



Smart Grid Benefit Opportunities & Issues

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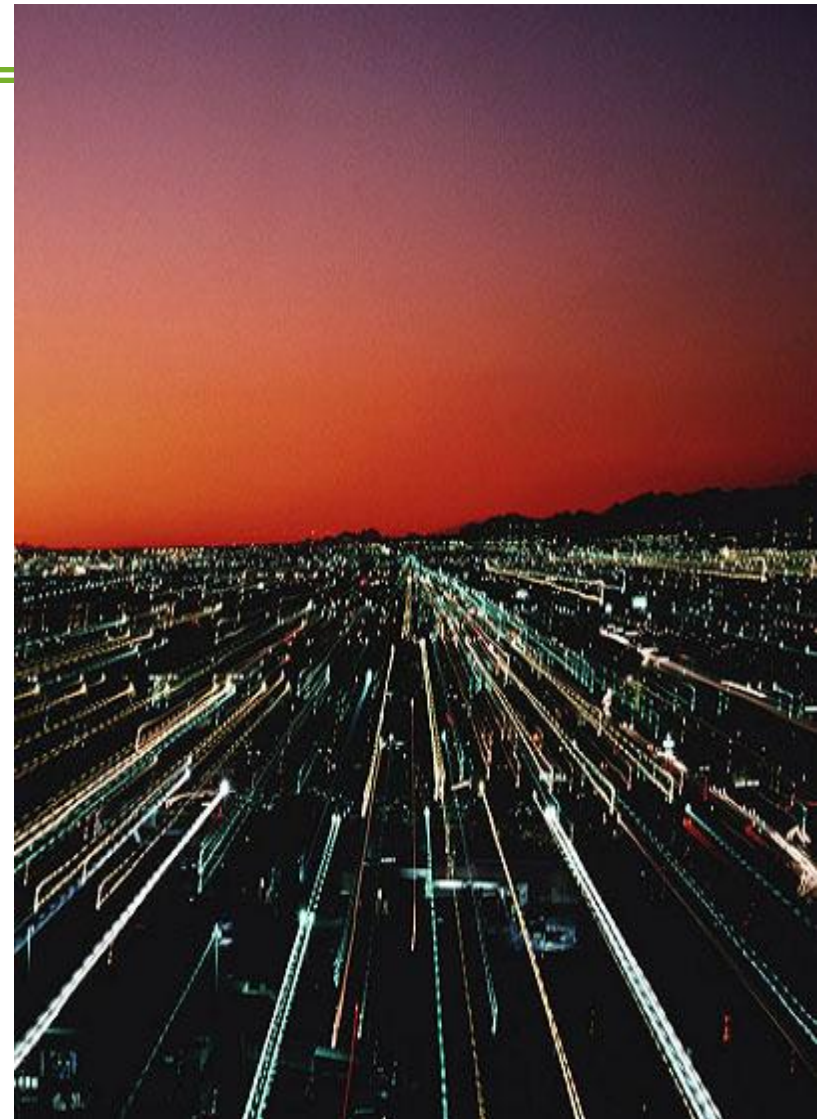
Forward to Fundamentals

