



Community-Led *Microgrids*

***Key to Urban Sustainability &
Personal Energy Management***

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Forward to Fundamentals

Electricity is the engine of prosperity and quality of life

Electricity is a consumer service-based enterprise

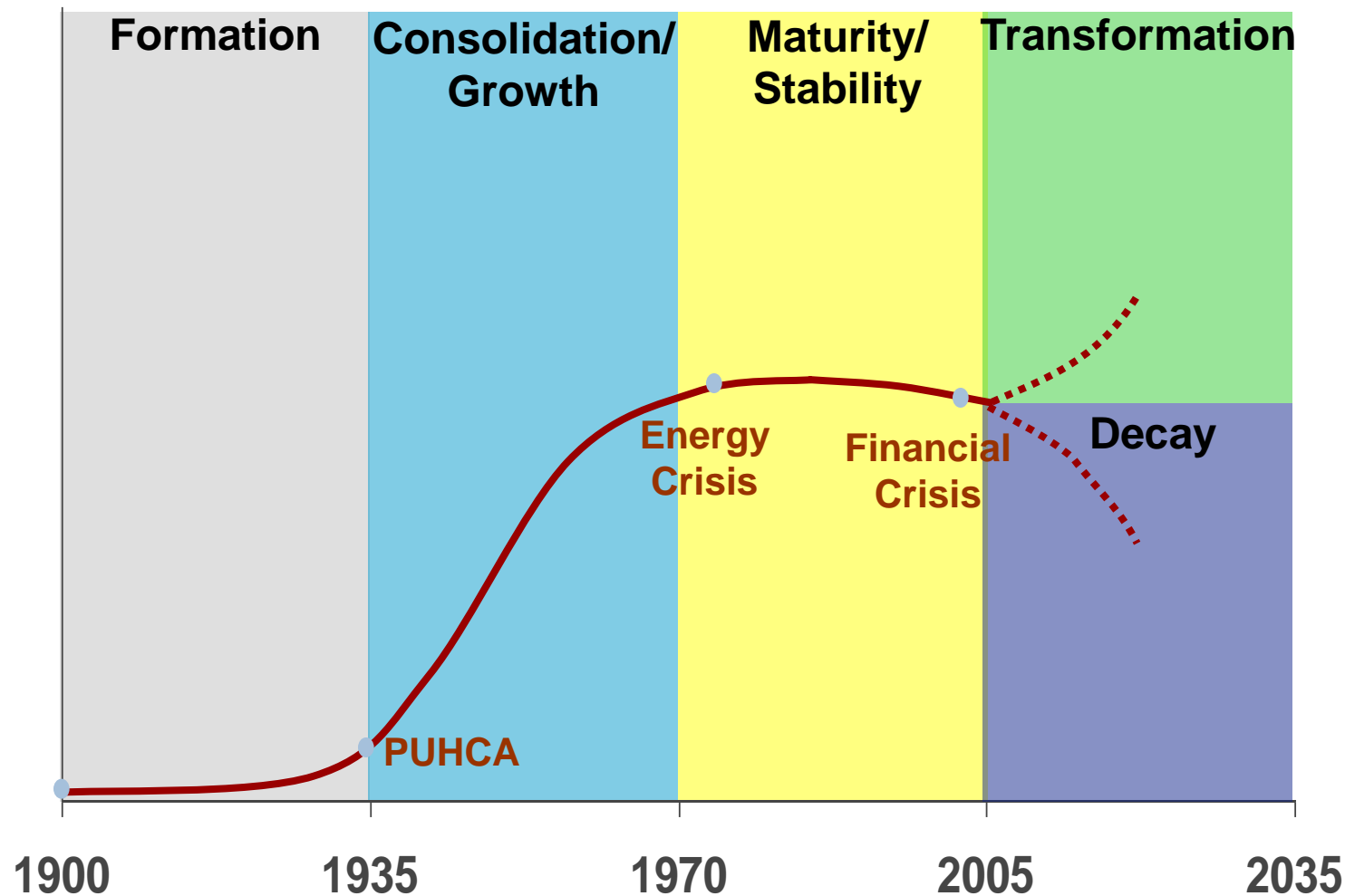
Technology can relieve cost pressures through elevation of electricity service value

Realizing these opportunities requires transformation of the electricity infrastructure & business model



Electricity Sector Life-Cycle

A Fork in the Road



Meet Sad Socket



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

Where to start?

