Rapid Prototyping Reveals

The Key to Unlocking Electricity Investment, Innovation, and Improvements

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GALVIN ELECTRICITY INITIATIVE

Sponsored by The Galvin Project, Inc.

Galvin Initiative Background

- Started by former Motorola Chairman Robert Galvin in response to electricity system failures and waste
  - Seeking to create jobs by attracting investment that transforms today's grid to meet consumers needs
- The initiative's goal is to develop, demonstrate and open source an improved design for the delivery of electric power, a design that:
  - will not fail the consumer, or "Perfect Power"
  - is based on smart microgrid, or community focus
  - is a journey of continuous improvement

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Galvin Initiative Motivation

- The economic vitality of our Nation's communities and utilities depends upon improving electricity service
  - Drive out waste to reduce costs
  - More reliable
  - More efficient
  - Less polluting, emphasis on carbon
  - More competitive
- Improvements paid for by attracting investment into innovation that eliminates waste

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Investment Paid for by Eliminating Waste

Waste Type	Wasted $, Billions	Wasted, ¢/kWh
Wasted Fuel	~ $50	~ 1.0
Market Inefficiency	~ $80	~ 2.0
Outages/Repair	~ $100	~ 2.5
Wasted Capital	~ $40	~ 1.0
Emissions Cost	~ $65	~ 1.5
Water Cost	~ $10	~ 0.2
Total Waste	~$260	~ *8.0

Galvin Initiative Strategies

- Provide new thinking and knowledge through research on **innovative policies and programs**
  - Empower consumers/communities
  - Unleash innovation and investment - jobs
  - Strengthen utilities
- Work with stakeholders to **develop innovative perfect power prototypes** or models
  - Rapid prototyping to test designs, technologies, and policies
    - Illinois Institute of Technology
    - New Mexico Mesa del Sol Development
  - Long term energy plans that result in continuous improvement

Why Change Anything?

- Today almost everything we operate depends on electricity
  - Furnace won't start without it
- Critical to life safety
  - Health care, heating, cooling, water
  - 50% of NY hospitals lost power during 2003 blackout
  - Long outages deplete backup fuel
- Outage and power quality induced economic losses increasing
- Consumers and businesses are demanding improved conservation and environmental performance (LEED, Energy Star, etc…)

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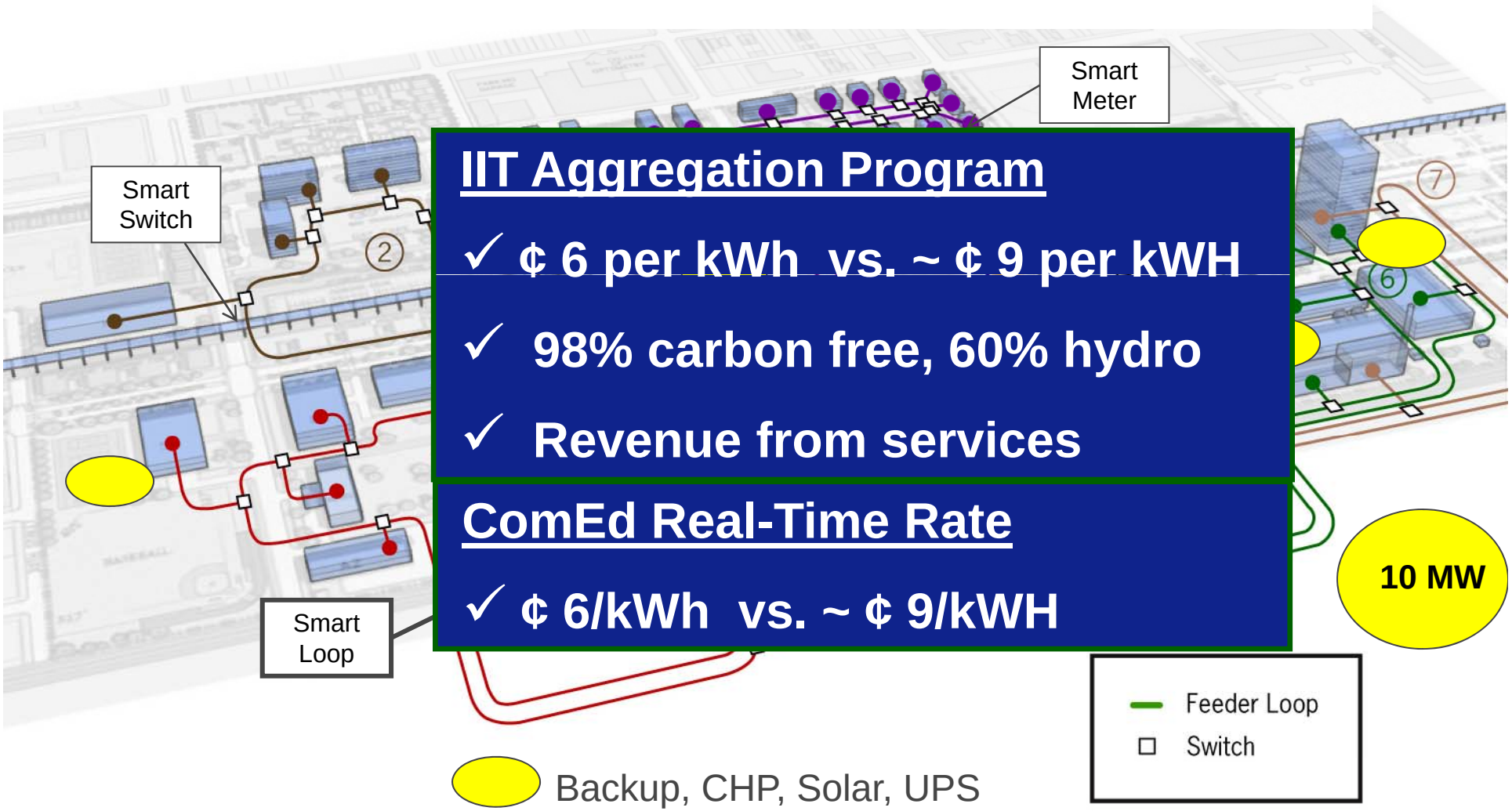
IIT Perfect Power Prototype



