



Building the Next-Generation Electrical Grid

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About Beacon Power

- **Established in 1997 (Nasdaq: BCON)**
- **Valuable technology for a smarter, more reliable electricity grid**
- **Focus on sustainable energy solutions**
- **Proven technology**
- **Vision: “Products and Services for the next generation electrical grid”**



Performance Under Extremes

- **Wide temperature ranges**
- **American desert**
- **Canadian winter**
- **Zone 4 Earthquake test**
- **Frozen marshland**
- **Under water!**



Flywheel Development Leadership

2kWh



**Self-contained
Vacuum**

**Composite
Flywheel**

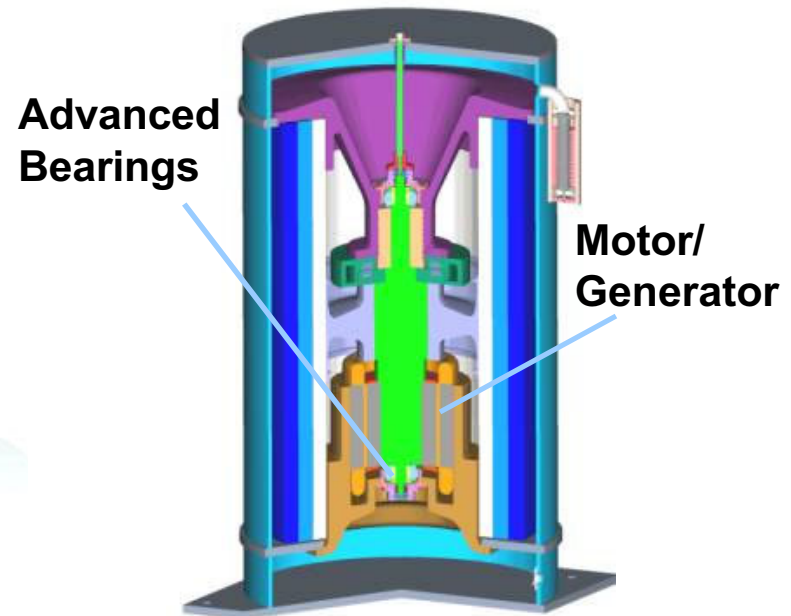
**Remote
Monitoring**

6kWh



**Clean
Technology**

25kWh



**Advanced
Bearings**

**Motor/
Generator**

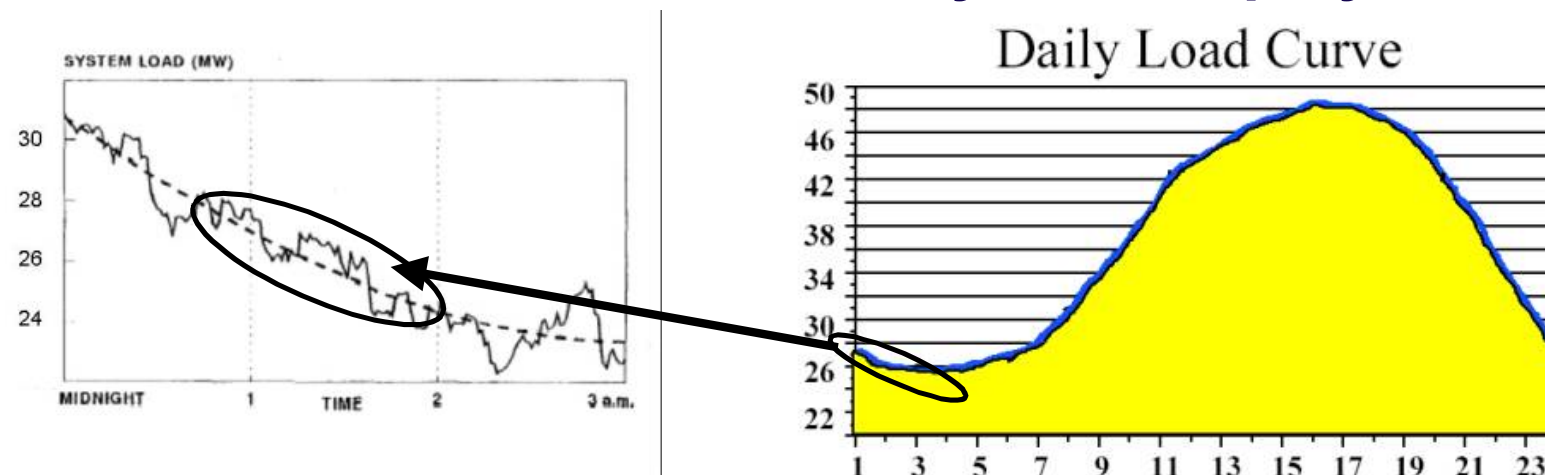
**20-year
design life**

Today's Electricity Grid

- **The greatest technological achievement of the last century, but...**
- **Decades of under-investment**
- **Reliability an issue; legislation expected**
- **New ideas will be needed**
- **Beacon is pursuing a significant opportunity in frequency regulation**
- **Product can serve other needs**

What is Frequency Regulation?