Electricity is the engine of prosperity and quality of life

Electricity is a consumer service- based enterprise

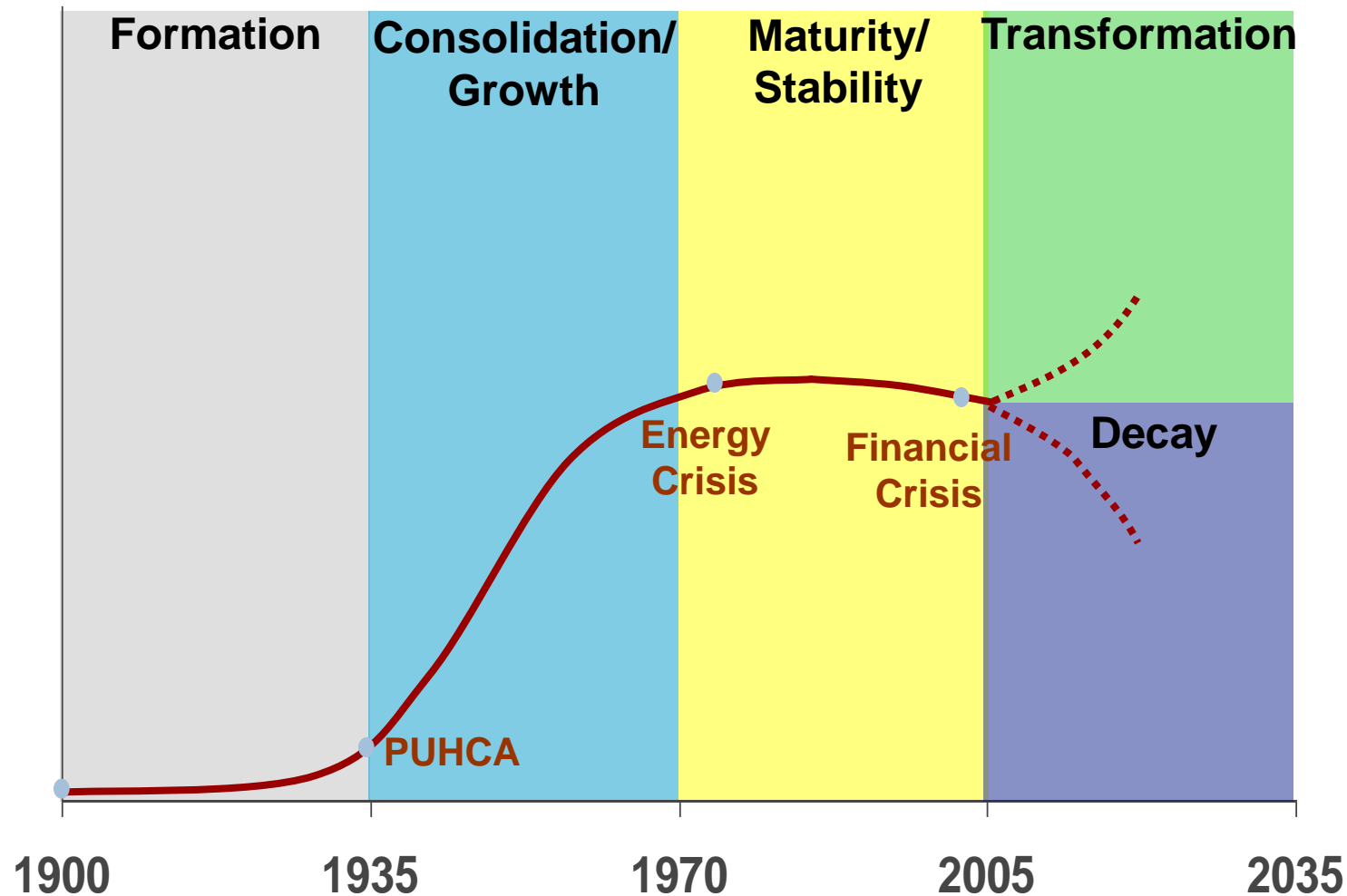
Technology can relieve cost pressures through elevation of electricity service value

Realizing these opportunities requires transformation of the electricity infrastructure



Electricity Sector Life-Cycle

A Fork in the Road



Transforming the Electricity Grid for the 21st Century

Electronically monitor & control the power system

Integrate electricity & communications

Transform meter into a two-way consumer services gateway

Incorporate Renewable & Distributed Resources

Reintroduce Direct Current (DC) Circuits/Microgrids

Enable smart, efficient end uses



“If I asked people what they wanted, they said faster horses”

