



PROMISE AND PERILS OF TECHNOLOGY DISRUPTION

Technology Innovation & Policy Forum 2018

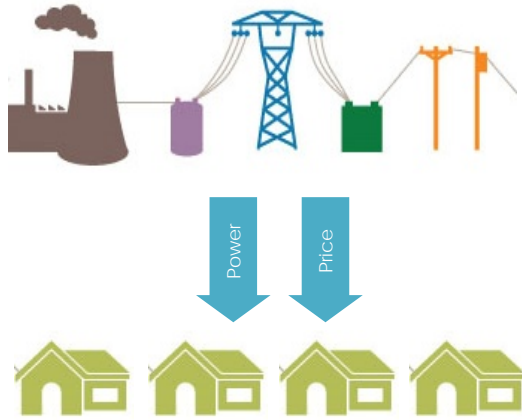
November 7, 2018



GLOBAL ENERGY NETWORK EVOLUTION

YESTERDAY

Generation Transmission Distribution

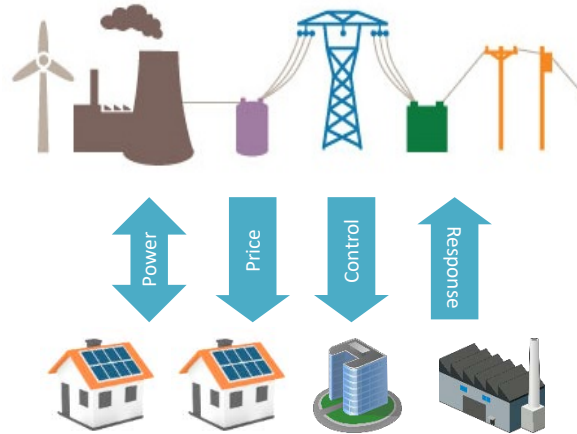


One-way pipeline model

- One-way “pipeline” model from centralized generation through to transmission and distribution
- Largely passive consumers
- Asset-based bricks and mortar platform (poles & wires)

TODAY

Generation Transmission Distribution

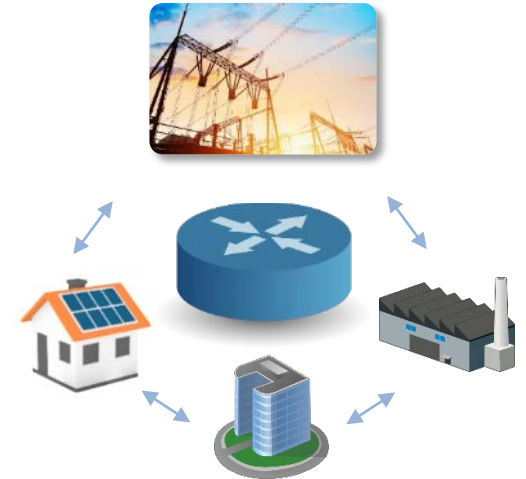


Distributed energy resources integration

- Increased adoption of distributed energy resources (DERs), e.g. generation, storage, demand, microgrids
- DER accommodation to integration
- Friction between utilities/DER businesses
- Data-driven smart grid platform

