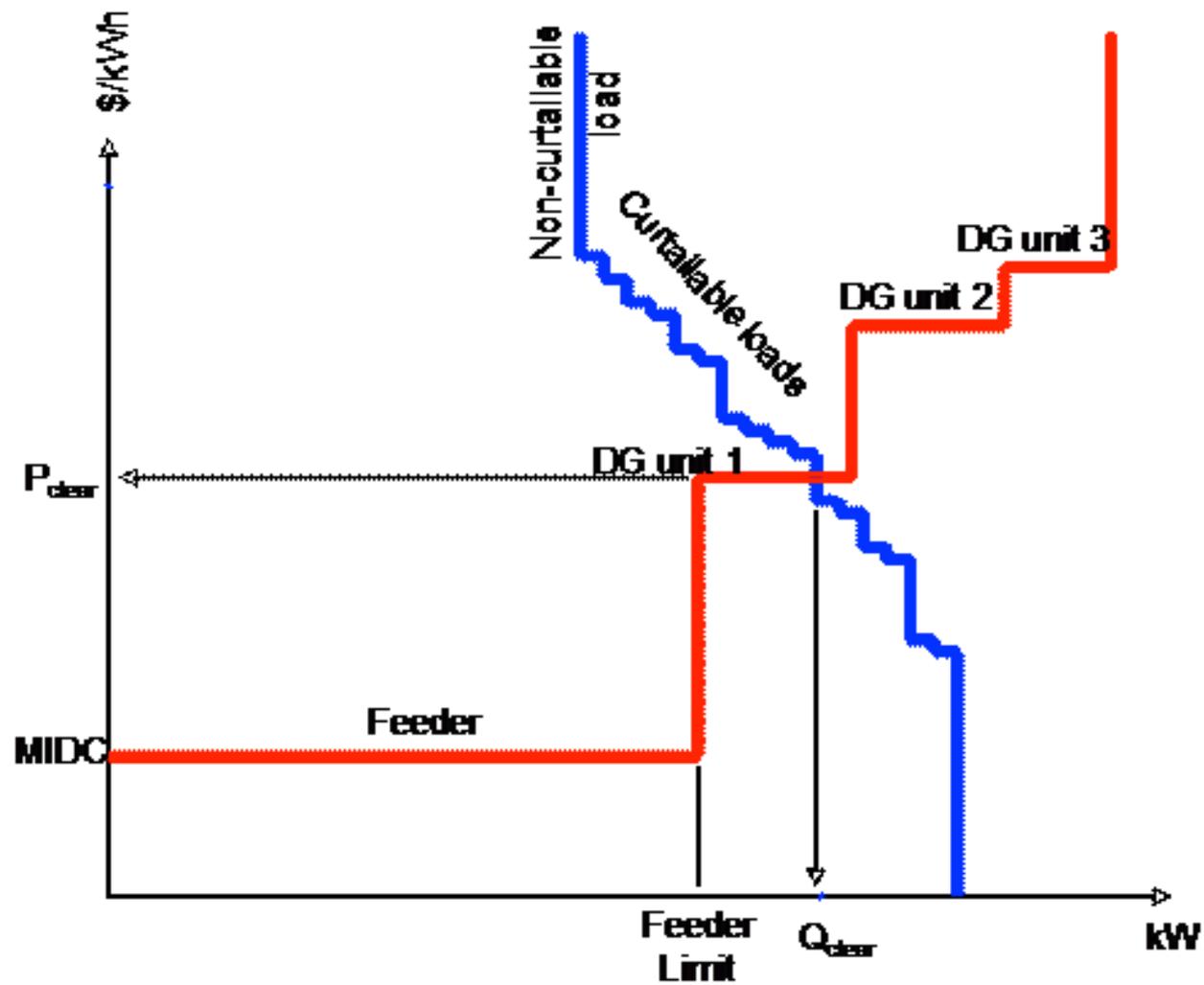
Today's power system



Source: EPRI (2014), p. 8

Defining transactive energy

- “Techniques for managing the generation, consumption or flow of electric power within an electric power system through the use of **economic** or market-based constructs while considering grid reliability constraints” (GWAC)
- **Decentralized**, bottom-up decision-making
- Using the exchange of value via transactions to enable **coordination** of
 - Production/generation of electricity
 - Consumption/use of electricity
 - Use of network capacity (use rights to a **common-pool resource**)
- Encompasses two dimensions of coordination
 - **Institutions**: market design, rules governing exchange
 - **Technology**: degree of autonomous control



