

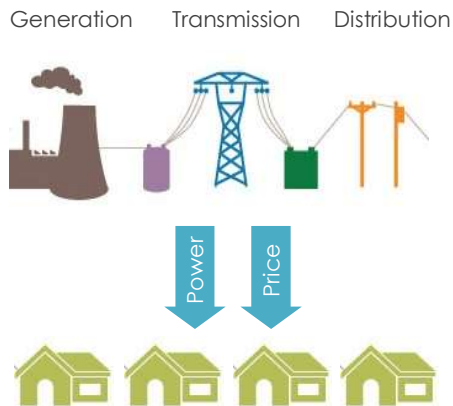


EMPOWERING UTILITIES IN A DECENTRALIZED ENERGY ECONOMY



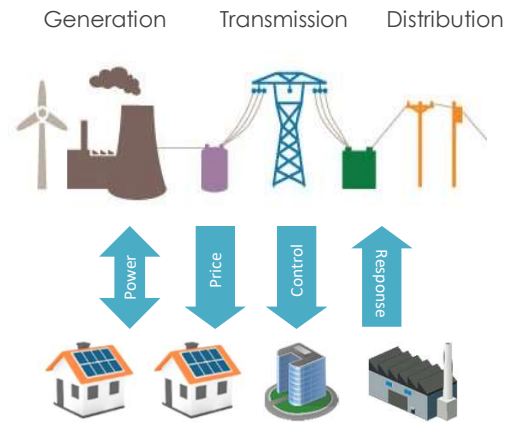
INDUSTRY EVOLUTION

YESTERDAY



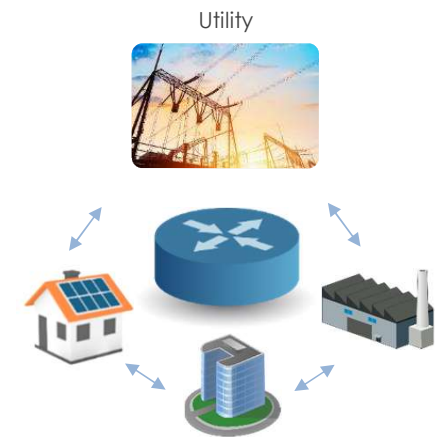
One-way pipeline model

TODAY



Distributed energy resources integration

TOMORROW

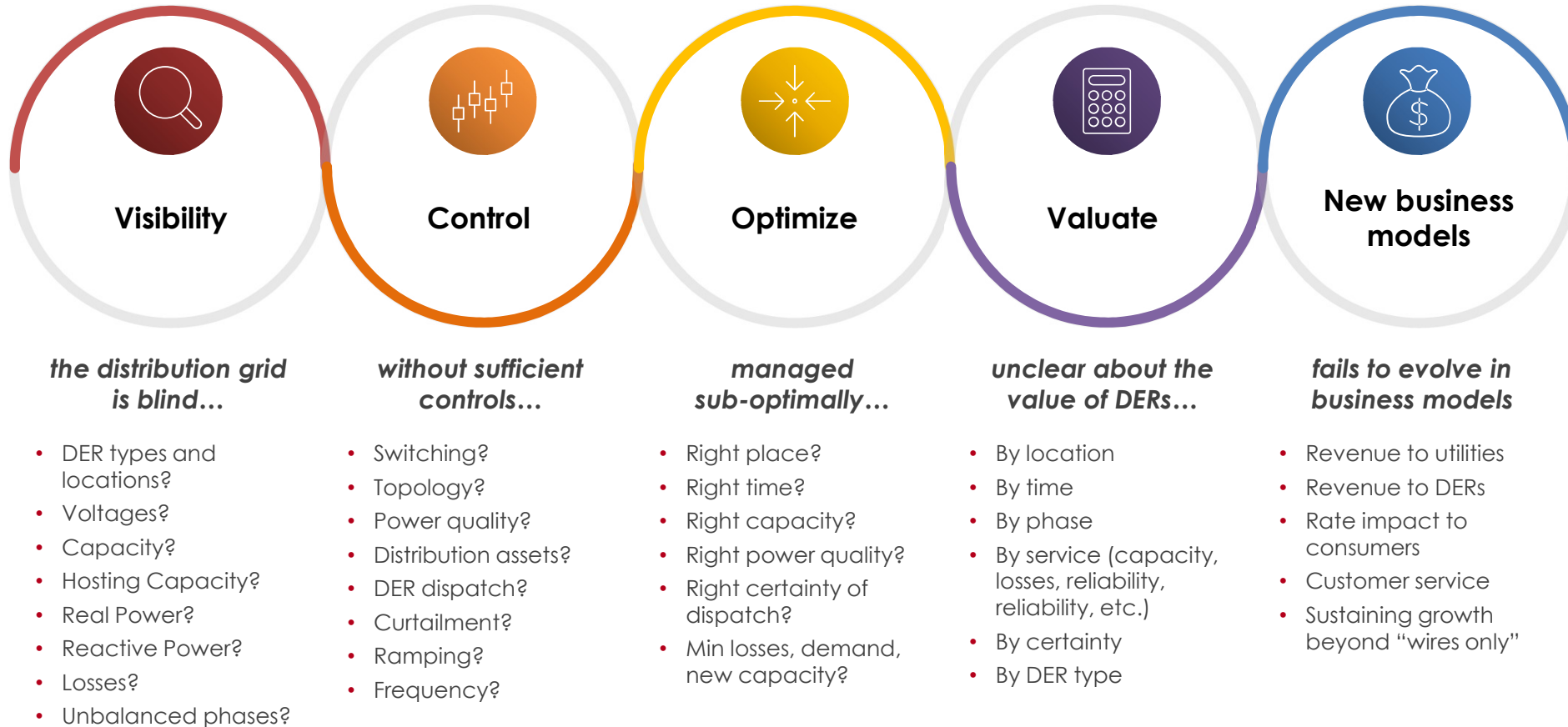


Multi-way transactive platform model

THE PROBLEM

CHAIN REACTION OF CHALLENGES

Blind,
Aging,
Congested
Grid

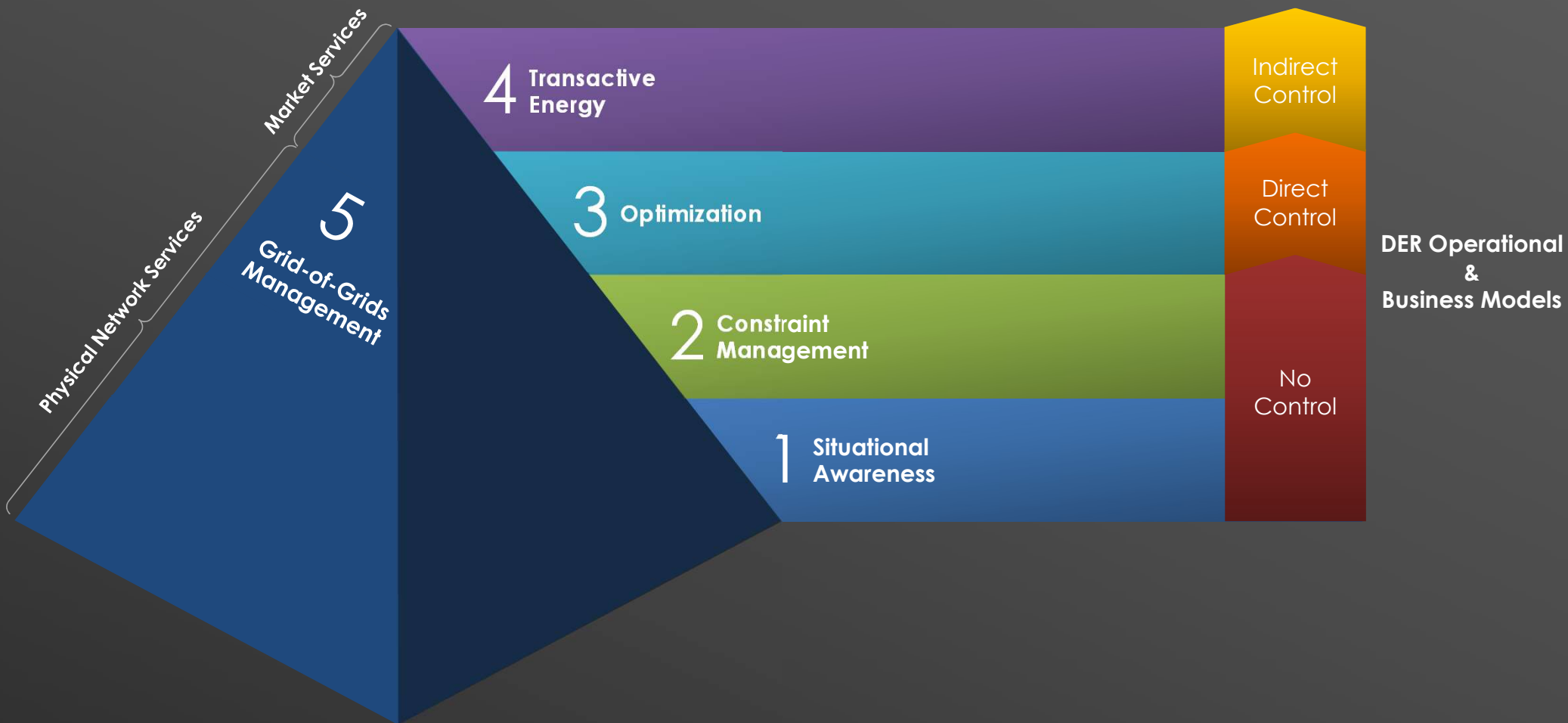


