Transactive Energy

A Sustainable Business and Regulatory Model for Electricity

Arizona Corporation Commission

Workshop on Emerging Technologies
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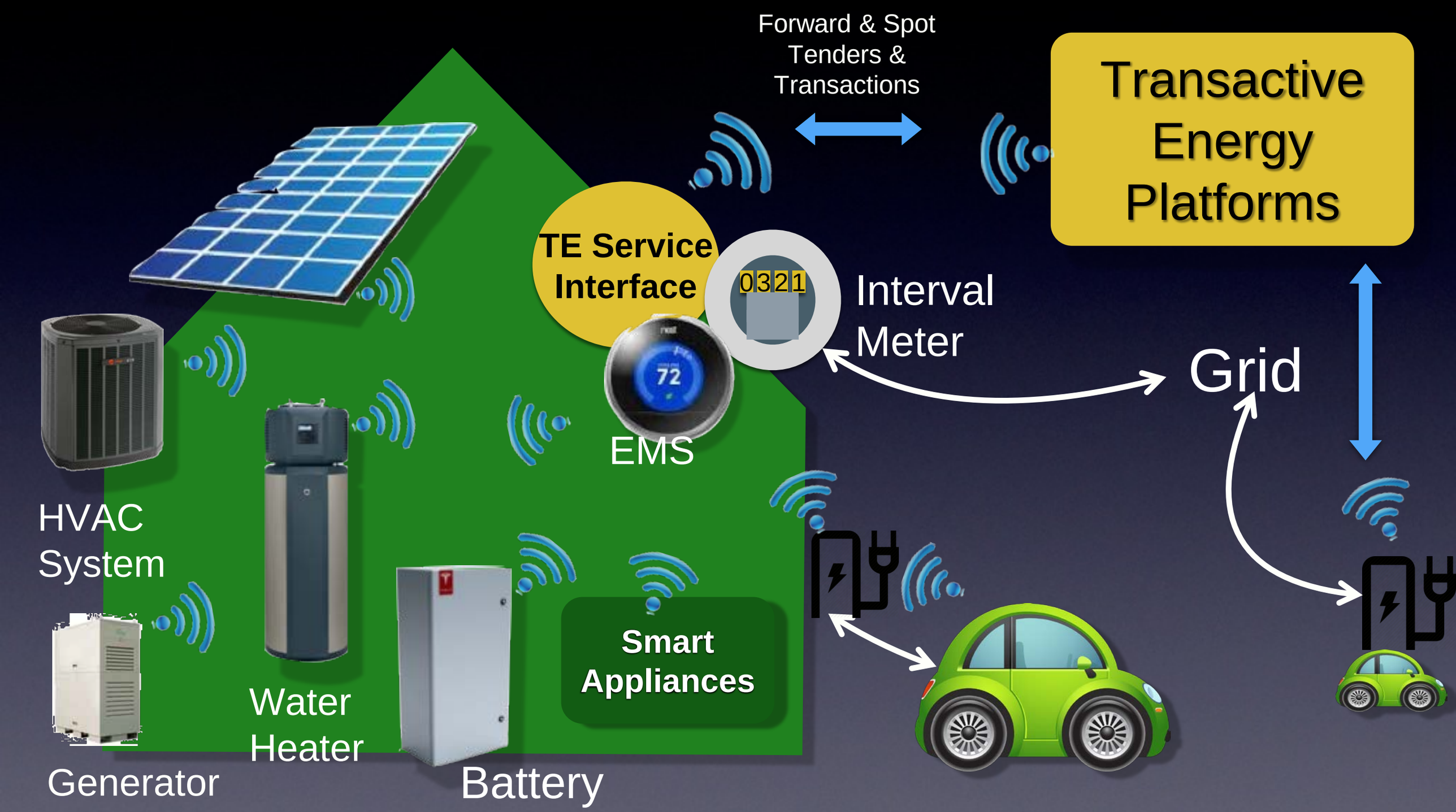
Emerging Technology Issues

- Solar
- Interval Metering
- Advanced distribution grid control
- Communications
- Storage and Microgrids
- Arizona Duck Curve
- Retail rates and Net Metering
- EIM 5-minute markets

A building (or charge station) with a plug-in looks like this in the Transactive Energy (TE) model.