Bob Galvin's recipe for renewal

A continuous quest for new ideas

Rapid prototyping

Pursuit of perfection using quality methods and tools

Policy reforms that enable and attract innovation and investment

“The Idea of Ideas,” written by Bob Galvin, 1991

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

Henry Ford

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

Enable smart, efficient end uses

Reintroduce Direct Current (DC) Circuits/Microgrids

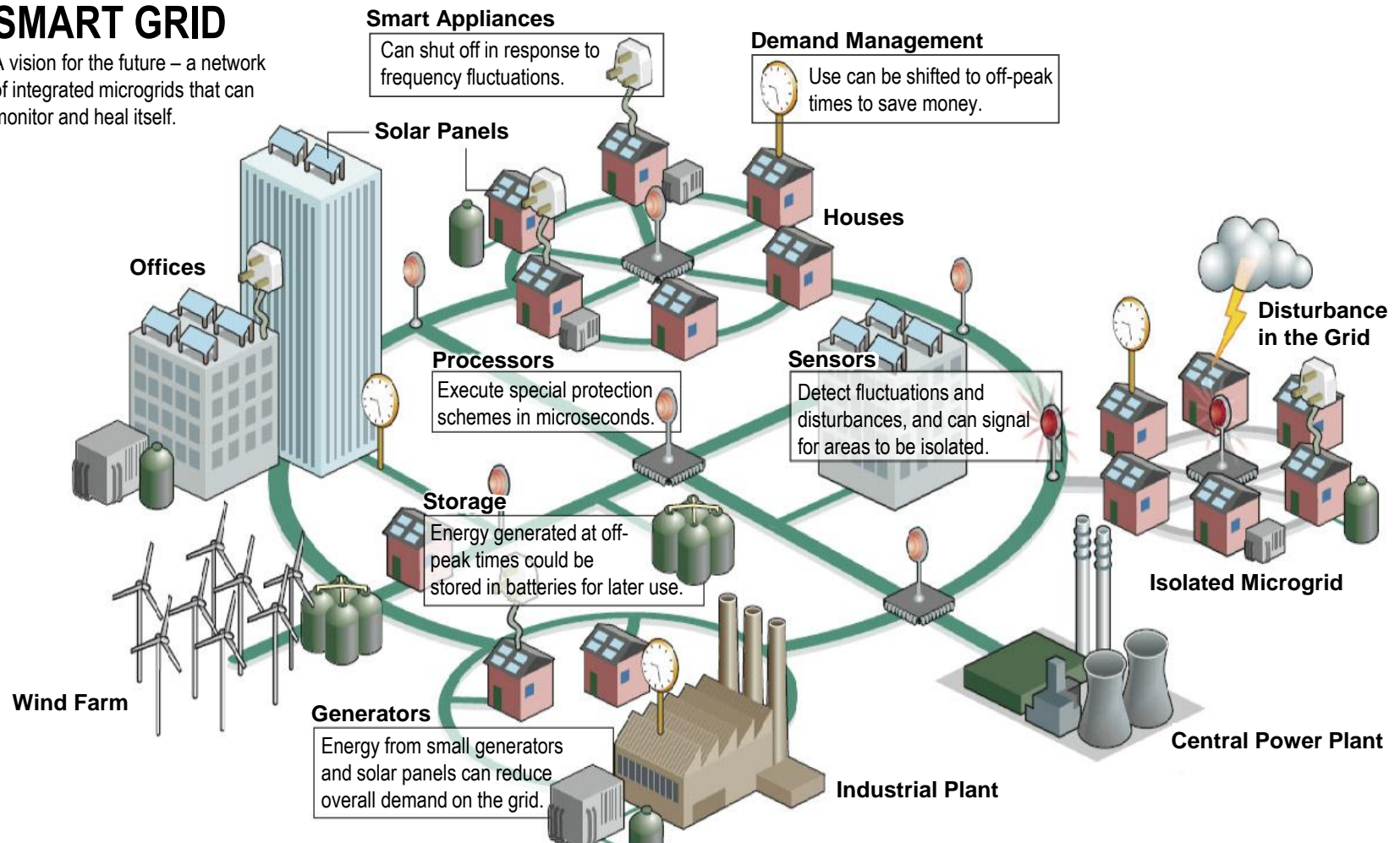


Enable the Future

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.