TYING IT TOGETHER

The distribution system has been a **black box**, but holds the key to unlock value in the integrated energy network

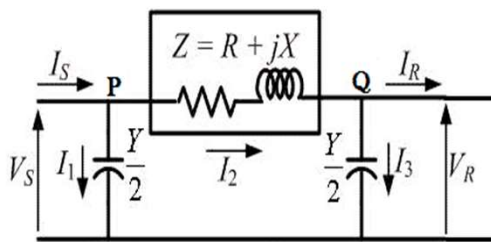


5-STAGE STRATEGY FOR MANAGING DERS



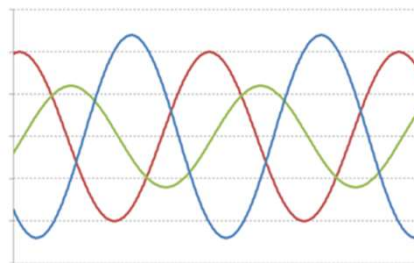
GRID'S DNA

MODELING & TOPOLOGY PROCESSING



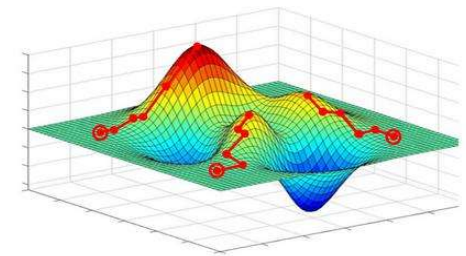
- 3-phase AC unbalanced for distribution grids at the “edge”
- Dynamic topology processor for “as-operated” network analysis
- Advanced decision making under complex two-way power flow

STATE ESTIMATION, FORECASTING & POWER FLOW ENGINE



- Full situation awareness (e.g. P, Q, I, V) under many unknowns while leveraging available data (e.g. SCADA, AMI) for convergence

NON-LINEAR OPTIMIZATION ENGINE



- Non-linear optimizer computing exact Jacobian, Hessian and Lagrangian, to overcome non-convexities to reach global optimality
- Multi-objective, multi-agent enabling new utility and customer business models (e.g. transactive energy)