TOMORROW

Utility

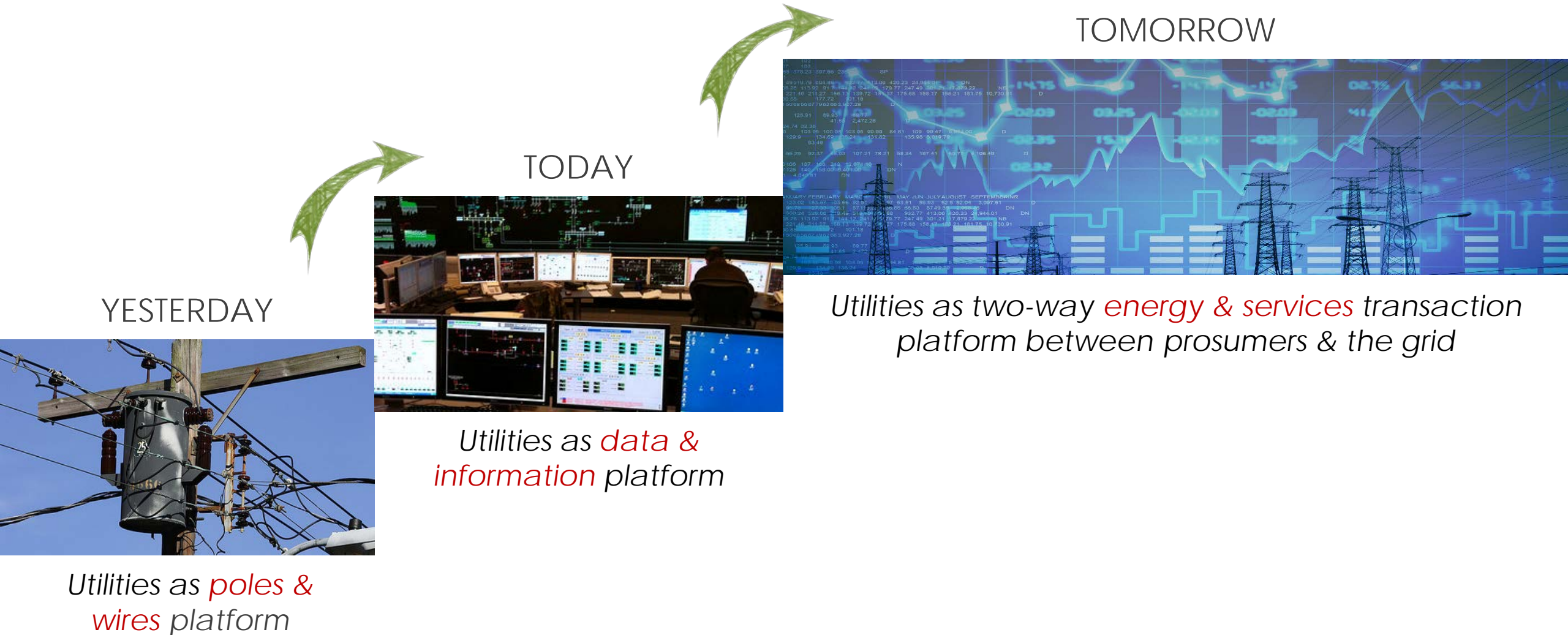


Multi-way transactive platform model

- Business and customer model transformation
- Utility as a service platform for DERs
- Integrative markets for win-win between utility/DER revenue models
- Value-based transactive platform

“5 D’s” megatrend: decentralization, decarbonization, digitization, deregulation, democratization

INEVITABLE SHIFT TOWARDS A SERVICE PLATFORM



DISTRIBUTION GRID AS A PLATFORM

Value Stacking

Aggregated to Locational Dispatch



Bulk Power

Aggregation & resource integration



Distribution Grid as a Platform

Grid 1.0: Electron Platform – Poles & Wires

Grid 2.0: Data Platform – Smart Grid

Grid 3.0: Transactive Platform – Value Exchange

Unlock customer service & stacked value models



DERs at the Edge

REVOLUTIONIZING THE UTILITY-CUSTOMER RELATIONSHIP

Grid/DER Valuation

DER locational and temporal valuation and price generation (if required), based on emerging economic/regulator models

Visibility, Control, Optimization

Power flow results on every node across the distribution network, dynamic hosting capacity, optimal power flow controls

Grid Investments & Operations

Utilities modernize grid investment planning and operations given the added value from DERs

TRANSACTIONAL ENERGY (TE)