Here's an example of how TE works for a consumer.

(Interoperable Transactive Retail Tariff / Rate)

- Based on my typical usage, I automatically transact with one or more suppliers for delivery of a fixed quantity of energy in each hour of the year(s) for a fixed monthly payment (subscription.)
  - If I use less than I subscribed for in each hour then I am paid for the difference at an hourly spot price.
  - If I use more than I subscribed for then I pay for the difference at an hourly spot price.
- At any time I can automatically buy or sell a quantity of energy at current tendered prices.

My energy management system (EMS) automates this process

Transactive Energy (TE) has four big ideas.

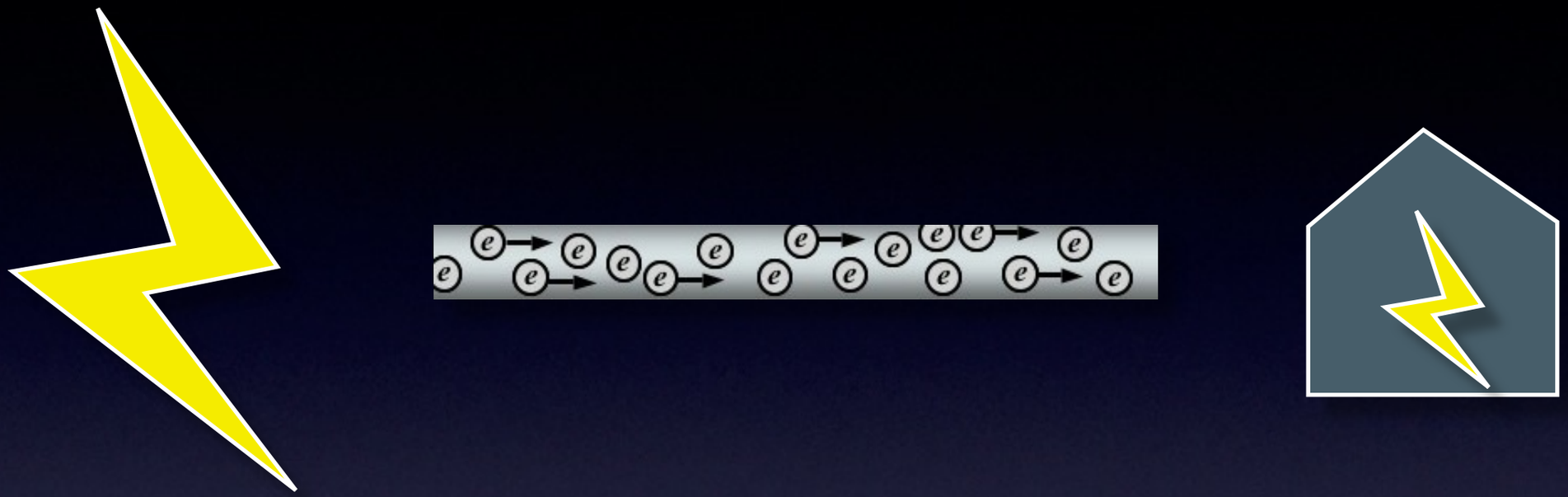
Forward transactions are used to coordinate investments and manage risk.

Spot transactions are used to coordinate operating decisions.

All parties act autonomously.

There are two products: energy and transport..

The two-way Transport product delivers the Energy product.



Electric energy (at a place and time)

