



**ELECTRIC POWER ENGINEERS**

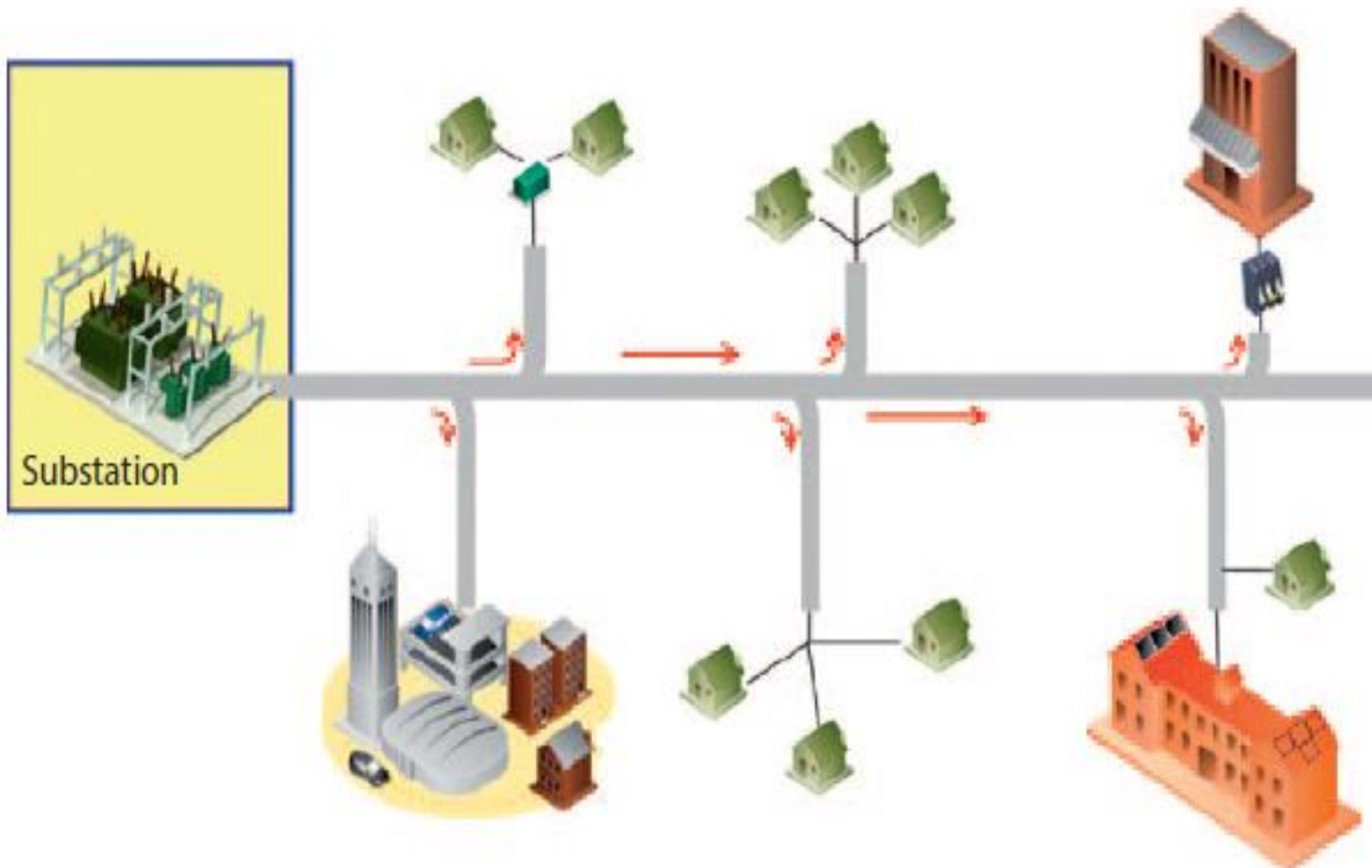
**ENERGY ENGINEERING EXPERTS**  
GENERATION | TRANSMISSION | DISTRIBUTION