"A system 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

Customer Value-Add to Grid

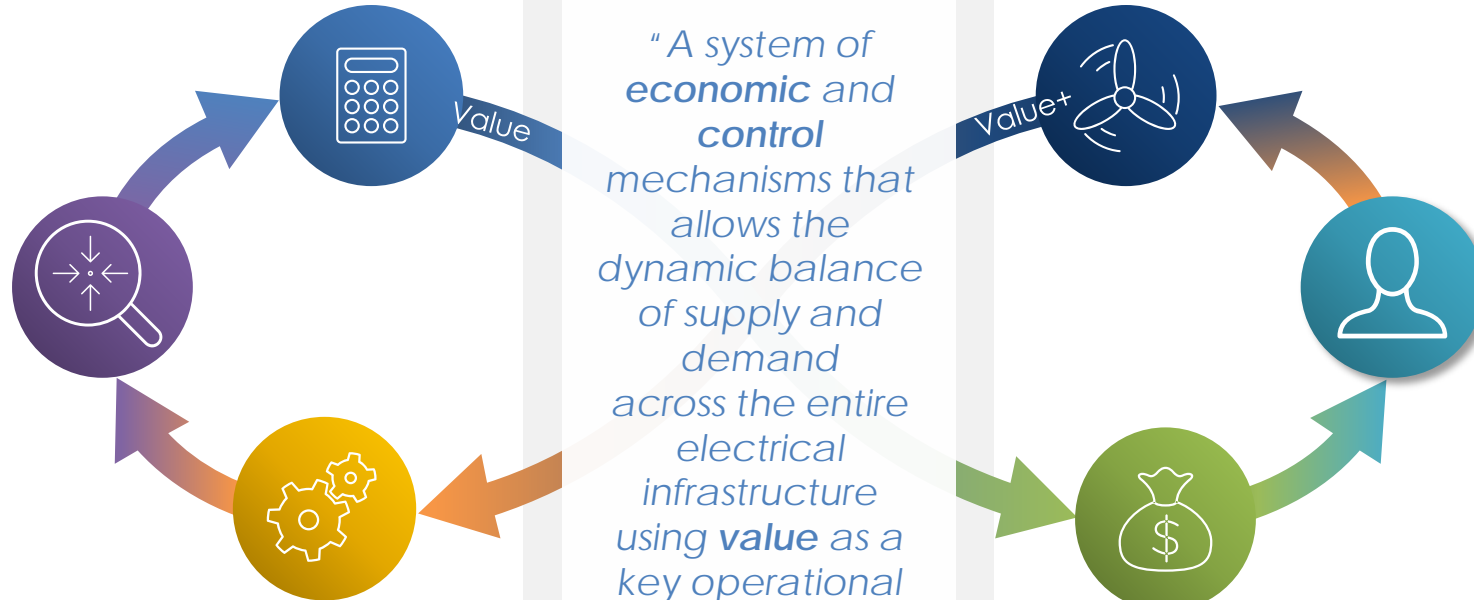
Engaged customers are incentivized to align operations to the benefit of the greater grid

Customer Engagement

Empowered customers can transact value with each other, enabled by the utility with the grid as a platform

New Platform Business Models

DER/energy efficiency values enable **integrated energy/service markets and win-win business models** between utilities and empowered customers



Advanced Grid Analytics

GridOS

demo@opusonesolutions.com

Select Workspace

Network Asset

Search...

- Line (86)
- Load (62)
- Node (88)
- 100
- 101
- 102
- 103
- 104
- 105
- Regulator (1)
- Shunt Capacitor (4)
- Switch (5)
- Transformer (1)

Information

Node 67

Apply changes

Base Voltage (LL) 4.16 kV

	A	B	C
Voltage (LN)	2.51	2.52	2.51
p.u. Voltages	1.05	1.05	1.05
Angle	-1.12	-121.00	119.07

Feeder IEEE-123-NODES

Hosting Capacity

(kW)

Time	ABC (kW)	A (kW)	B (kW)	C (kW)
22:00	20	20	20	20
03:00	100	100	100	100
08:00	210	210	210	210
13:00	270	270	270	270
18:00	20	20	20	20