Example: Transmission Connected Substation

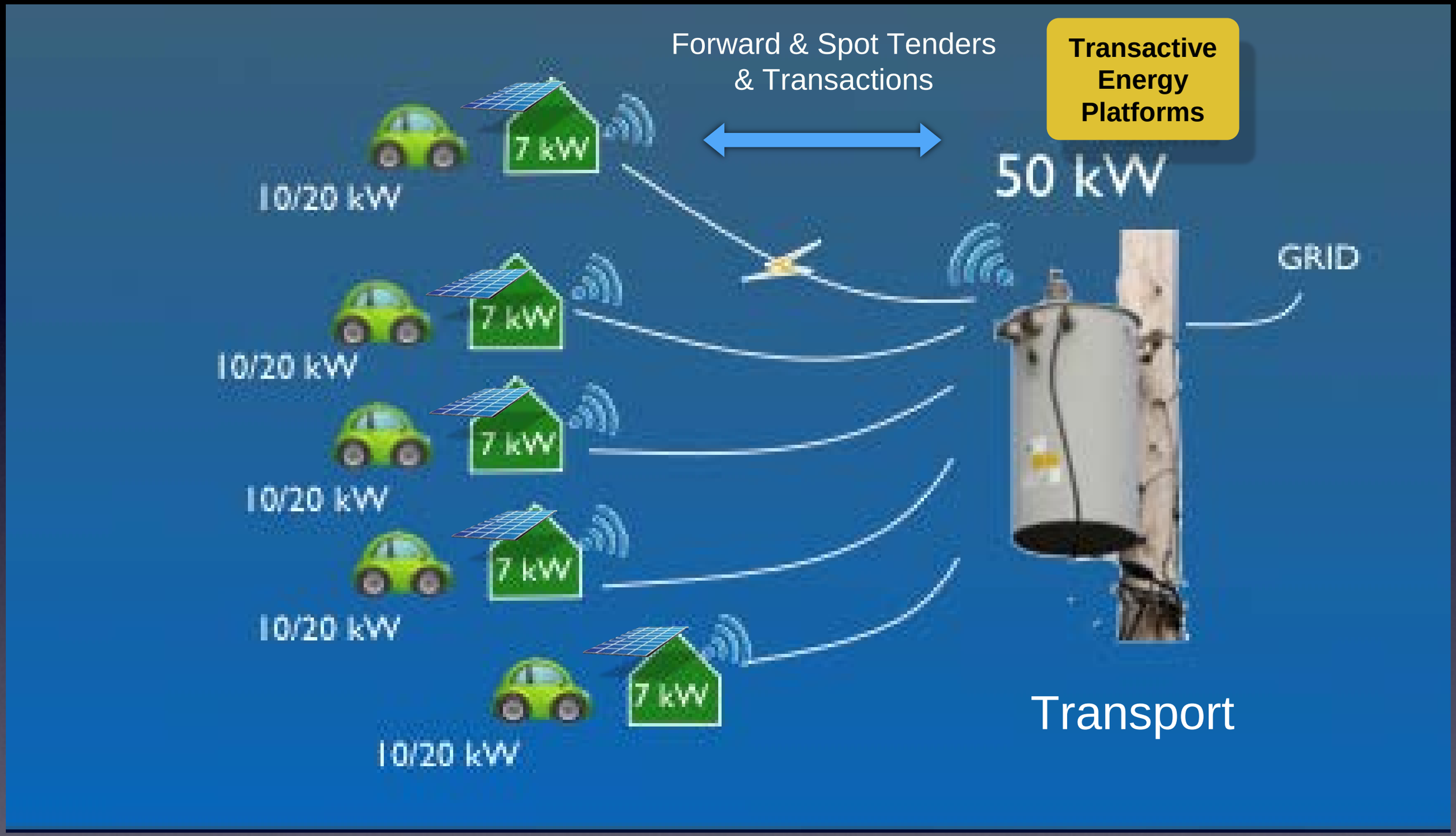
Transport

Example: Two-way Feeder

Electric energy (at a different place and same time)

Example: Building

TE Transport with Solar and Plug-Ins.



Transport

Architecture of the TE Business and Regulatory Model

Grid Custodians:

Congress, DOE, EPA, FERC, NERC, Legislatures, PUCs, Munis, CCAs, PMAs, Coops

Energy Services Parties

- Consumer
- Producer
- Prosumer
- Storage Owner

Transport Services Parties

- Transmission Operator (TO)
- Distribution Operator (DO)

