Amber_Kinetics, Inc.

| utility scale flywheel energy storage

Funded in part by the Energy Storage Systems Program of the U.S. Department Of Energy through *National Energy Technology Laboratory*

Edward Chiao | co-founder & CEO | nov 2010

Smart Grid Demonstration Program

Sub-Area: 2.5 Demonstration of Promising Energy Storage Technologies

problem

intermittent wind & solar generation

= unstable electric grid

solution

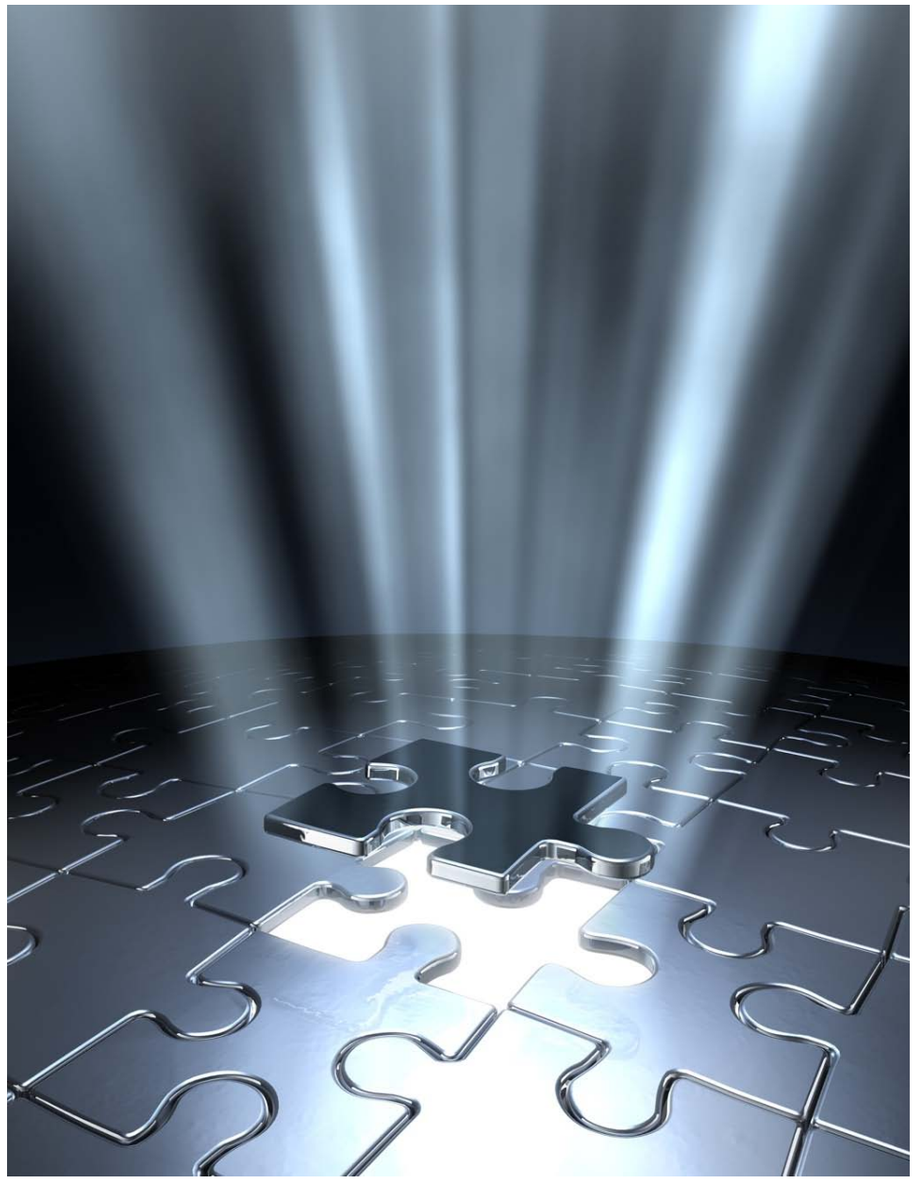
energy storage: balances supply & demand

= smarter electric grid

Utility Scale Energy Storage

A demanding set of requirements

Metric	Requirements
Capital Cost	< $1,500 / kW (4 hr duration)
Installed Size	1-20 MW
Discharge Time	0 - 4 hours
Storage Efficiency	80%+
Cycle Life	150,000 deep cycles
Calendar Life	25+ years
Carbon Dioxide	Zero Emissions
Degradation	None