Source: Interview with Massoud Amin, "Upgrading the grid," *Nature*, vol. 454, pp. 570-573, 30 July 2008

Benefits of Grid Modernization (per household)

Annual Savings \approx \$1,000

- **Reduced Consumption**
- **Dynamic Pricing Access**
- **Avoided Capacity Costs**
- **Improved Reliability**
- **Job Creation / Income Growth**

Annual Costs \approx \$300

- **Infrastructure Investment**
- **Consumer Investment**

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**

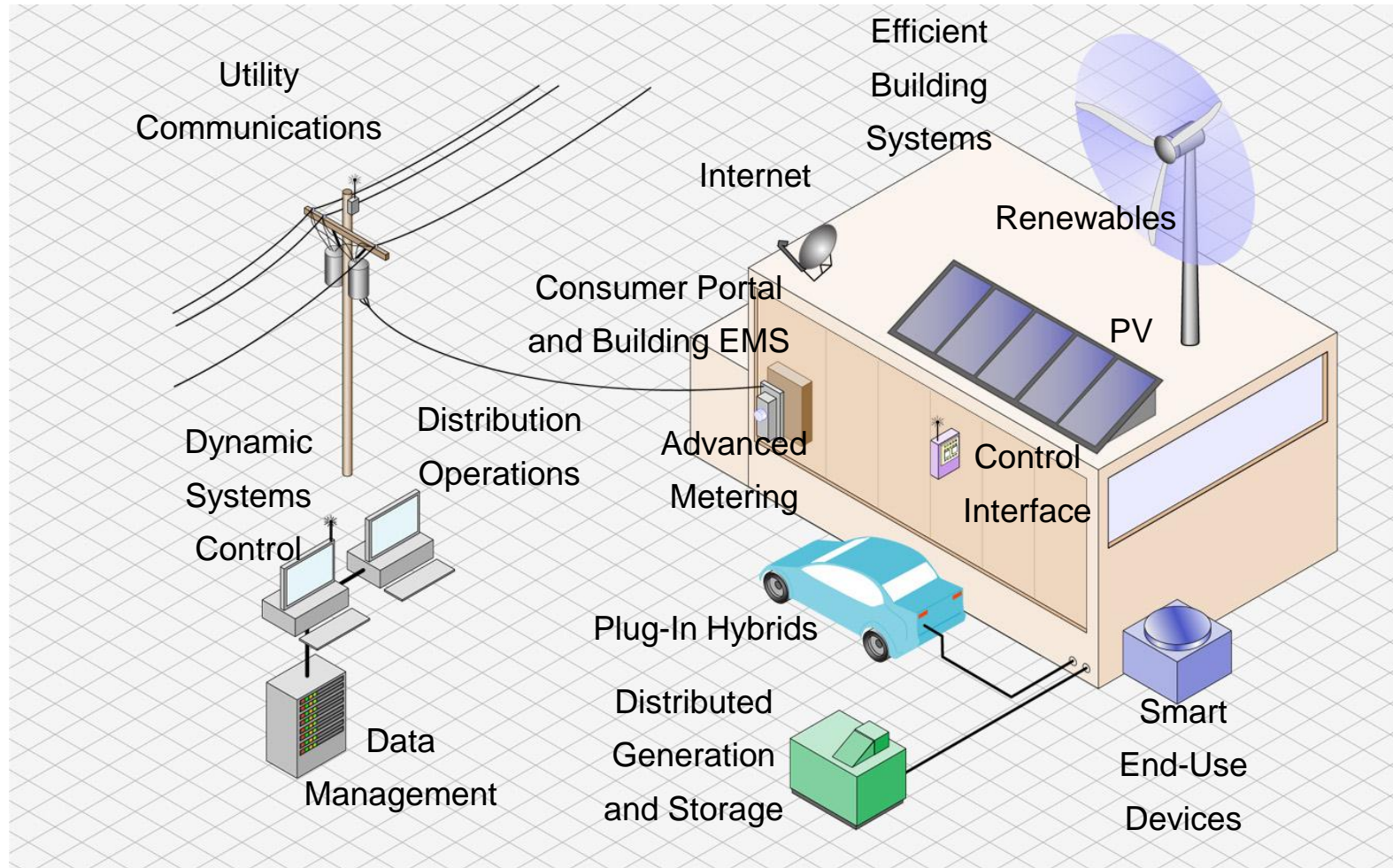
The result significantly increases both consumer and producer benefits

Lessons Learned

Dot.Com Boom & Bust

- **Overestimated the pace of demand for Internet-based services**
- **Assumed that Internet would crush existing telecom business models**
- **Security concerns and state controls recentralized parts of the Internet**
- **Other lessons?**