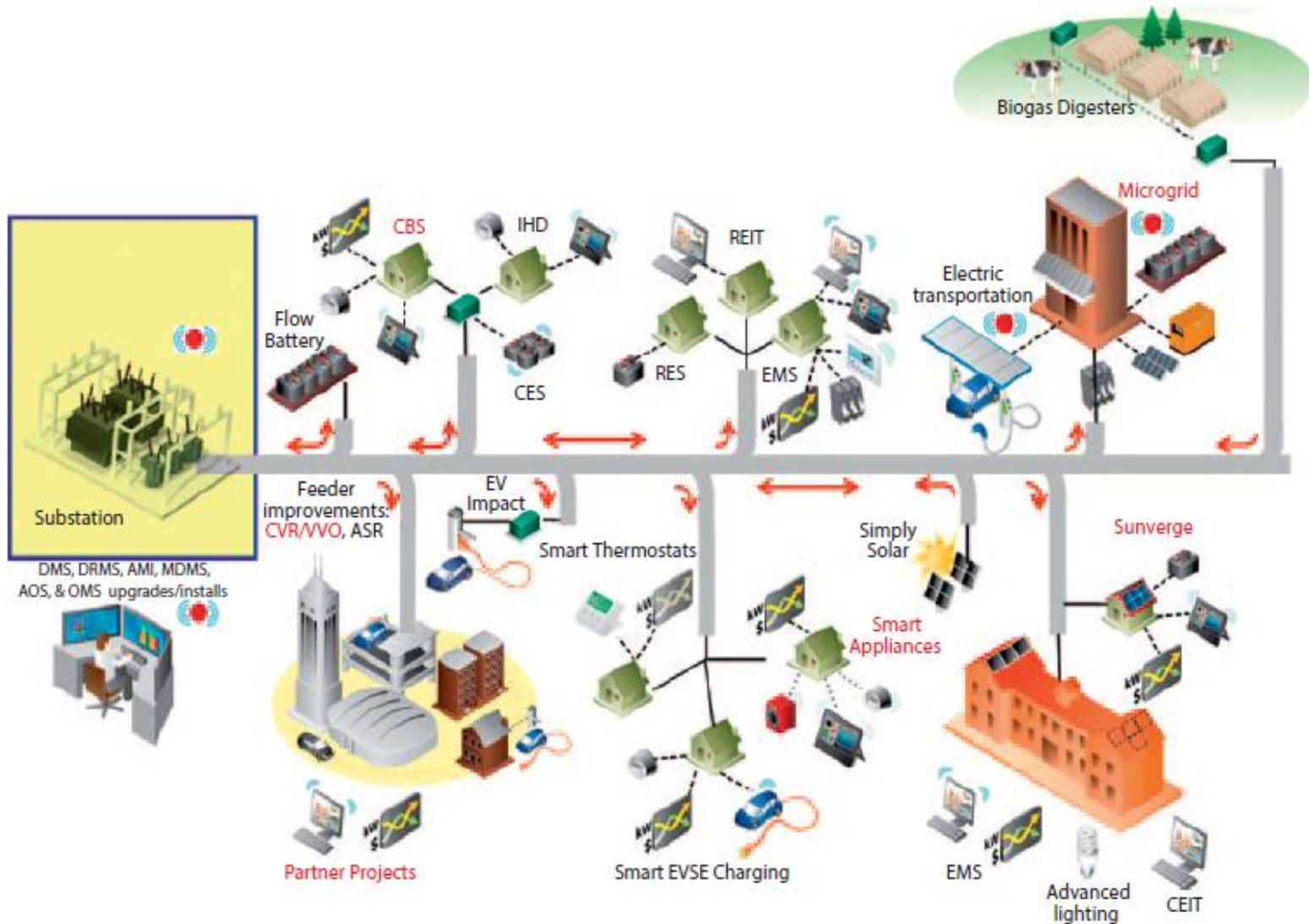
# MODERN POWER SYSTEMS: DRIVING CHANGE

**KENNETH A. DONOHOO,  
DIRECTOR OF POWER  
SYSTEMS**