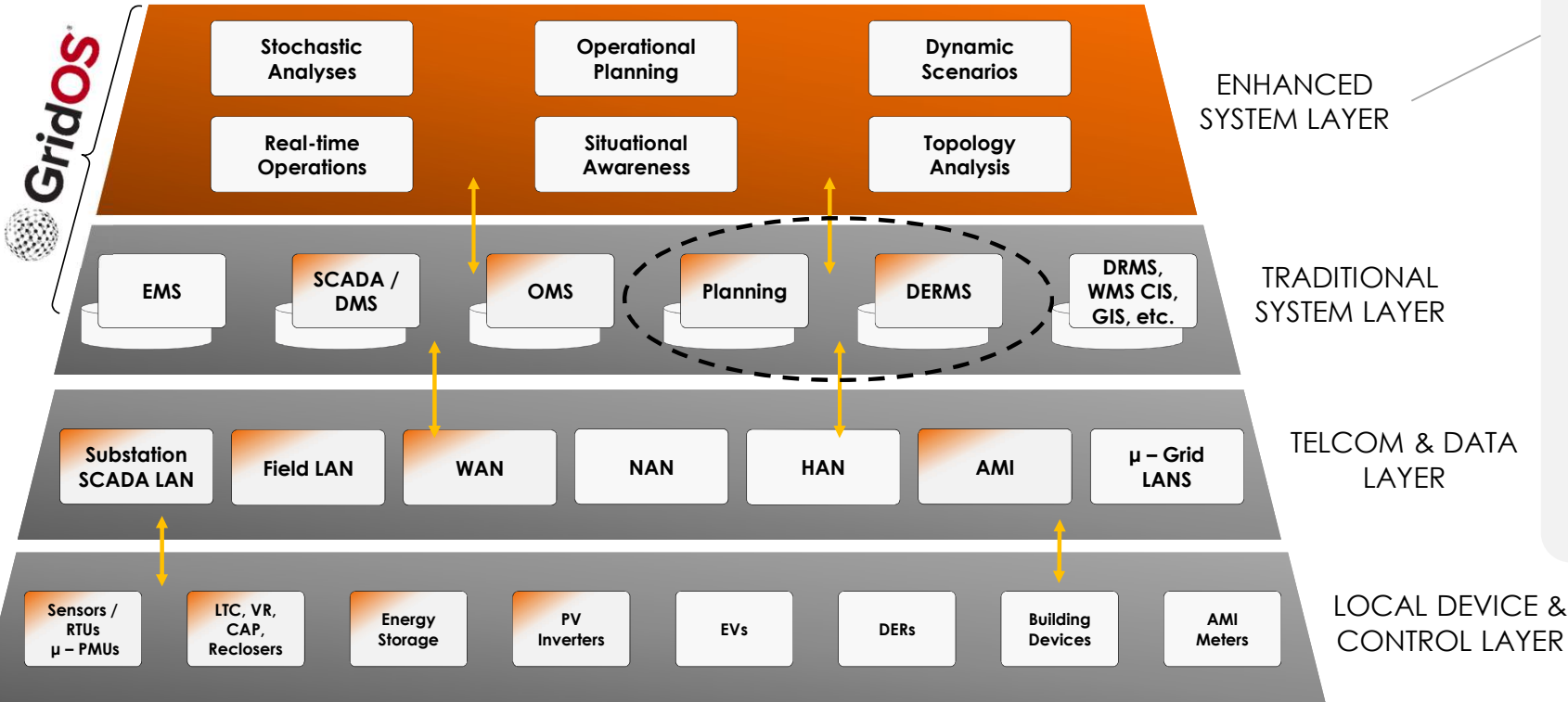
PLATFORM APPLICATION SUITES



ENHANCED SYSTEM LAYER FOR DERS



ENERGISE Solutions Architecture



"...advanced methods to **model, simulate, and predict** distribution power system behaviors.."

"..these methods include **real-time distribution power flow (PF), optimal distribution power flow (OPF), distribution system state estimation (DSSE), stochastic analysis, predictive analysis, dynamic scenario building** for "what-if studies", and **machine learning** techniques."