50 m 200 ft

Hosting Capacity

99/12/31 19:00 21:00 23:00 01/01/20 03:00 05:00 07:00 09:00 11:00 13:00 15:00 17:00

© 2018 Opus One Solutions. All rights reserved. Proprietary and Confidential

Add Asset

6

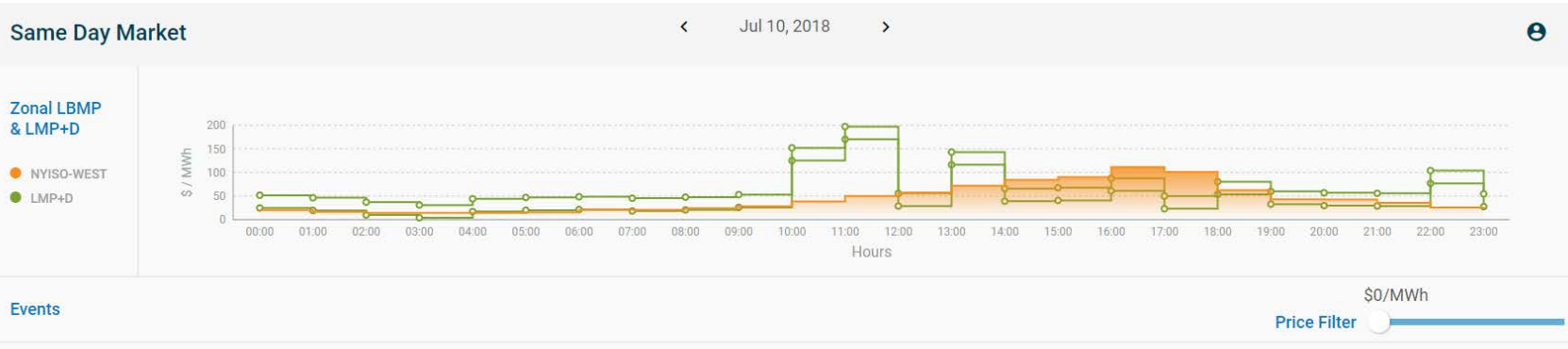
TRANSACTIONAL ENERGY – VISION TO REALITY

TRANSACTIONAL ENERGY MARKET

EDT 23:13:52

- Home
- Same Day Market
- Day Ahead Market
- My Assets
- Report

Powered by GridOS®



Events

Time (24h)	LMP+D (\$/MWh)	Total (\$)	Market Participation (MW)
8:00 - 8:59	\$20.67 - \$47.67	\$133.04	0.00
9:00 - 9:59	\$25.91 - \$52.91	\$166.51	0.00
10:00 - 10:59	\$125.10 - \$152.10	\$724.80	0.00
11:00 - 11:59	\$170.22 - \$197.22	\$994.08	0.00
12:00 - 12:59	\$28.71 - \$55.71	\$192.81	0.00
13:00 - 13:59	\$116.24 - \$143.24	\$699.34	0.00
14:00 - 14:59	\$38.96 - \$65.96	\$253.76	0.00
15:00 - 15:59	\$40.72 - \$67.72	\$265.11	0.00

GridOS

Select Workspace

Network Asset

Synchronous Machine (4)

Information

Synchronous M... RP-DC1-1000KW

Phase: ABC

Power Factor: 0.80

Rated Power: 1250.00 kVA

Rated Voltage: 13.80 kV

Rated Power: 1000.00 kW

Reactive Power: -750.00 kVAR

Node: 109821320

Feeder: 118

Measurements

Real Energy: Stop Meter kWh

Reactive Energy: Stop Meter kVArh

Market Information

Distribution Coincident Factor: 1.00

Derating Factor: 1.00

Marginal Distribution Cost: \$/MWh

Delta Loss: %

Forecast Schedule

Upload a new Schedule



Reforming the Energy Vision

nationalgrid



opus one solutions



JOSHUA WONG
President and CEO
jwong@opusonesolutions.com
1 (416) 818-1518