

The Clean Energy Boom and Critical Metals Demand

Critical & Rare Metals Summit III

October 26, 2010

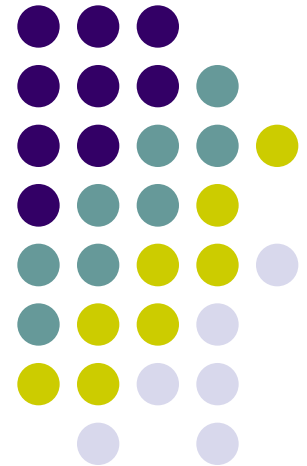
Washington, DC

Moderator:

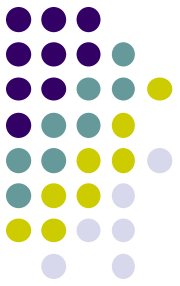
Keith A. Delaney

Executive Director

Rare Earth Industry and Technology Association



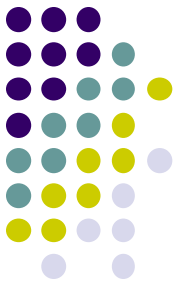
Panelists from Wind Industry



- **Madhav D. Manjrekar, Ph.D.**, *Green Energy & Power Systems, Corporate Research*,
SIEMENS CORPORATION
- **Taylor Robinson**, *VP Global Supply Chain*, NORTHERN POWER SYSTEMS



Panelists from the Auto and Advanced Lighting Industries



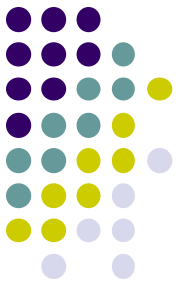
- **Edward Becker, Ph.D.**, Materials Technical Specialist, *Powertrain Division*, GENERAL MOTORS LLC.
- **Brian Wynne, President**, ELECTRIC DRIVE TRANSPORTATION ASSOCIATION (EDTA)



- **Michael Wozniak, Lighting Supply Chain**, GENERAL ELECTRIC COMPANY



Panelist from the Energy Storage Industry

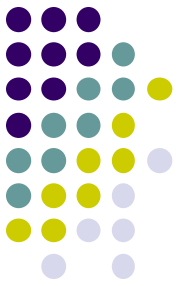


- **James Greenberger**, *Executive Director*, NATIONAL ALLIANCE FOR ADVANCED TECHNOLOGY BATTERIES (NAATBatt)



High power Ni-MH Battery
from Toyota Prius

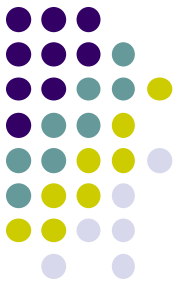
Clean Energy Demand Panel Hypotheses






China has no incentive to support supply chains outside of its own borders. We can only hope for a **“soft landing”** between now and 2012 when non-Chinese production is fully online in the US and Australia.

Global stakeholders are not prepared for the magnitude of Clean Energy demand for Rare Earth materials and components beyond 2012.

Why We Aren't Prepared: The Scale of Clean Energy Demand



Applications		Typical Quantity of RE Oxides per unit
Traditional Markets i.e. disc drives, personal electronic devices, power tools, etc.		Grams
Hybrid and electric vehicles – direct drives and electric assist motors	 <p>Chevy Volt</p>	Kilograms
PMG Wind Turbines		Metric Ton

Non-Chinese RE Processing Capacity Coming Online



Molycorp Inc. (US) and ***Lynas Corp.*** (Australia)

By 2012, both will be running at an announced capacity of 20,000 and 11,0000 mt REO per year respectively

*After 2012 the Rest of the World (**ROW**) is counting on companies like *Alkane, Arafura, Avalon, Great Western, Hudson Resources, Matamec, Quest, Rare Element Resources, Stans Energy, Ucore* and others*

Note: It can take ***5-12 years*** and up to ***\$1 billion to develop and commercialize a new RE property*** – an extremely ***risky, rigorous and expensive*** process

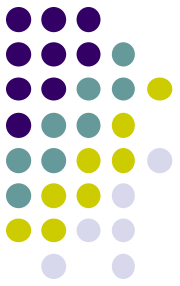
Annual Global Wind Power Installation Projections (in MW)