The Micro Grid & Its Role in Helping Meet These Challenges



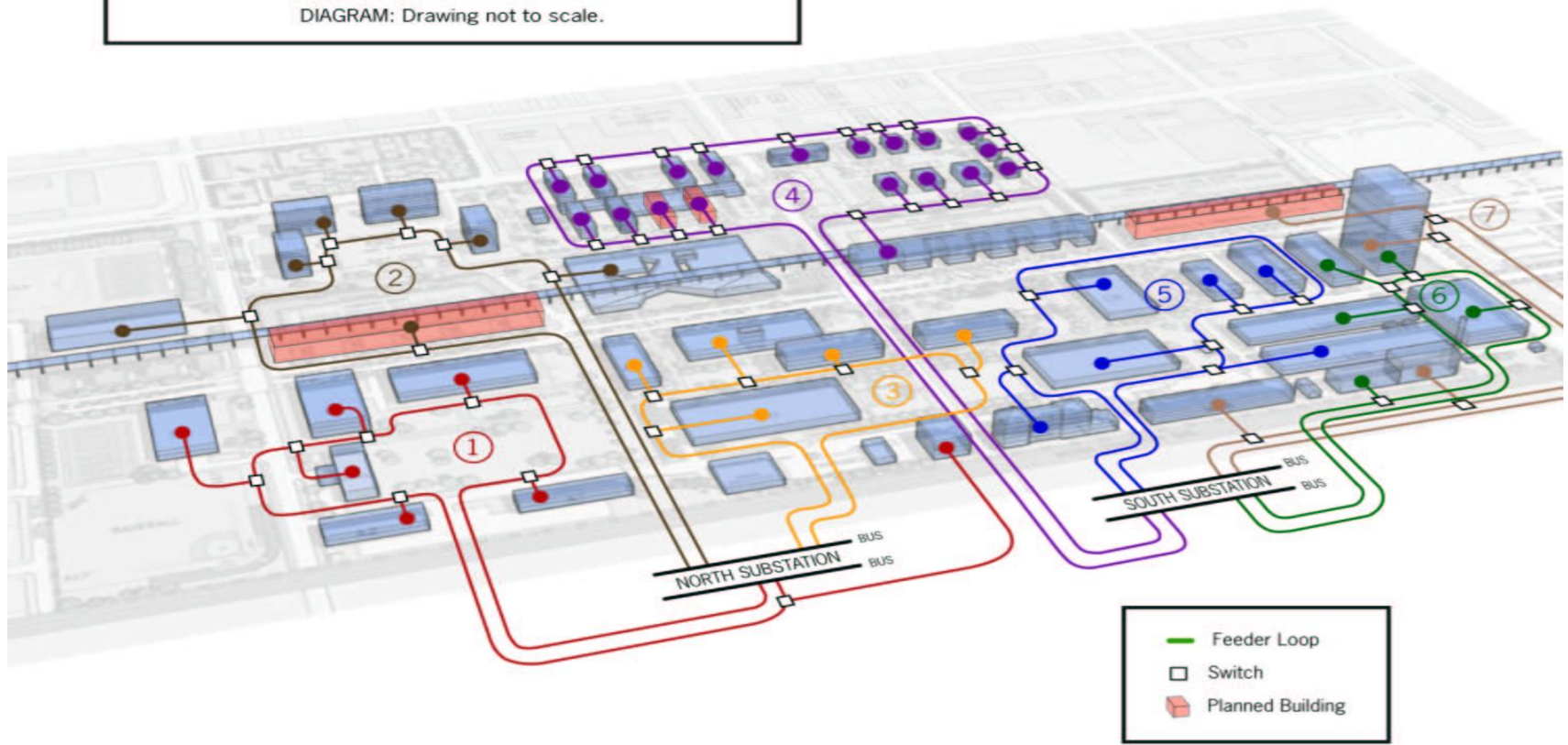
The Role of the Microgrid

- **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 with Perfect Power

High Reliability Distribution System:

DIAGRAM: Drawing not to scale.



Perfect Power Seal of Approval

LEED Model

Performance Categories

- **Safety, Security & Reliability**
- **Cost and Transparency**
- **Consumer Empowerment**
- **Green Grid Rating**

Intelligent Policy Recommendations

- **Provide consumers with choice of access to transparent real-time electricity pricing.**
- **All customer-specific data belongs to the customer**
- **Establish strict distribution reliability and efficiency standards.**
- **Hold utilities publically accountable to specific system performance standards.**
- **Link utility earnings to service quality not quantity sales – performance-based rates.**

Intelligent Policy Recommendations

- **Expand net metering to include physical and virtual aggregation.**
- **Enable retail energy management service competition to incent entrepreneurial and utility innovation.**
- **Enable early adapters to easily demonstrate the benefits beyond doubt.**
- **Require absolute interoperability of smart grid components.**

Principles of a New Electricity Constitution

- **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**
- **Provide all Consumers with Time-of-Use Electricity Rates & Incentives**

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