Smart Grid Demonstration Program

Sub-Area: 2.5 Demonstration of Promising Energy Storage Technologies

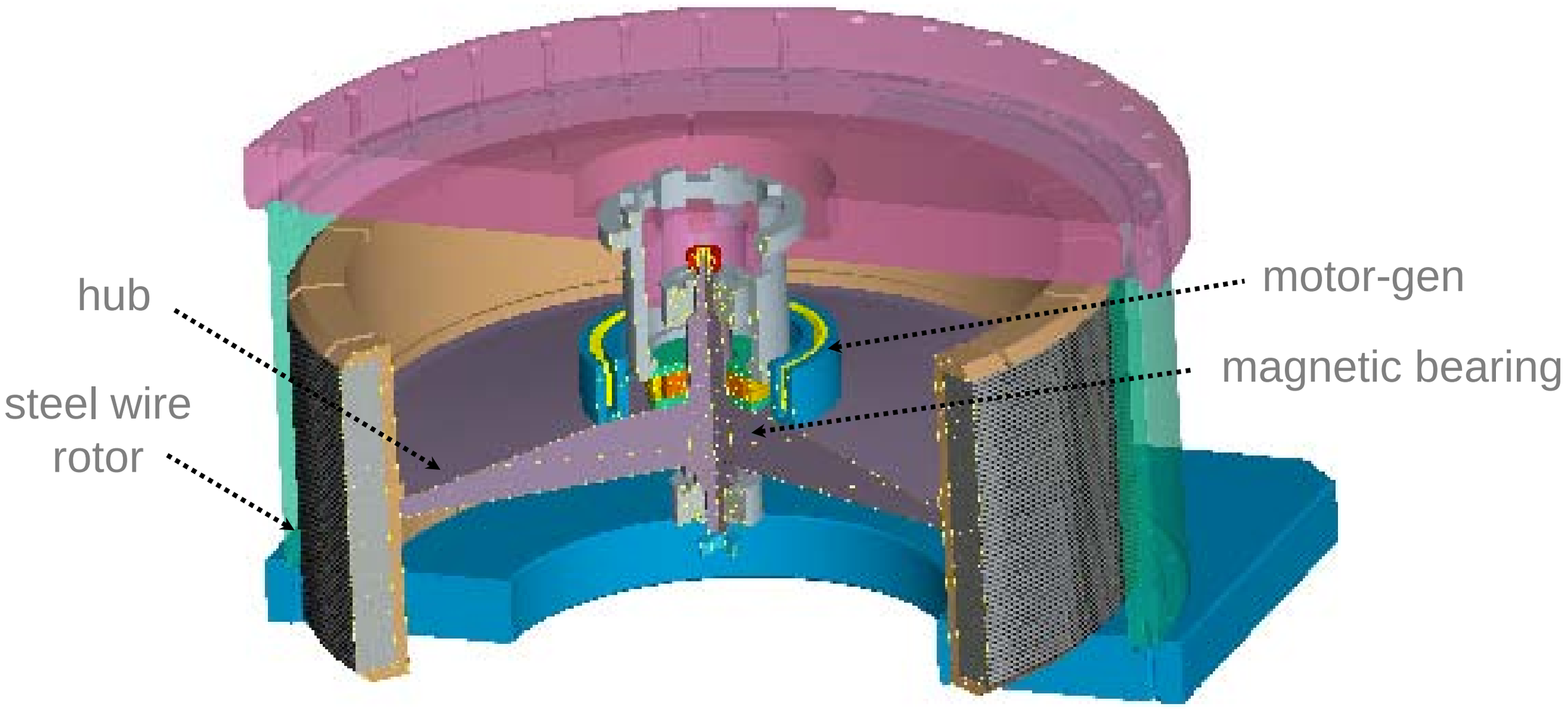
flywheels: kinetic energy storage

- 48 month project (3 phases)

- Engineering & Commercial prototypes

- Grid-connected demonstration (Phase 3)