- **Critical Ancillary Service**
 - Maintains balance of generation and load
 - Currently performed by generators
 - Market and Pricing well documented
 - Sold on Day Ahead and Hour Ahead markets
 - Approximately 1.1% of generation
- **Additional demand created by wind deployment**

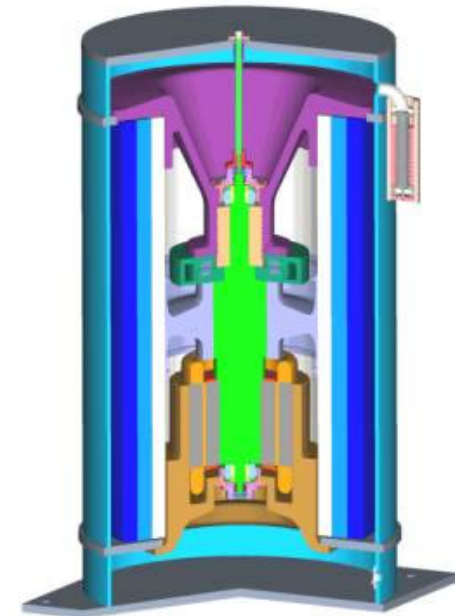


Regulation Supply Characteristics

Characteristic	Nuclear	Fossil Simple Cycle	Hydro	Nat'l Gas Simple Cycle	Nat'l Gas Combined Cycle	Beacon Flywheel
Ability to ramp up/down	None	Slow	Excellent	Good	Limited	Out-standing
Rate of Change	Hours	<+/- 1%/min	+/-3%/min	+/-2%/min	+/- 0.5%/min	+/- 100% 1 sec
Operating Range	100%	20%-100%	95-105%	80-100%	20-100%	0-100%
Regulation range	N/A	+/- 3-4%	+/- 5%	+/- 10%	+/- 2%	+/- 100%
Negative impact of cyclic operation	N/A	Governor wear, Boiler tube fractures	Efficiency, wear of control mechanisms	Fuel efficiency, Turbine blade failures	Governor wear, Boiler tube fractures	None

Why Flywheels?

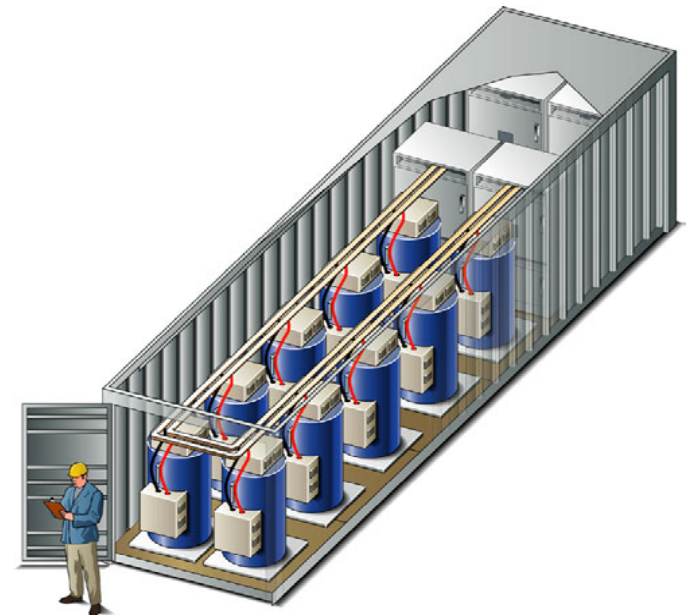
- **Ideal for frequency regulation**
 - Regulation is *recycling* energy
 - No emissions
 - Low operating & maintenance cost
 - 20 year design life
- **Fast response is more effective than present technology**
- **Frees up existing generators in tight markets**