Transaction Platform Providers

Tender and Transaction Data Bases

Intermediaries

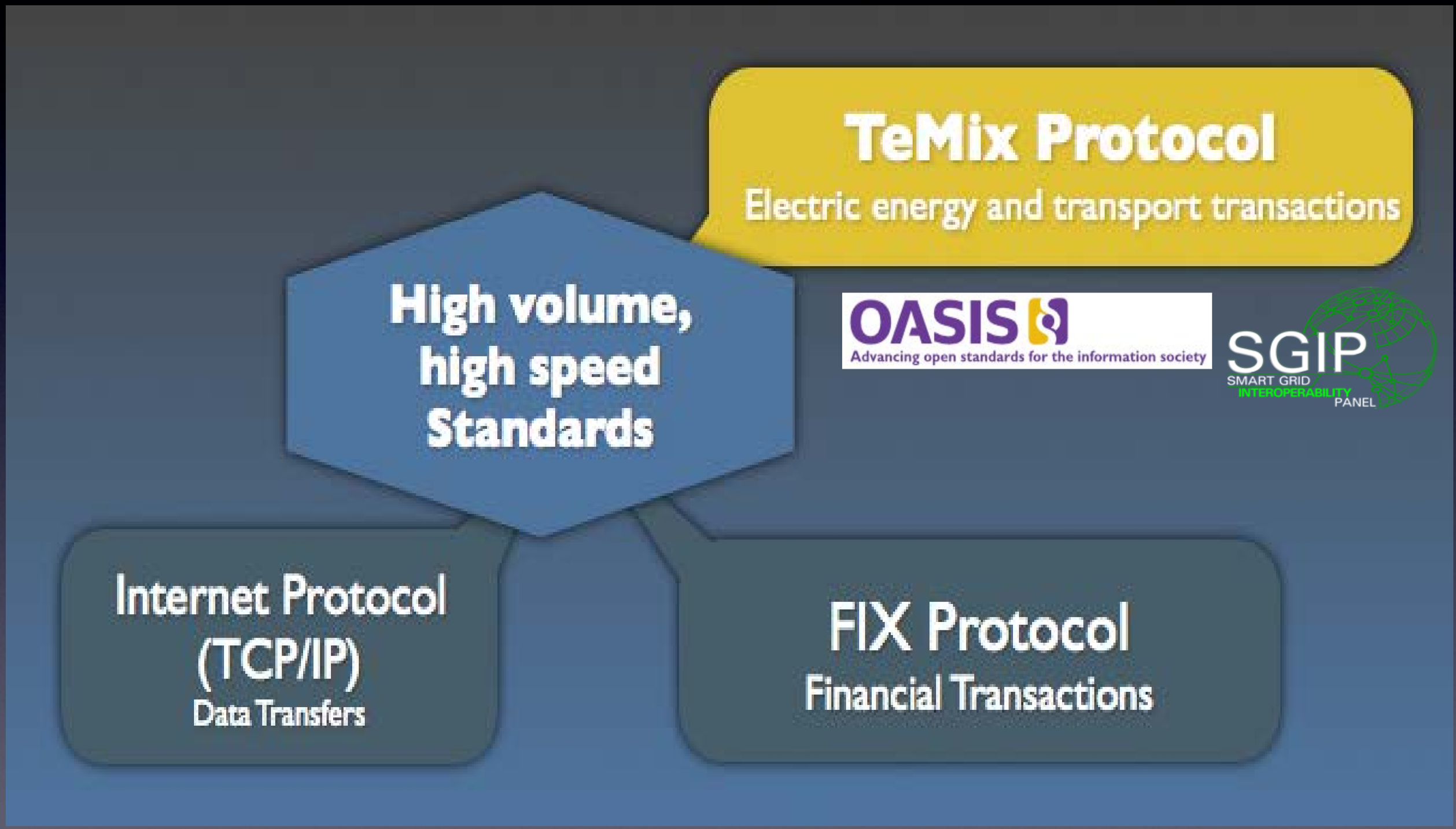
- Exchanges
- Marketers
- Retailers
- System Operators