A transactive continuum with examples

Not transactive

Fully transactive



Standard regulated service

Direct load control

Dynamic pricing with, e.g., standard digital thermostat

Dynamic pricing with price-responsive PCT

Regulated average price contract

Centralized control, fixed payment

Decentralized coordination

Decentralized coordination with autonomous response



IoT and transactive energy

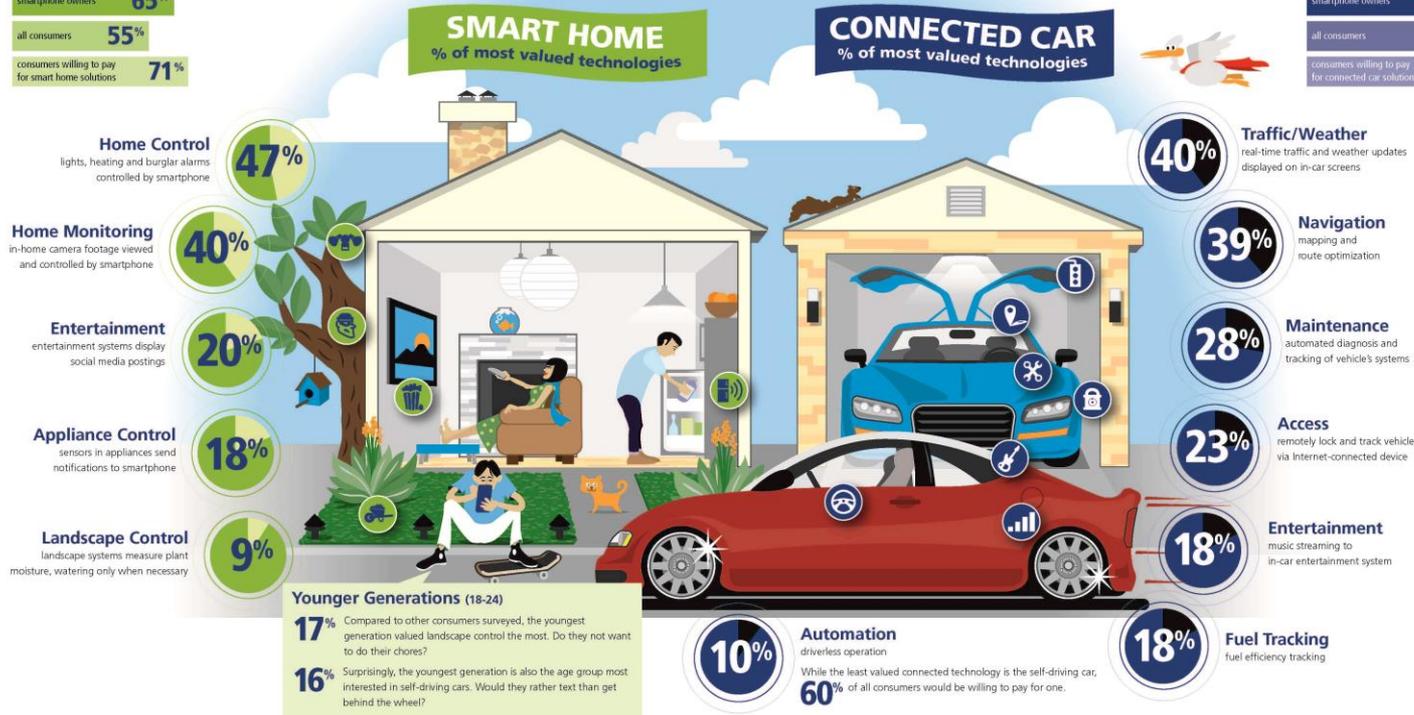
The Internet of Things Moves In

The 2014 U.S. edition of Deloitte's Global Mobile Consumer Survey reveals that smartphone owners overindexed in their desire for Internet of Things (IoT) solutions for the home and car.