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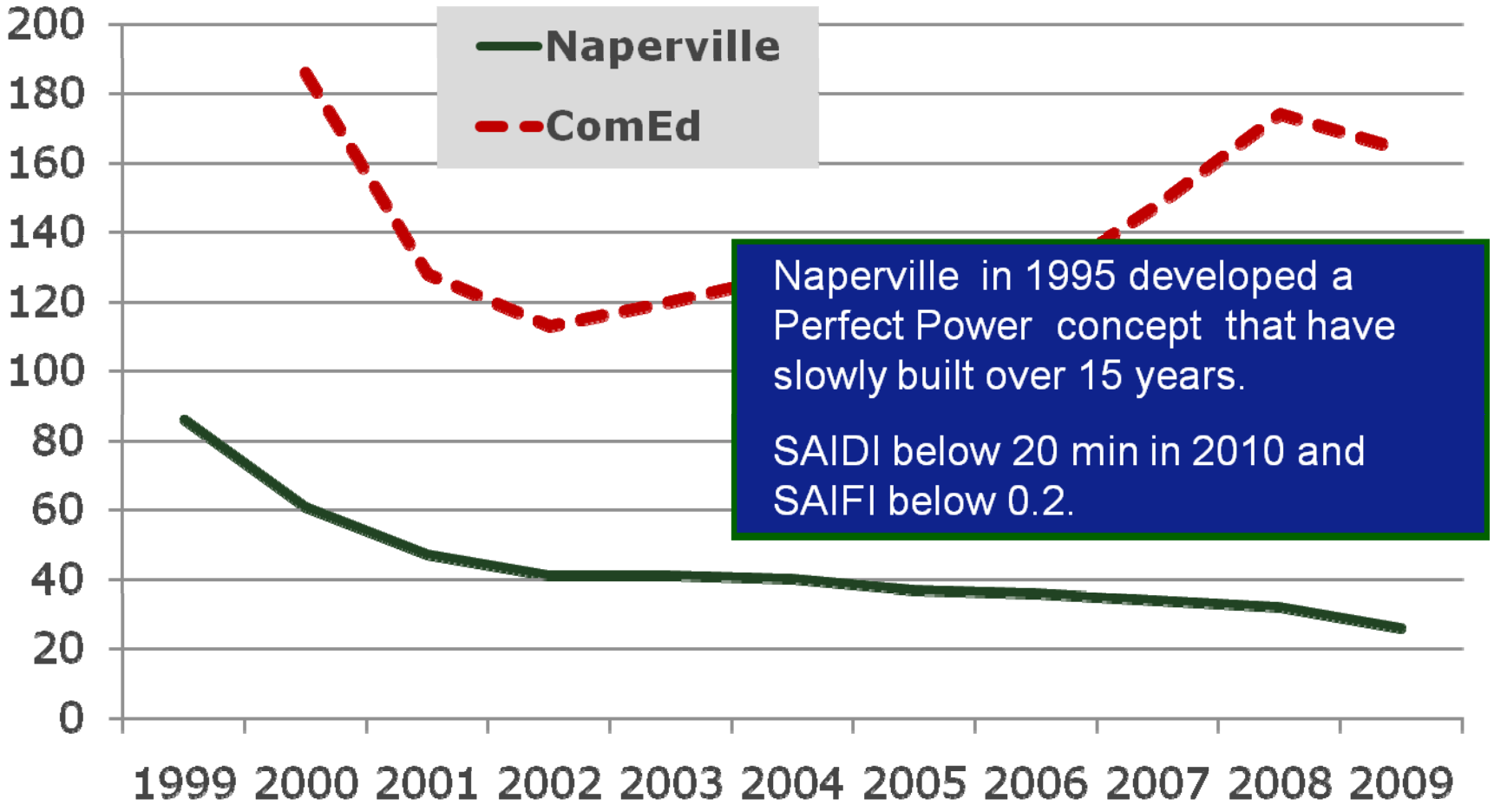
Naperville Perfect Power Project