Flywheel Energy Storage Architecture



Next Steps

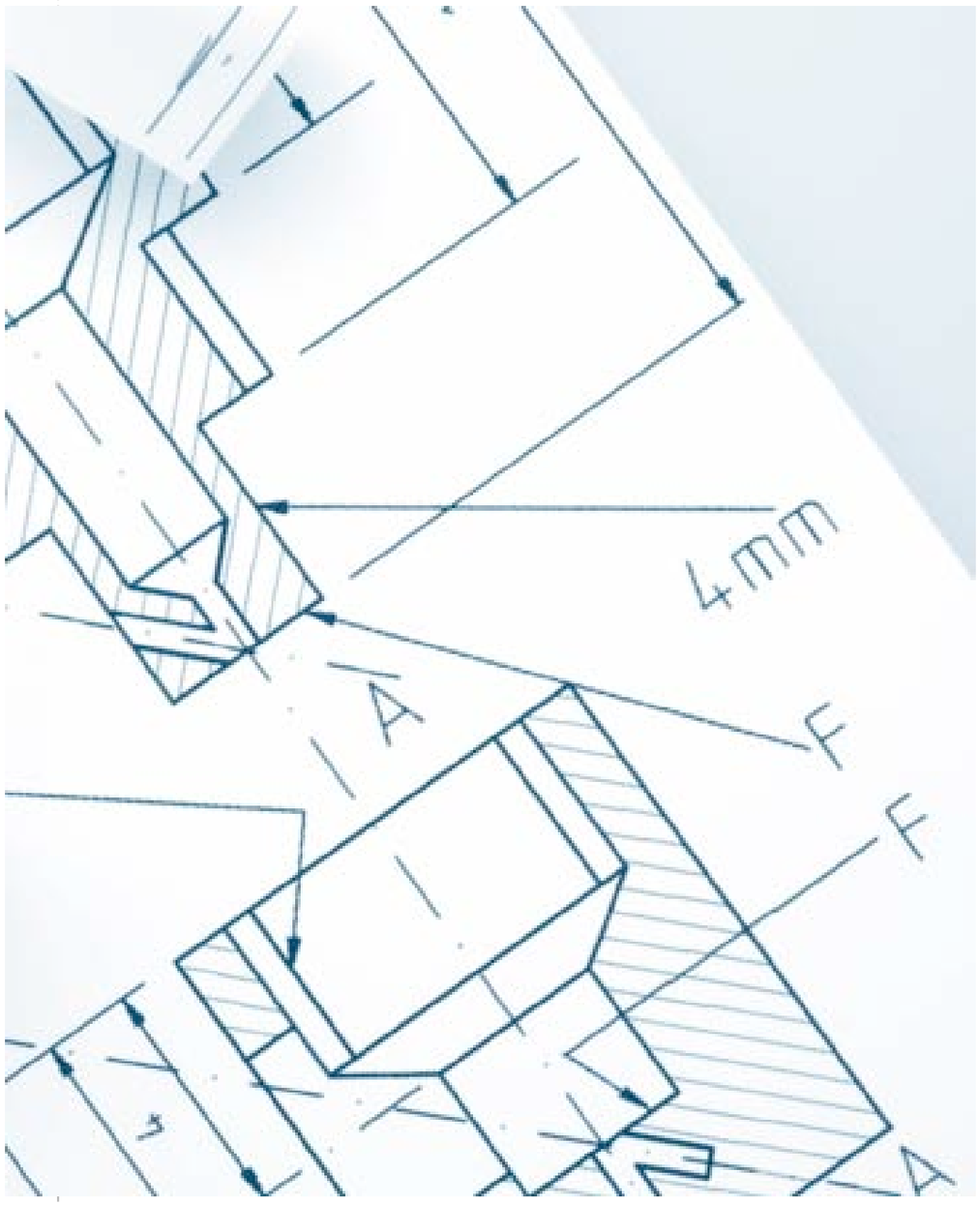
Demonstrate Low-Cost Material

Prototype to demonstrate cheap, high strength steel rotor performance

High Strength
- Metalworking process to achieve high strength
- Very low cost, simplified MFG process

Demonstrate: 15x lower $ / kWh rotor cost

Longevity
- 25 year operating life
- 150,000 deep cycles
- Abundant material, scalable architecture



Technology Development Plan

3-Phase Development

Phase One: Engineering Prototype System

- Demonstrate flywheel system, rotor performance
- Demonstrate low-loss bearings & motor

Phase Two: Commercial-Scale Prototype System

- 100 kWh flywheel energy storage system
- Scale up & cost down

Phase Three: Grid-connected Demonstration

- MWh size grid-connected demonstration
- Demonstrate performance & cycle life

thank you

questions | comments | partnership opportunities

ed@amberkinetics.com