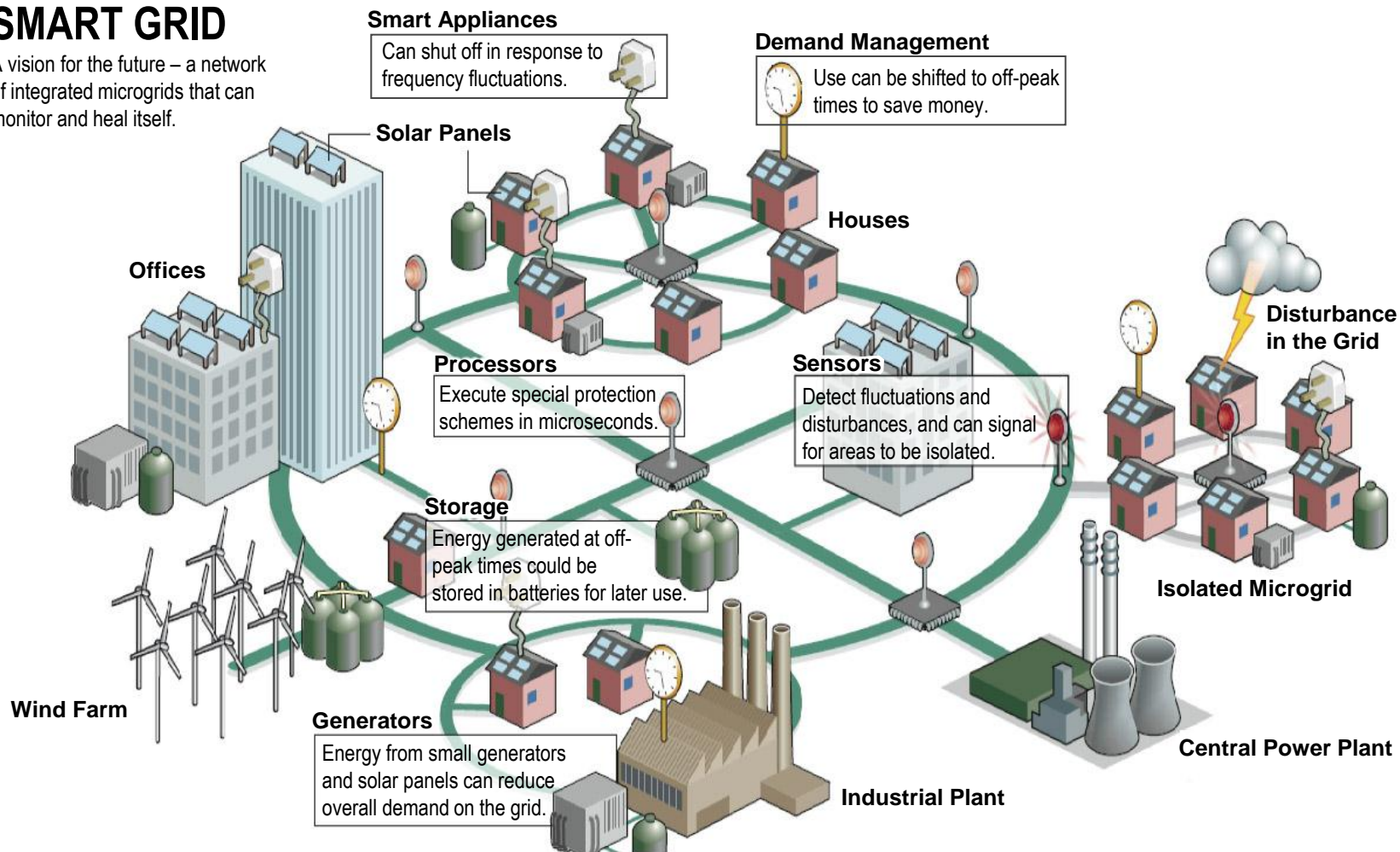
Henry Ford

Enable the Future

Integrate microgrids, diverse generation and storage resources into a smart self-healing grid system

SMART GRID

A vision for the future – a network of integrated microgrids that can monitor and heal itself.



How can the Smart Grid Improve Competitiveness and Create Jobs?

- **Enable municipalities and utilities to increase service reliability**
 - Improve safety and reduced economic losses
 - Eliminate hidden reliability costs and attract 21st Century jobs
- **Enable residents to manage costs**
 - Avoid higher priced peak electricity
 - Protect residents from rising fuel and new capacity costs
 - Leverage off-peak electricity through dynamic pricing
 - Generate revenue by providing ancillary services to the system operator
- **Enable municipalities and utilities to improve the environment**
 - Provide residents access to lower carbon generation sources
 - Enable municipalities to improve competitive value, esthetics and increase the overall value of real estate

Unlocking Smart Grid Benefits Requires

- **Intelligent Technology**
- **Intelligent Policy**
- **Empowered Consumers**

INTELLIGENCE = the ability to understand and deal successfully with new situations

Constraints to Transformation

- **Lack of Consumer Knowledge**
- **Obsolete Cost/Benefit Accounting rules**
- **Dysfunctional Building Design & Construction Processes**
- **Utility and Regulatory Resistance**
- **New Entrant Barriers – Discriminatory Rules & Tariffs**

CONCLUSION – These constraints will be overcome by cost and quality pressures.