The Beacon Smart Energy Matrix

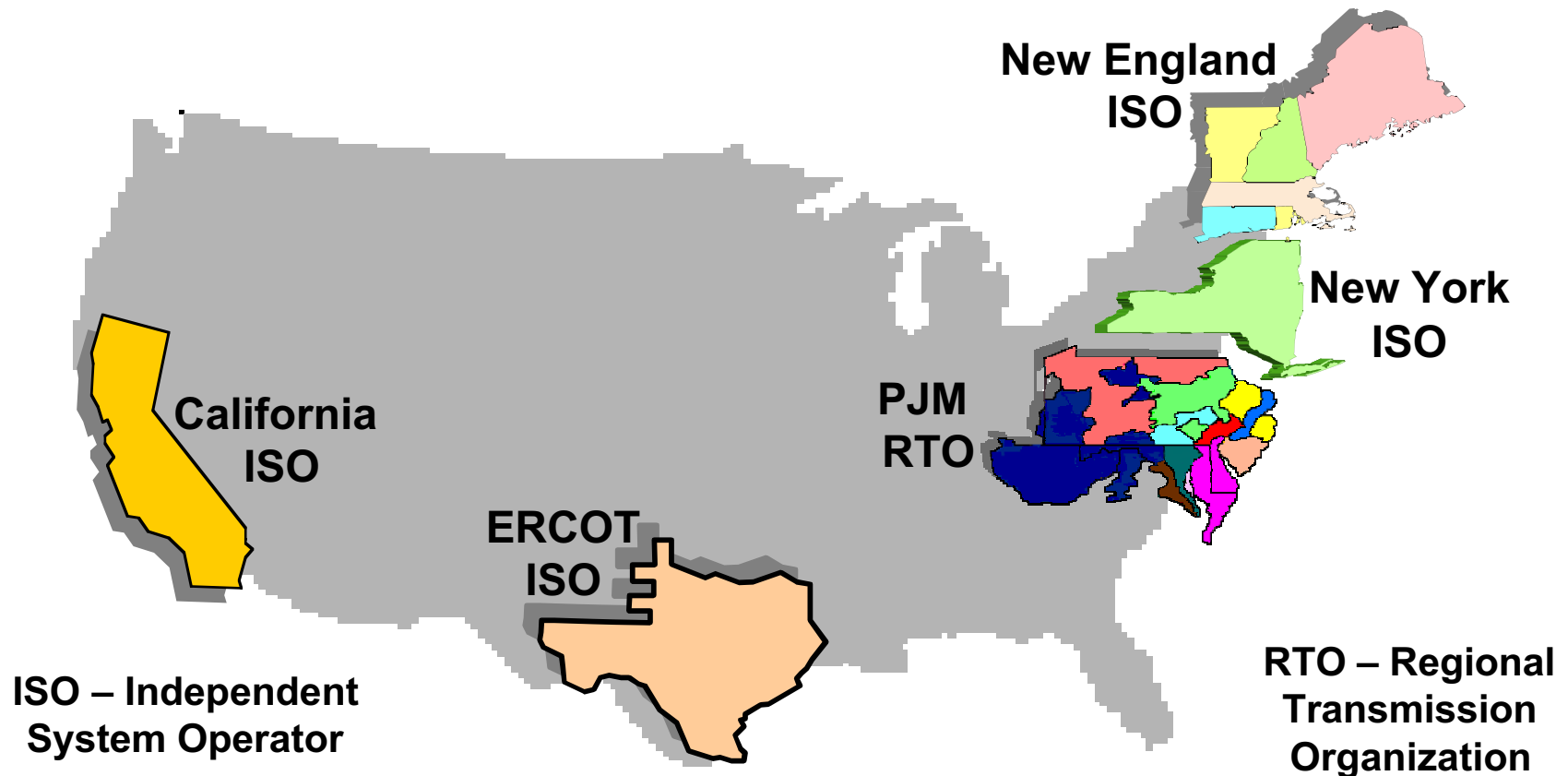
A “Megawatt in a Box”

- Uses Beacon core technology
- (10) 25-kWh flywheels
- 1 MW for 15 minutes
- Quick deployment
- Ideal for frequency regulation