IDP REFERENCE PROJECT

Largest IDP project, repository of DER valuation and NWA generation in the world

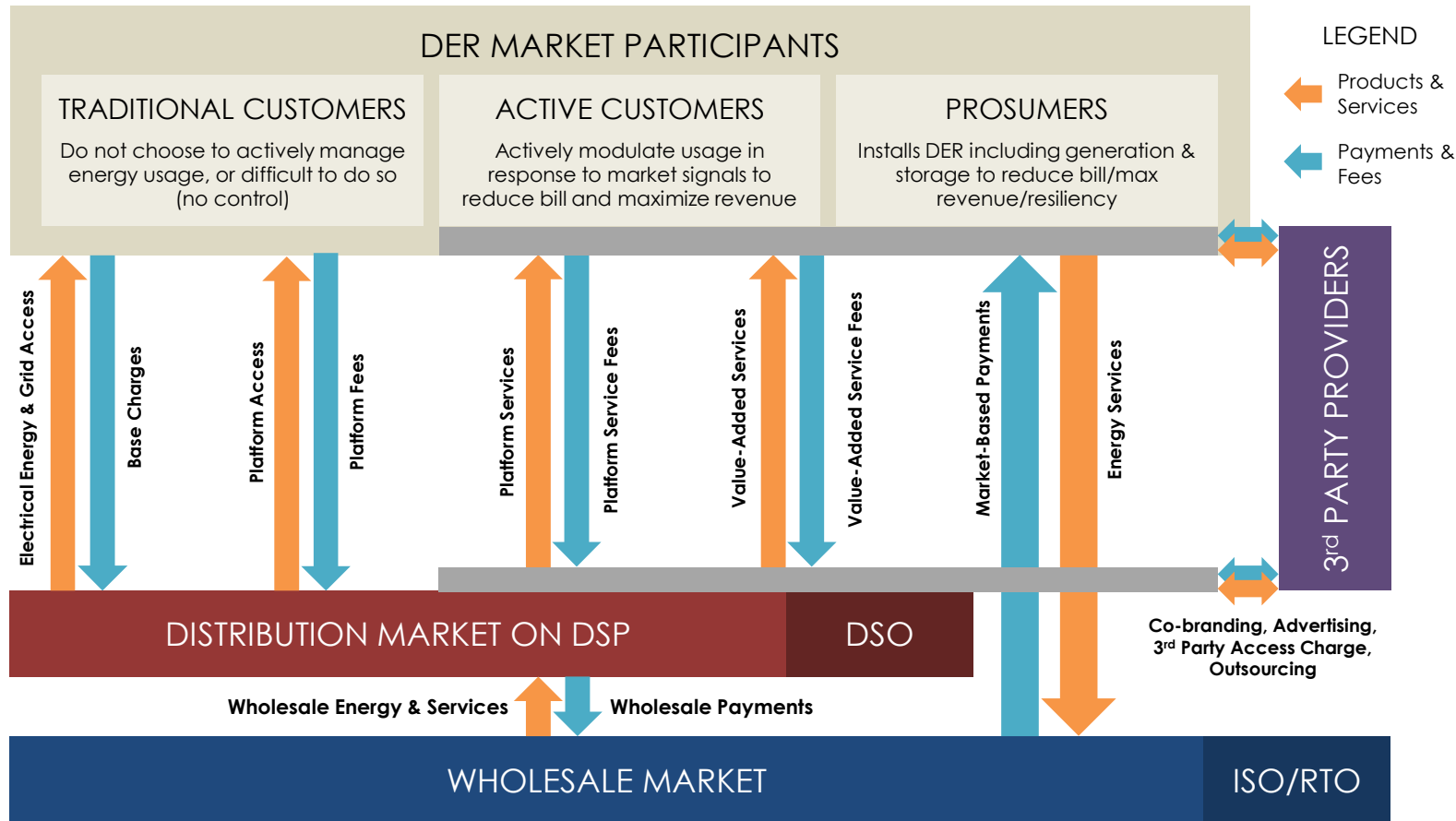


1. DER valuation along full value stacks (vertically) and networks (horizontally)
2. Dynamic hosting capacity analysis
3. Non-wires alternatives generation
4. Investment strategy and risk analysis
5. Generation & transmission coordination (fuel supply, bidding, etc.)



- 2,000+ feeders across service territory
- 10 year planning horizon at 8760 intervals, at every asset level and every node
- Directs multi-billion \$ capital investment plan over the next 10 years

SUITE #3: TE MANAGEMENT



Transactive
energy platform
to **transact**
value between
grid and DERs

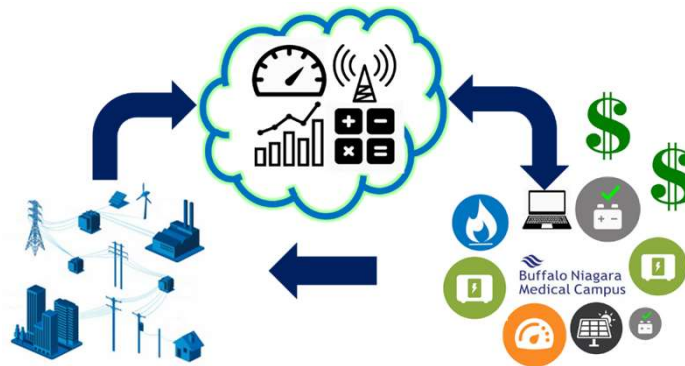
TE REFERENCE PROJECT: NATIONAL GRID

Integrative win-win business models using DER value as a key operational parameter in NY REV