Average interruption duration (min) per customer per year



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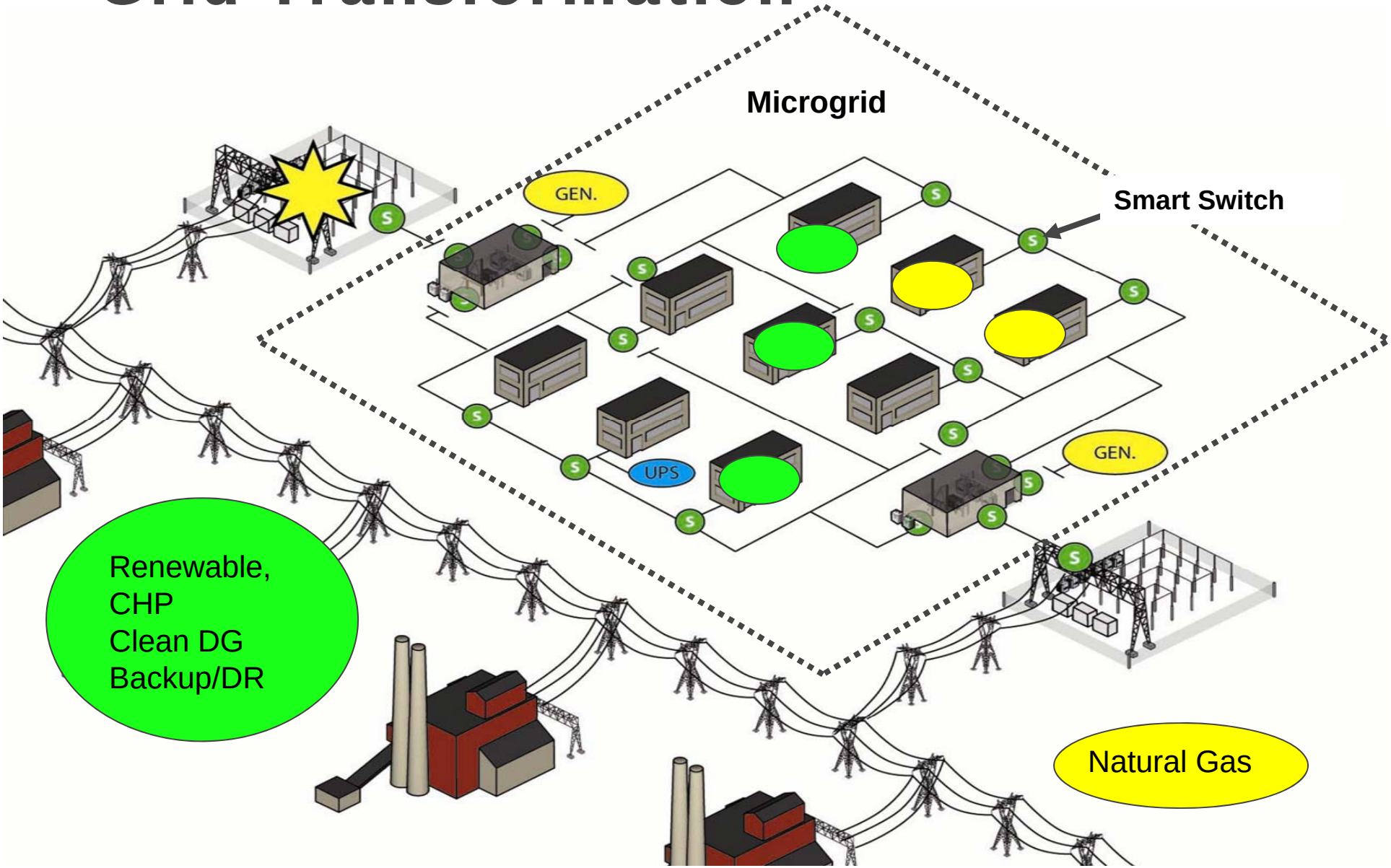
Rapid Prototyping Grid Transformation



What will Perfect Power Do?