SMART GRID POLICY IMPLICATIONS

- **A Smart Grid is a *transactive* network, seamlessly connecting producers and consumers**
- **Price-responsive end-use devices enable autonomous consumer control: *empowerment***
- **A Smart Grid requires looking beyond the regulated monopoly business model**
 - **Remove barriers to competitive retail services**
 - **Remove barriers to non-utility technology investments**

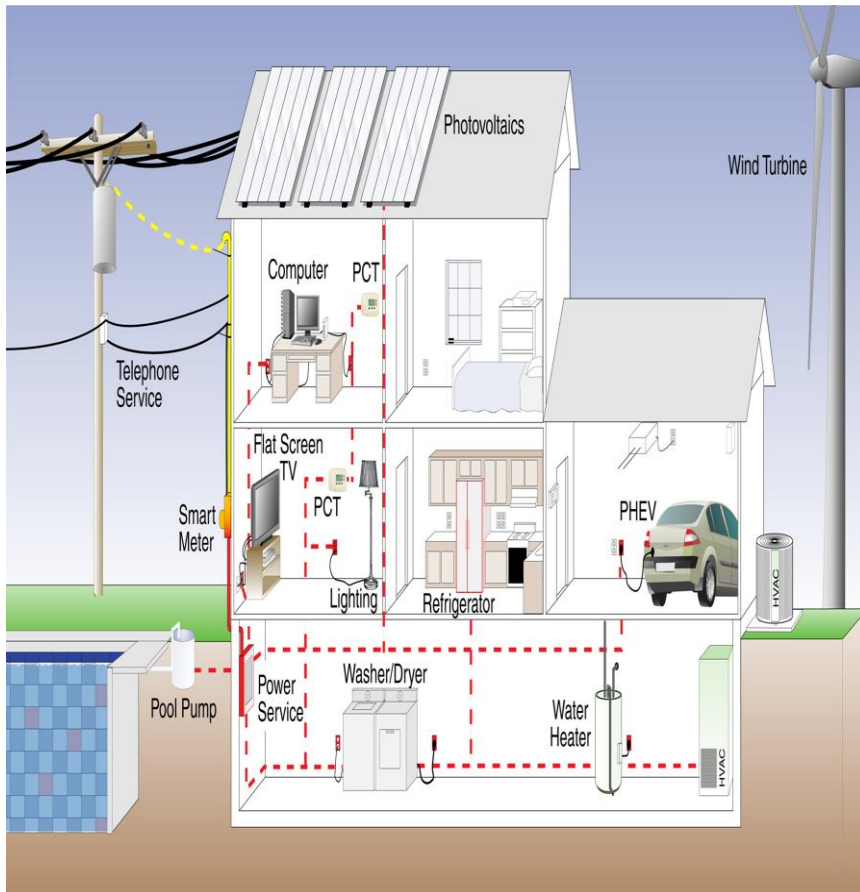
The result significantly increases both consumer and producer benefits

Business Model Implications

A Smart Grid changes the utility business model from selling bulk dumb energy to clean, efficient, reliable services.

New Technology Opportunities Abound

Set it, and forget it homes



Hyper-Efficient Technologies

 Heat Pumps	 Ductless Cooling	 Appliances
	Residential	
	Commercial	
 VFC Cooling	 VFC Cooling	 Data Centers

U.S. Consumer Awareness

- **Aware of how much power they use** **57%**
- **Would Cut power use if they could track it** **67%**
- **Want to see and control their power use** **75%**
- **Heard of the “Smart Grid”** **33%**

Harris Poll – February 26, 2010

Office of Science & Technology Policy For Consumer Interface with the Smart Grid: Summary of Views

Smart meter should be one, but not the only gateway between the home network and the smart grid

Communications standards are needed but must allow flexibility and customer choice