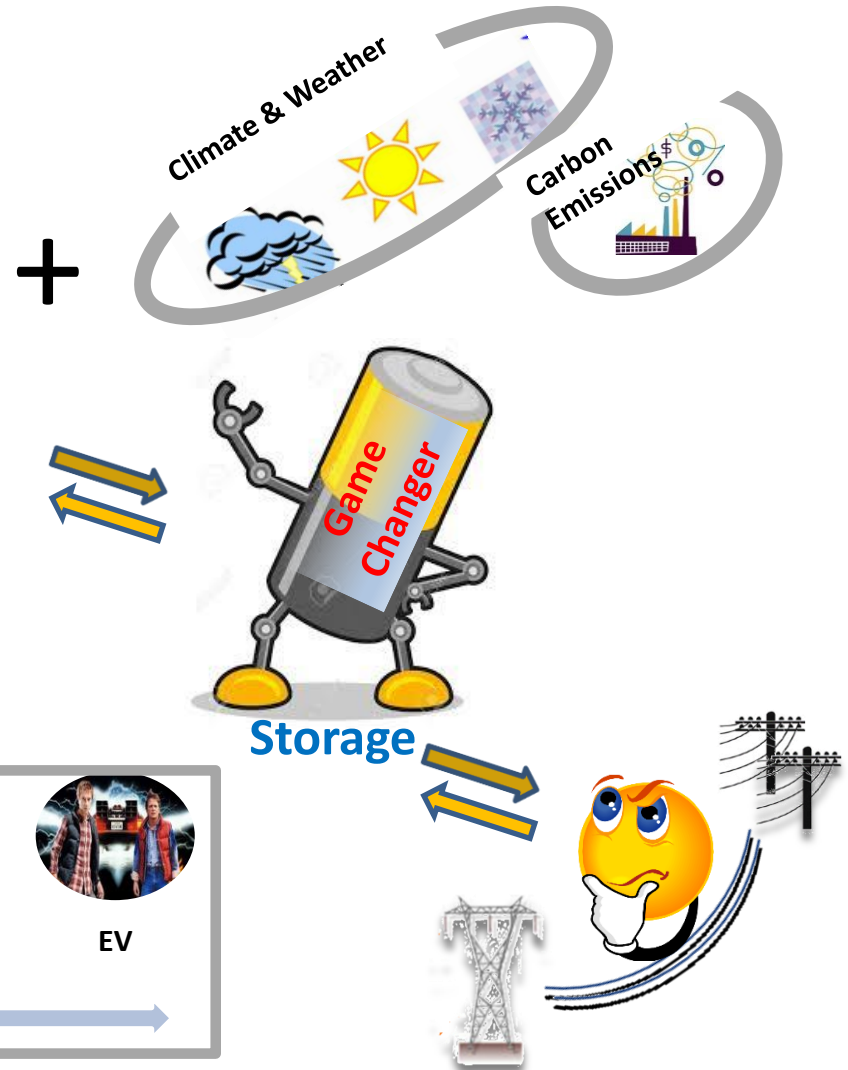
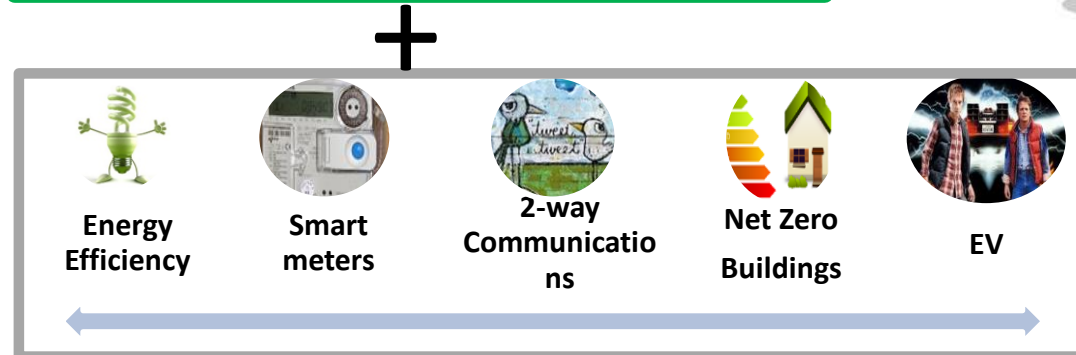
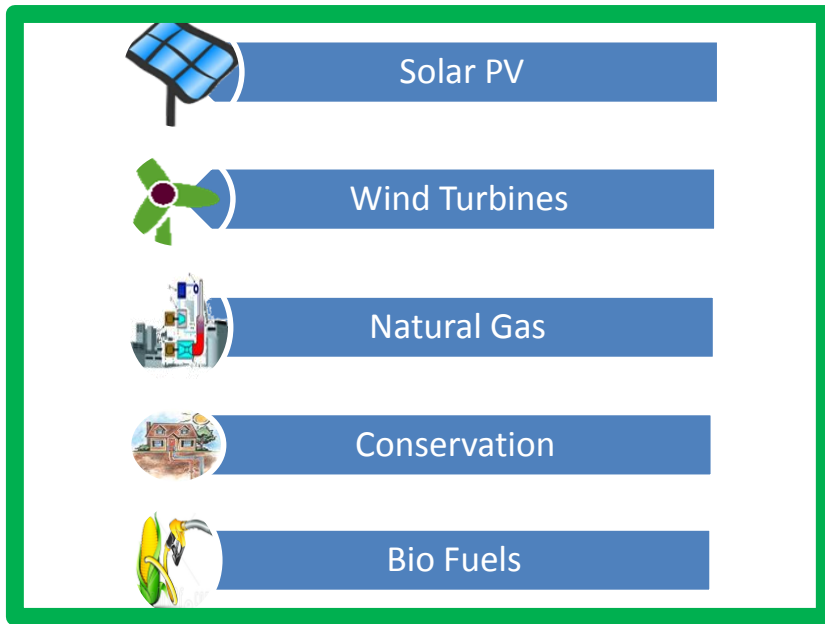
# TRADITIONAL GRID