- **Improve reliability by 70% or more**
  - Self healing distribution
  - Redundant distribution
  - On-site generation, UPS, and back-up power
  - Protected distribution (enclosed, underground)
- **Lower Cost**
  - Empower consumers with pricing, automation, and meters
  - Value consumer ancillary services
  - Eliminate waste and become more efficient
- **Improve conservation by 50% and lower carbon by 60%**
  - Attract investment in cleaner generation and efficiency
- **Attract investment and innovation**

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Policy Reform is Needed to Engage Innovators and Attract Private Investment

- Clean generation: wind, biomass, geothermal and waste heat recovery
- Intelligent home automation and metering
- Intelligent building automation and controls
- Advanced lighting
- Advanced on-site electricity production
- Solar thermal and PV
- Intelligent systems and controllers that integrate loads and generation to operate seamlessly based on pricing and ancillary service payements

Policy Reform Best Practices

Empower Consumers with the tools and ability to act

- Freedom to choose suppliers
- Long-term financing
- Aggregation: community and virtual
- Real-time usage data

Strengthen Utilities by setting targets and performance metrics

- Metrics, targets and reporting by community
- Establish smart grid requirements
- Retain a portion of the distribution rates locally
- Allow local government investment
- Prototype smart grids at community scale

Value Consumer Participation with economic savings

- Access to wide range of dynamic pricing
- Payments for anciliary services
- Day ahead price market
- Net metering at retail rates

Eliminate Barriers to investment and innovation

- Allow physical aggregation of meters
- Streamline and encourage interconnect
- Energy Districts - private wires
- Allow consumers to choose advanced meter and post meter technology
- Eliminate subsideies for new development

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Attracting Investment in Generation, 1996 to 2008

	Total 1996	Added, GW	Invest, $ billion	Unused Capacity
Natural Gas Simple	160	87	175	**75%**
High Eff Gas, CCCT	15	141	420	
Coal	313	7*	30	**25%**
Nuclear	101	-1	0	8%
Hydro	78	-1	0	NA
Other Renewable	10	24	**60**	NA
Total Generation	~680	~250	**~680**	
% Change		**37%**		

Unused capacity of 3 billion MWh vs. total U.S consumption of about 4 billion MWh

Source – EIA Annual Energy Outlook 1999 and 2010

* NETL Report, http://www.netl.doe.gov/coal/refshelf/ncp.pdf

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Attracting Investment in Clean Generaiton
Non-Hydro Renewable Generation (GWh)
2003 - 2009

Top 10 States		
Total	57,000	%
Texas	**16,754**	29%
Iowa	6,502	11%
Minnesota	4,495	8%
California	3,410	6%
Washington	3,112	5%
Oregon	3,003	5%
Colorado	2,820	5%
North Dakota	2,758	5%
Illinois	2,709	5%
Oklahoma	**2,149**	**4%**

Total renewable generation U.S. = 330,000

Other Southern States	
Total	**-1,850**
West Virginia	594
South Carolina	527
Missouri	422
Tennessee	127
North Carolina	62
Kentucky	30
Georgia	8
Virginia	-111
Maryland	-287
Arkansas	-308
Louisiana	-495
Mississippi	-664
Alabama	-825
Florida	-938

Source – EIA, http://www.eia.doe.gov/cneaf/electricity/epm/epm_ex_bkis.html

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Engage Leverage Local Governments

- Local governments effectively manage all infrastructure except electricity and gas
- Local governments deal with outages
- Inefficiencies result from:
  - Lack of coordination with local infrastructure projects
  - Lack of local improvement plans
- Utilities are not held accountable to local governments for specific performance outcomes and metrics

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Policy Opportunities

- Form or expand the role of state or regional power authorities to pursue power in competitive markets using PPA's
  - Shift risk from consumers to markets
  - Unleash innovation
- Hold utilities accountable to local governments
  - Require that performance metrics be reported to
  - Retain a portion of collected rates locally
  - Allow local governments to use rates to develop local improvement plans
- Consider performance based rate making
  - Develop robust set of performance metrics/outcomes
  - Tie utility earning to improved performance