TE Service Interface

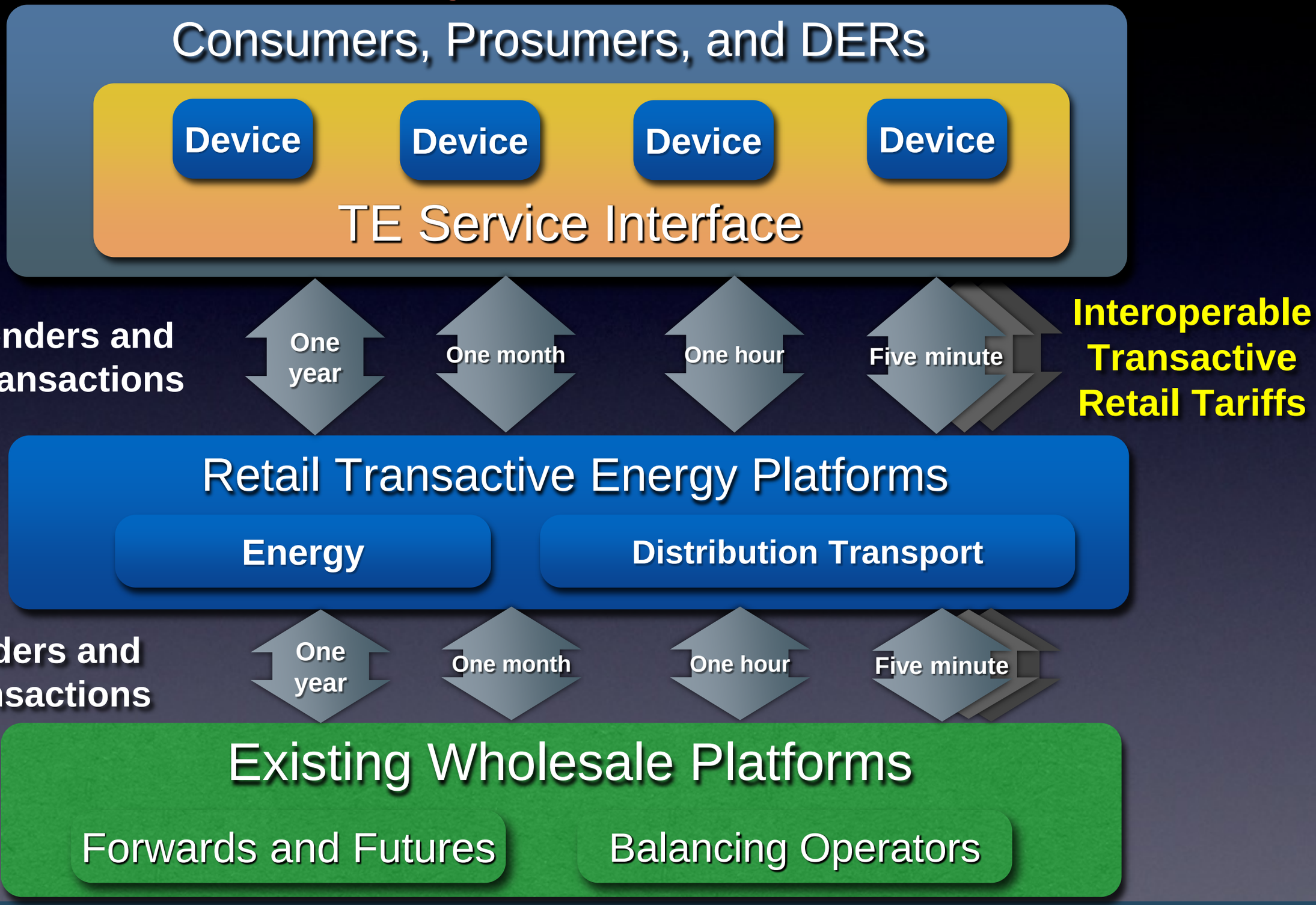
Tenders and Transactions

The TE business process is straightforward.

“Open and free” TeMix protocol supports standard transactions on multiple communications systems.



Transactive Energy can be incrementally deployed to work with current systems and entities.