# IMMINENT GRID



# SMART GRID





# DIFFERENCES

CHARACTERISTICS	TRADITIONAL GRID	IMMINENT GRID
<b>Technology</b>	Electromechanical, dumb, limited communications between devices	Digital, smart, communications between devices, remote control, self regulation
<b>Distribution</b>	One-Way	Two-Way, can put energy back onto the transmission grid
<b>Generation</b>	Centralized	Distributed on all voltage levels
<b>Sensors</b>	Few Sensors	Sensors throughout T & D
<b>Monitoring</b>	Manual	Self monitoring without direct need for intervention
<b>Restoration</b>	Manual	Self-Healing
<b>Equipment</b>	Failure & Blackout	Adaptive & Islanding
<b>Control</b>	Limited	Pervasive, complex operations
<b>Customer Choices</b>	Fewer	Many

# MICROGRIDS

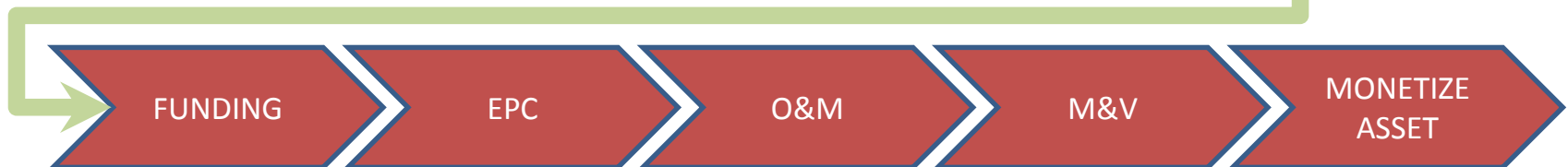
## SECURE MICROGRID® DEVELOPMENT PROCESS US PATENT #9,026,260