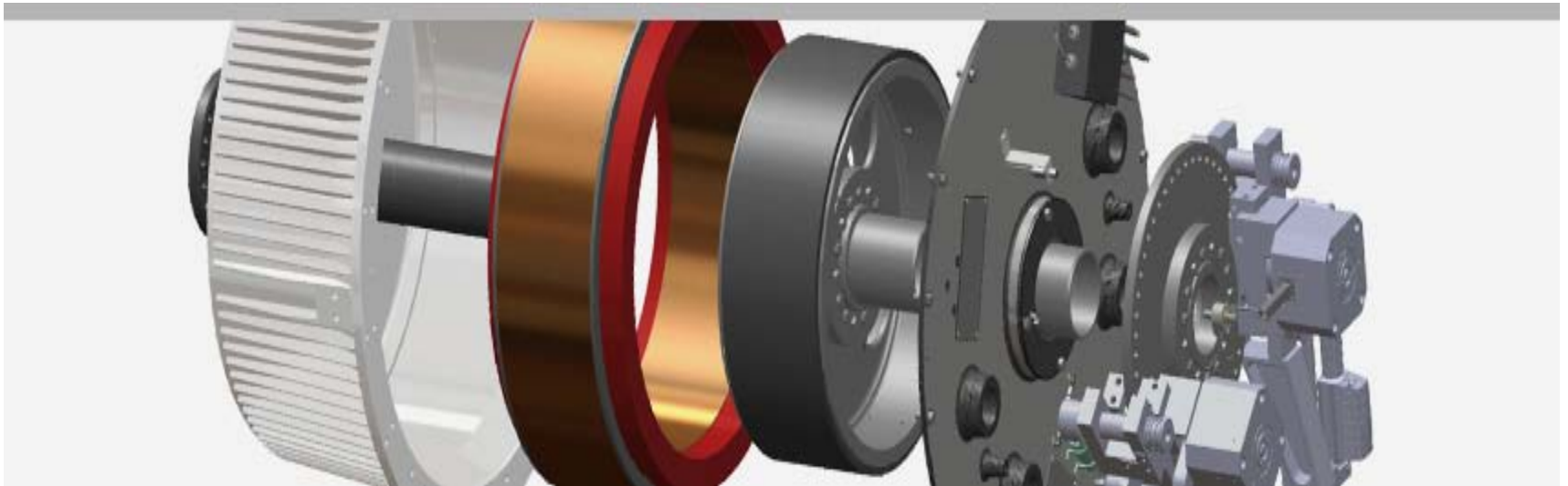
	2015 (Average)	2020 (Average)
US (DoE 20% Wind by 2030 Goal)	16,000	16,000
Europe ¹	25,400	23,200
ROW (ex China)¹	5,000	5,000
Global Total (ex China)	46,400	44,200

¹ US Energy Information Administration, International Energy Outlook, May 2010

Rare Earth Permanent Magnet Generators (PMGs) and Wind Power Alternatives

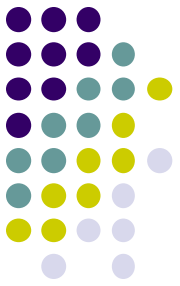


PMGs represent the most cost effective renewable energy technology and *will claim a significant portion of global renewable energy market – just how large a portion is key!*



Northern Power Systems Permanent Magnet Generator

Advantages of PMG vs. Conventional Wind Turbines



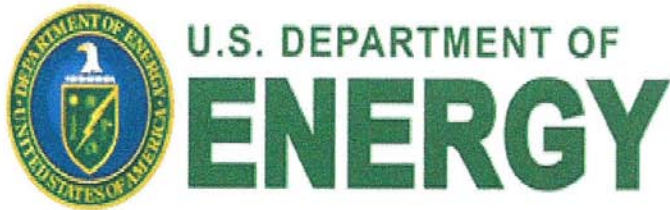
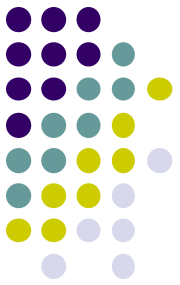
High efficiency at all wind speeds especially low and medium speeds

Increased reliability – less downtime

Maintainability – less maintenance

Grid integration

REPM Generators to be Used in World's Largest Wind Project



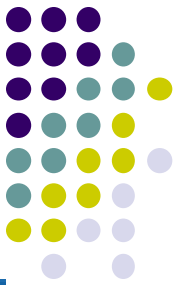
October 8, 2010

Department of Energy Offers Conditional Commitment for a Loan Guarantee to Support World's Largest Wind Project

Recovery Act-Supported Loan Will Create Jobs and Avoid Over 1.2 Million Tons of Carbon Pollution Annually

- \$1.3 Billion Project
- 845 MW Capacity (*5 % of annual 16,000 MW wind installation goal*)
- Requiring approximately 200 mt of REPM oxides
- Power sold at fixed price to So Cal Edison for 20 years

2012 and Beyond, Where Will the REPM Materials Come From?

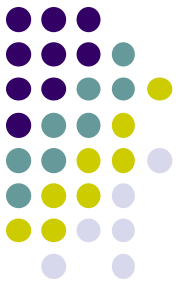


In 2012, *the combined output of Molycorp and Lynas would yield enough REPM oxides to produce 19,000 MW capacity* (assumes PMGs on average would require 500 kgs RE magnets / MW).