Would find value in smart HOME solutions



Would find value in connected CAR solutions



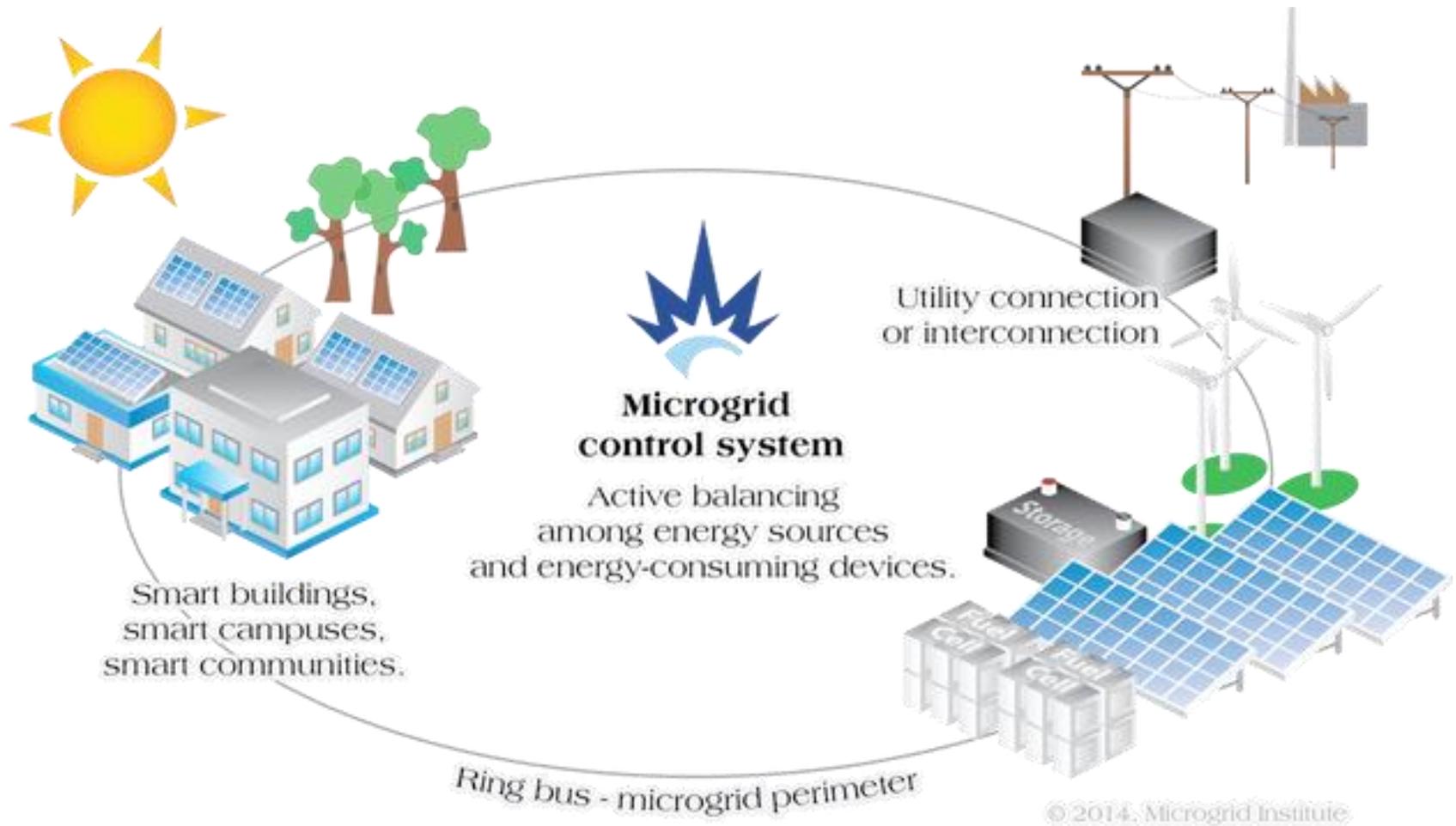
Deloitte.

For additional insights from the 2014 Global Mobile Consumer Survey: U.S. edition, visit www.deloitte.com/us/mobileconsumer @DeloitteTMT

"% of most valued technologies" refers to smartphone owner data. Respondents could select more than one option.

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Microgrids at the distribution edge



Implications and challenges of innovation and transactive energy

- Implications of digital + DER technological change
 - Dramatic reduction in **transaction costs**
 - A **transactive** network harnessing automated transactive coordination of agent decisions and coupling it with automated physical control
 - Unbundling and lowering retail market **entry barriers** become more efficient institutional frameworks than previously
 - Resource **diversity** – destabilization or resilience?
- How does a transactive network enable DER participation in **markets**?
Microgrid participation in markets?
- How does a transactive network interact with grid management **architecture**?
 - If not an actual market, how is the **signal** generated and by whom?
 - Intelligence around the distribution **edge**
 - Transactive control within **buildings**

Transactive technology is opening up
new avenues for consumption,
production, and pricing beyond binary
competition/regulation categories

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The Economist

OCTOBER 31ST–NOVEMBER 6TH 2015

Economist.com

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