Flywheels are a true “working storage” device

Daily Markets for Regulation Services



PJM is currently the largest centrally dispatched Control Area in North America

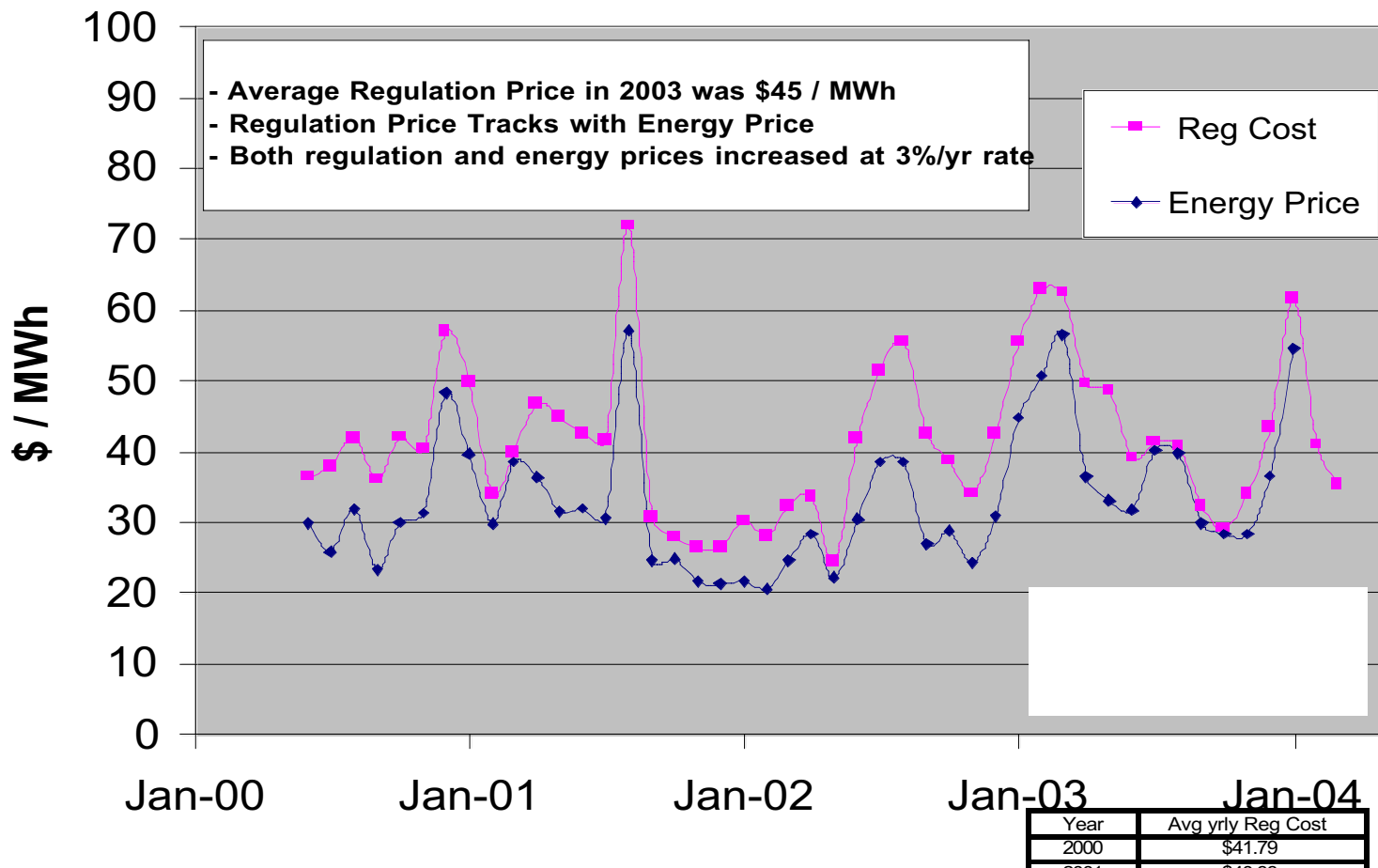
Evaluated by PJM

- **PJM collaborated with Beacon to model performance**
 - Evaluation was positive
- **PJM incentives:**
 - Diverse resources enable market efficiency and enhance reliability
 - PJM gives alternative sources fair opportunities to participate in the market
 - Resource diversity helps to reduce the ability of suppliers to exercise market power.
 - Distributed resources can be an important asset to a healthy and robust market

PJM Revenue Potential

Average price = \$45/MW-hr (\$394K/MW-yr)

Regulation Cost History



Market Characteristics

ISO RTO	2003 avg Regulation Purchased (MW)	2003 Avg. Regulation Price (\$/MWh)	2003 Annual Regulation \$ Millions
CAISO	382	\$36.58	\$122.4
P J M	365	\$45.05	\$144.0
NEISO	189	\$36.72	\$60.8
NYISO	275	\$28.32	\$68.2

Approximately
\$400 million/year

These markets represent 22% of U S generation

Additional Applications and Benefits

- **Support for Distributed Generation**
 - Stabilize voltage
 - Provide load following
- **Improve performance of high penetration wind sites (island applications)**
- **Potential - reduce congestion by operating beyond first contingency on congested lines**

Outside Interest

- **Cooperation from PJM in evaluation and discussion of flywheel-based frequency regulation**
- **Smart Energy Matrix system proposed for demonstration in New York (NYSERDA contract not yet negotiated)**
- **Smaller contract from U.S. government agency for flywheel research – other possibilities exist**
- **Interest from CAL ISO**



Next Steps

- **Joined PJM in January 2004**
- **Beacon is developing a scaled Smart Energy Matrix system**
- **Will develop communication and control in conjunction with ISOs**

With new funding:

- **Develop full size Smart Energy Matrix (1 MW/15 min)**
- **Build regulation service business**
- **Apply product to emerging markets**
- **Seek out complementary products**





Questions?





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