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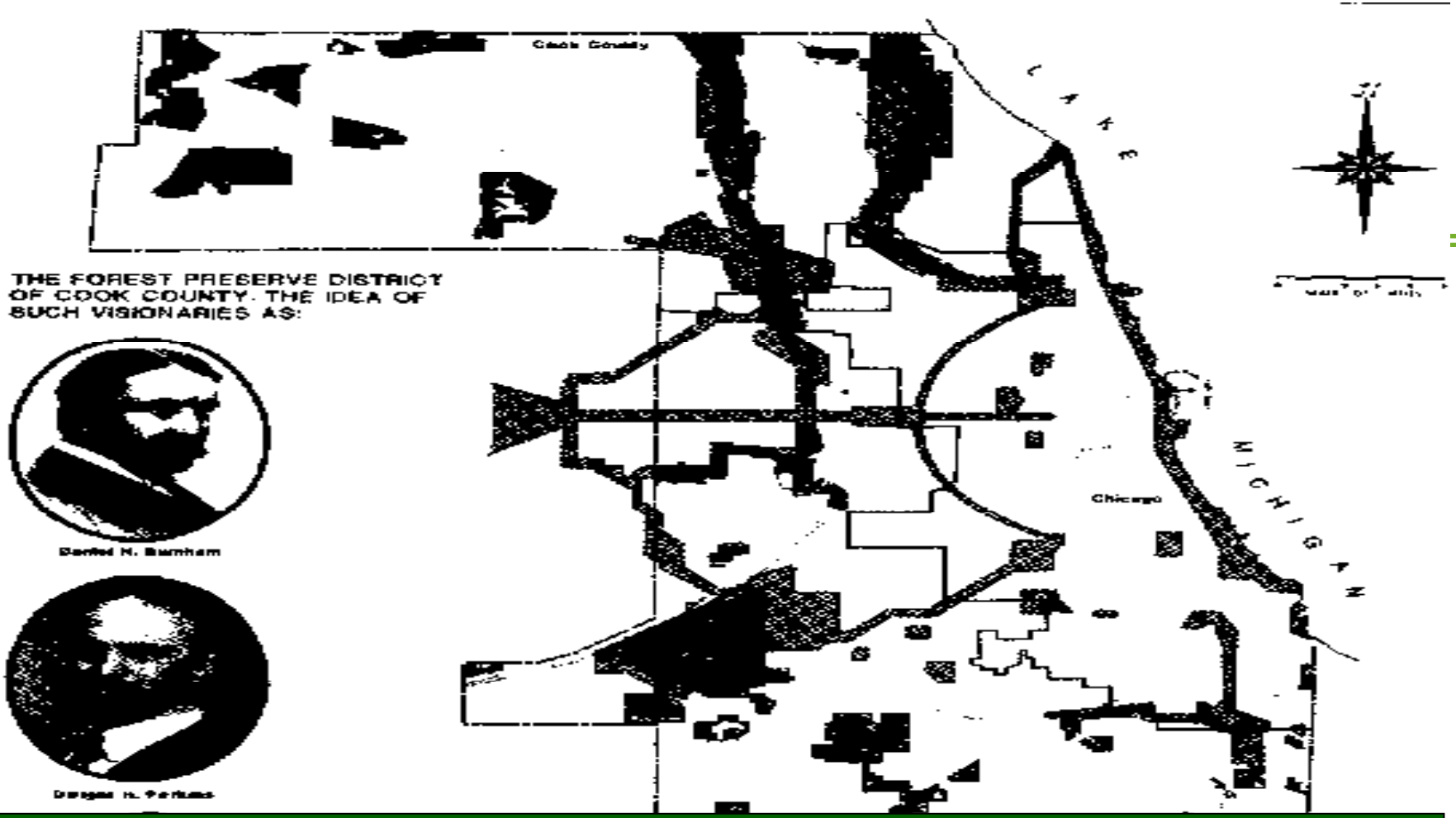
Principles of Change

- A group of leaders must step outside the crowd and advocate what is right
- The proposed change must be accompanied by a candid acknowledgment of the deficiencies of the existing structure or governance
- Change must come from noble purposes
- The application of “enlightened thinking – the way of thinking that is free, open, objective, rational, and tolerant versus a thinking that is self centered and unduly traditional.”
- “Resistance to existing restrictive ways is a natural right, is in order, and is essential.”
- The constructive roles of commerce and property must be embraced.”



Daniel Burnham famously declared that leaders should “Make big plans; aim high in hope and work, remembering that a noble, logical diagram once recorded will not die.” Perfect Power prototypes provide a “noble, logical diagram” for each city, major development, or county.

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