1. Calculate and generate location-based pricing signals based on LMP+D
2. Incentive generation from local DER owners
3. DER bidding agent
4. Market clearing
5. Adaptation of OpenADR 2.0

nationalgrid



Distributed System Platform:



"an intelligent network platform that
(1) provides safe, reliable, and efficient electric services by integrating diverse resources to meet customer's and society's evolving needs
(2) fosters broad market

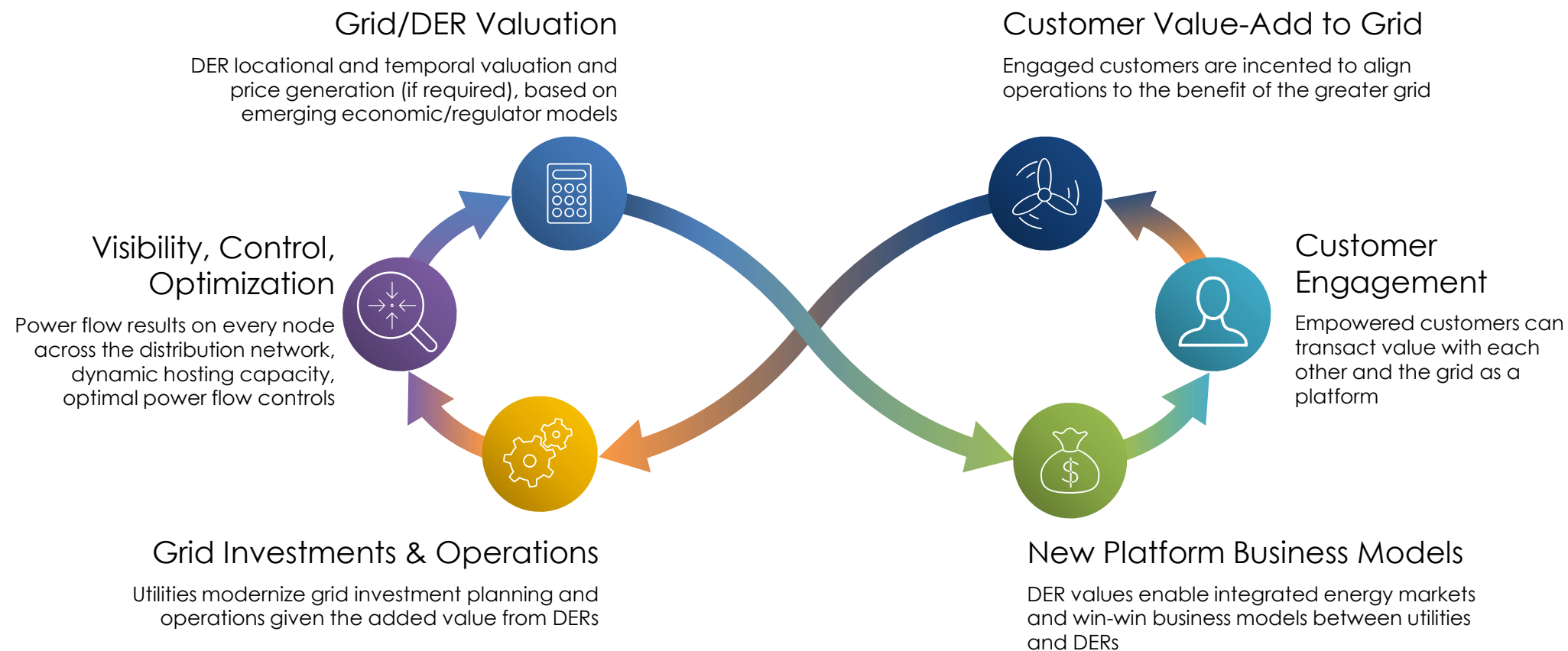
the DSP

(1) offers services such as information, interconnection, or dispatch services at prices and terms regulated by the PSC
(2) compensates DER providers and their customers for the value they provide to the grid. The order states that the DSP market structure must exchange DER services in fair and open markets."



Buffalo Niagara
Medical Campus

POSITIVE FEEDBACK LOOP OF CONTINUOUS VALUE





Mark Hormann

Director of Grid Solutions

mhormann@opusonesolutions.com

1 (650) 477-6459