Consumers should have right to access real time meter data

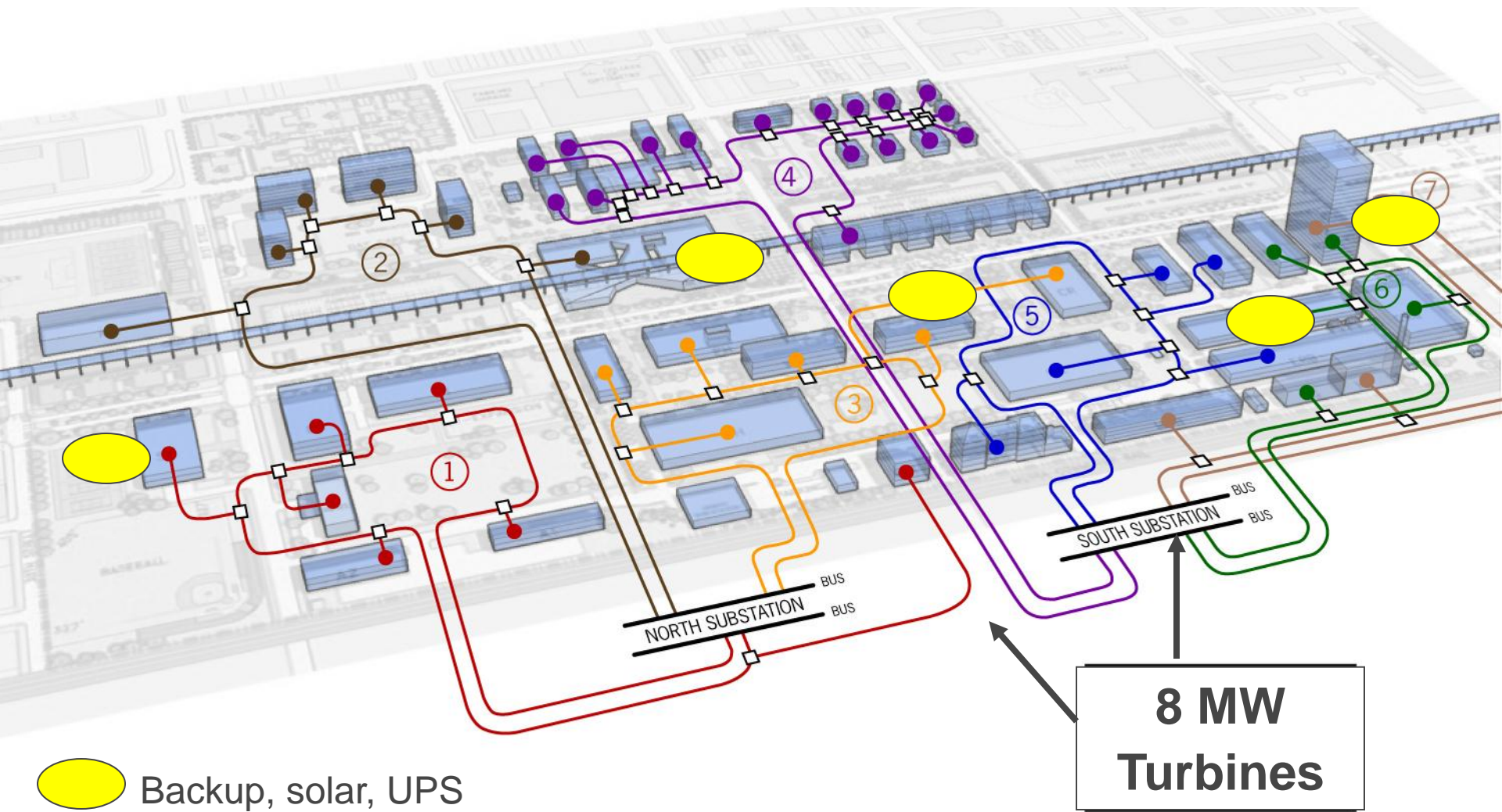
Consumers should have choice among competitive offerings for energy management services

Data privacy and integrity must be ensured

The Role of the Microgrid

- **Optimize distribution performance and service value**
- **Seamlessly integrate electricity supply and demand**
- **Convert buildings from Power Pigs to Power Plants**
- **Provide the most user-friendly consumer empowerment**
- **Open the door to entrepreneurial innovation**
- **Enable local green enterprise zones**

IIT Perfect Power Microgrid



Meet Sad Socket



You'd be sad, too, if you had to power digital-age businesses on 1950s technology

Principles of a New Electricity Constitution

- **Provide all Consumers with Time-of-Use Electricity Rates & Incentives**
- **Require Fundamentally Higher Distribution Reliability Standards**
- **Compensate Utilities Based on their Reliability, Efficiency and Customer Service Quality**
- **Eliminate Regulated Monopoly Restrictions On Intelligent Microgrids and Distributed Generation**
- **Establish Truly Competitive Retail Electricity Service Markets**

HOW THE MICRO GRID REVOLUTION WILL UNLEASH CLEANER,
GREENER AND MORE ABUNDANT ENERGY

PERFECT POWER

TOP COMPANIES
& TECHNOLOGIES
TO WATCH

**ROBERT GALVIN
AND KURT YEAGER**
WITH JAY STULLER