### PROJECT DEVELOPMENT



### TECHNOLOGY PROVIDERS



### PROJECT DELIVERY

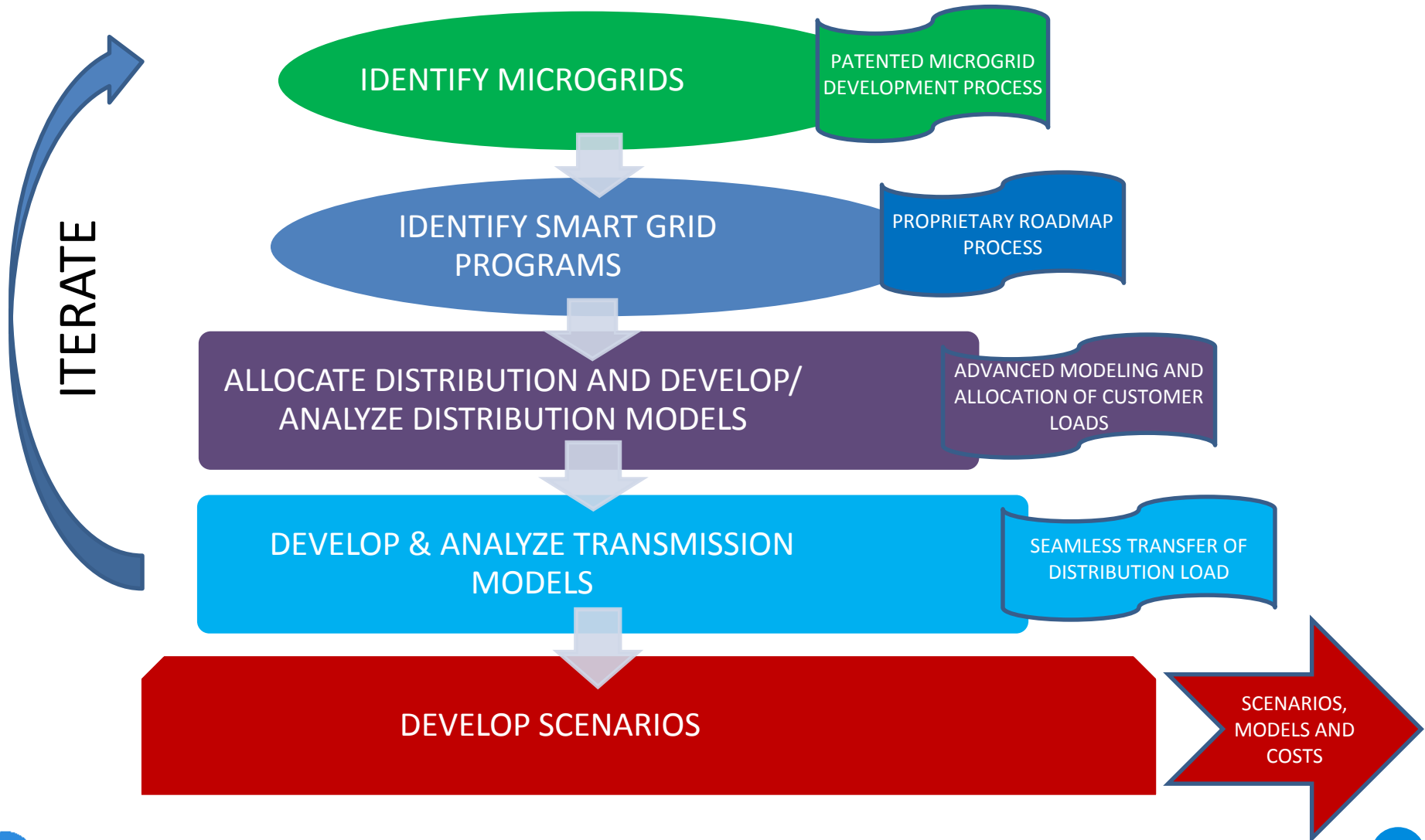
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KEN DONOHOO ESIG DENVER 10/03/2018



# PLANNING PROCESS





# BASIC CONCEPTS

- Power suppliers and consumers are responding to the rapidly changing environment and market
- Big changes fueled by IoT, smart grid, block chain and data analytics
- Delivering energy in multiple directions
- T&D system planning and operations must change and adapt to the dynamics to the market and allow full technology integration
- Software developers, planners, operators and designers must recognize the need to update technologies and models that are driving the grid now
- Number of reasonable variations in our planning and operations is growing exponentially
- Configured to provide enhanced grid resiliency for extreme events including secure microgrids
- **Decisions about T&D networks made today will affect how power is supplied for decades**





# CONCLUSIONS

- Maintain and enhance the safety, security, reliability, and resiliency of the electric grid, at fair and reasonable costs, consistent with customer goals
- Facilitate comprehensive, **coordinated**, transparent, and integrated grid planning across distribution, transmission and resources
- Ensure optimized utilization of resources and electricity grid assets to minimize total system costs for the benefit of all customers
  
- **Much more complex combined power system**
- **Can no longer operate and plan independently**
- **We must transform now to reflect modern power systems**
  
- **We must become a champion for creating projects and programs that deploy advanced analytics, communications and controls**
- **Our challenge is to define practical implementable steps**
- **The longer we wait the harder it gets**

# DISCUSSION



<https://www.epeconsulting.com/>



<https://www.treia.org/gridnext/>