If ROW is going to reap the ultimate benefits of Renewable Energy, *how many additional Molycorp or Lynas-sized RE mines and processing plants does the world need in 2013 and beyond?*



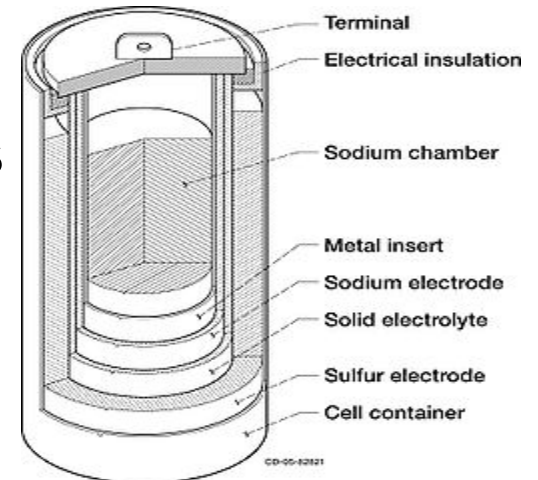
Other Clean Energy Demand Issues to be Addressed by the Panel



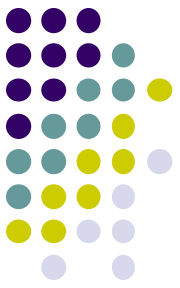
Advanced Lighting (CFLs and LEDs) ***demand outside of China***. Important market for RE Heavies (Eu, Tb and Y).



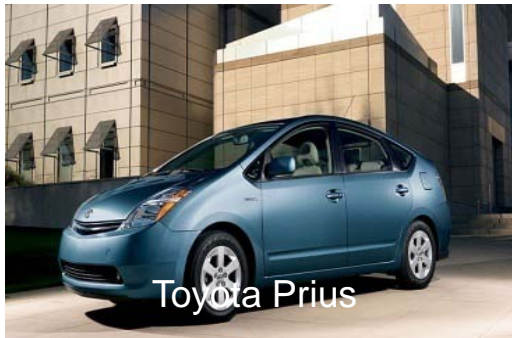
Emerging energy storage technologies and applications ***including wind farms*** feeding the grid



Clean Energy Demand Automotive



Direct Drives in Hybrid, Plug-in Hybrid and All Electric Vehicles



Toyota Prius



Chevy Volt

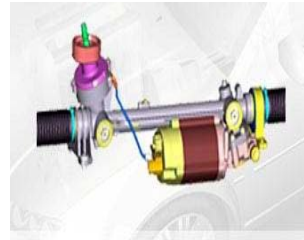


Nissan Leaf

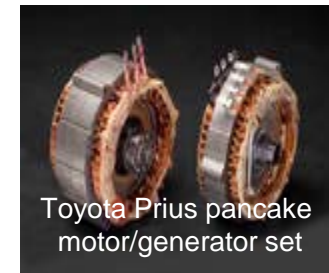
Electric Assist Motors to Take Load Off Power Trains



Integrated
Starter/Generator



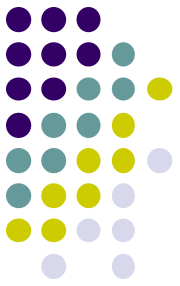
Bosch Electric Power
Steering System



Toyota Prius pancake
motor/generator set

Regenerative Braking

Auto Industry Panelists Will Discuss

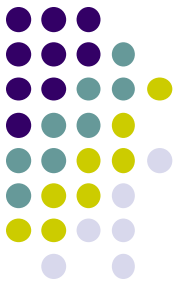


REPM demand outlook for advanced electric vehicles outside of China in the 2016 – 2030 timeframe

REPM demand outside of China for electric assist motors for Internal Combustion Engine (ICE) vehicles in the 2016 – 2030 timeframe

The interactive influences of renewable energy and energy storage on the growth of advanced electric vehicles market

Emerging Clean Energy Applications for Rare Earths We Haven't Discussed Yet



Off Road Vehicles



Electric Diesels



Electric Motor Scooters



JSF and More Electric Aircraft



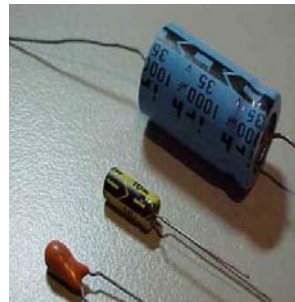
CHPS Future Combat Systems



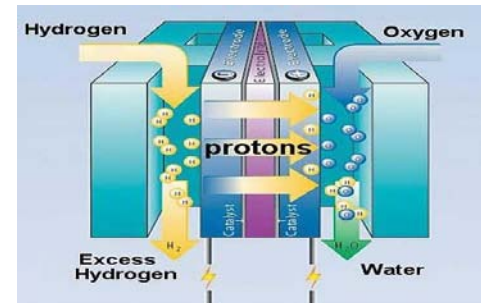
Zumwalt DDG 1000



Maglev Trains



High Energy Density Capacitors



Fuel Cell Systems