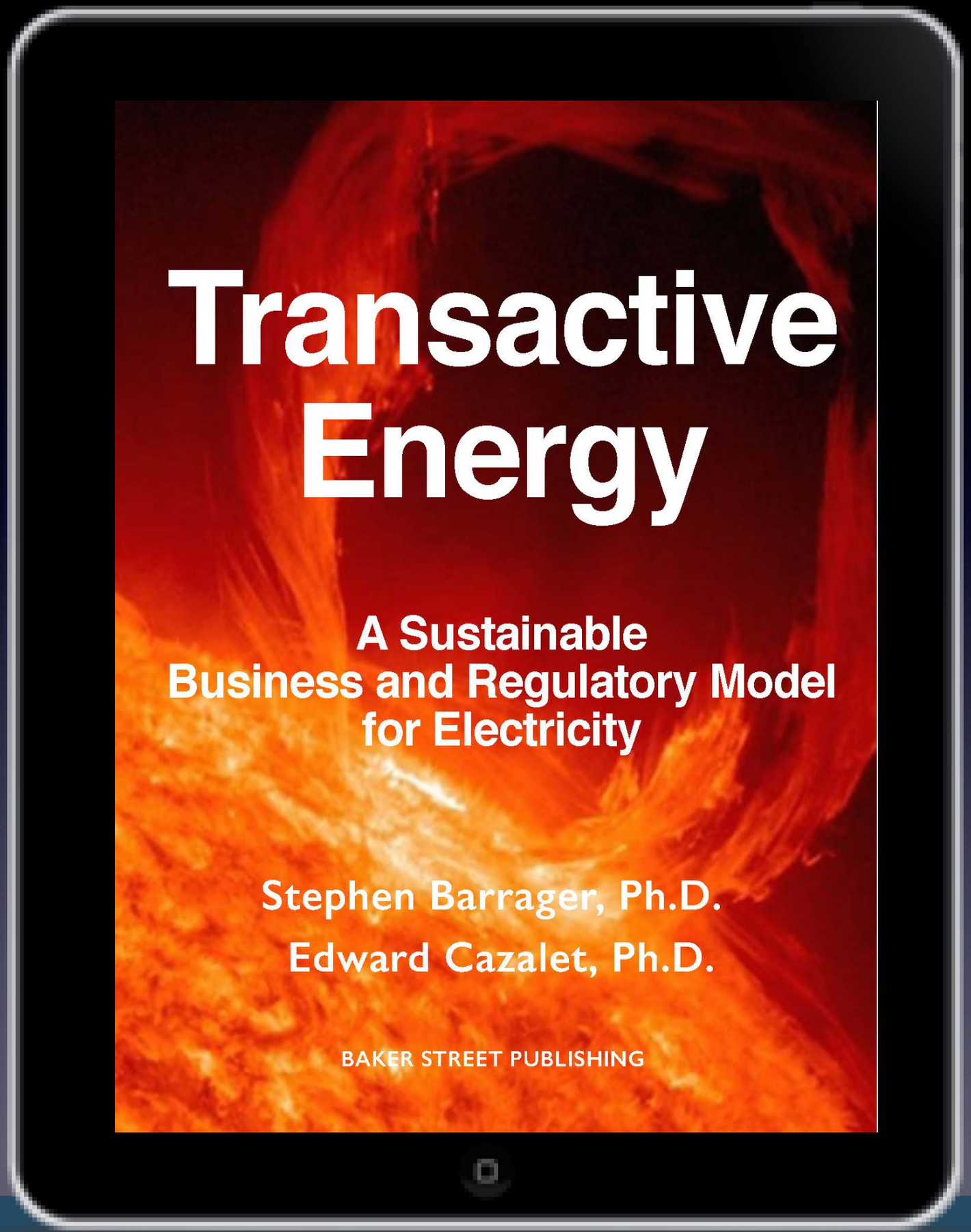


Visit TEA for continuing open discussion of Transactive Energy.

TEA™

TRANSACTIVE ENERGY ASSOCIATION

www.tea-web.org



Available on the Apple iBook Store.

Key Takeaways to Support Emerging Technologies

- Operations and investment functions for energy and transport should be separate and coordinated using forward and spot transactions.
- Recover fixed and variable costs with
  - forward fixed priced subscriptions and variable spot prices on short intervals, avoiding
  - Minimum $/mon bill, fixed $/mon charge, demand $/kW charge and constant $/kWh charges.
- Distribution transport rates should be based on two-way flows on short intervals.