

Energy Systems for the 21st Century



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The Energy Supply Challenge



- **Rising Worldwide Energy Demand / Energy Costs**
- **Growing Impact of Climate Change**
- **Oil-Producing Regions Instabilities**

Sandia's Vision

Provide systems perspective and technological solutions for fuel and electricity that help assure:



- Secure and sustainable supply
- Safe and resilient delivery infrastructure
- Clean, efficient use of resources

Technology Innovation—In a Systems Context

Key Attributes of Future Energy Systems

Energy Surety Requirements

Safe

Safely supplies energy services to end user

Secure

Resists natural and manmade disruptions

Reliable

Maintains delivery when & where needed

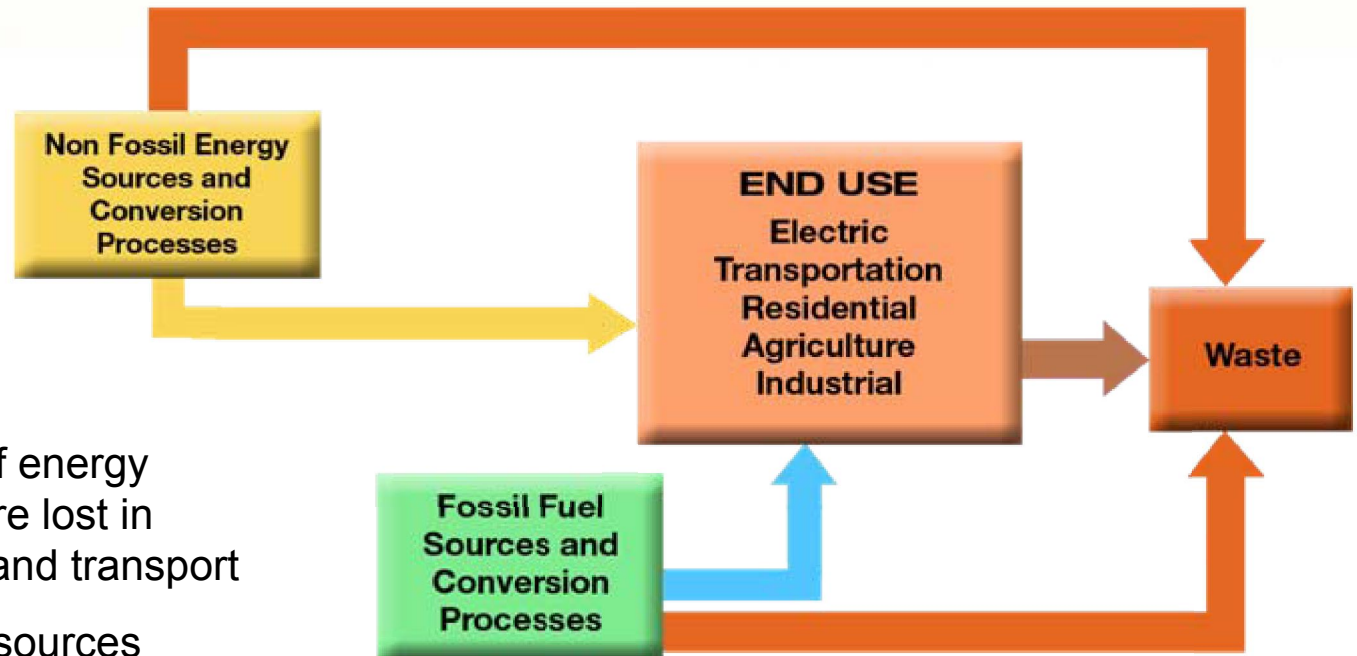
Sustainable

Matches resources with needs

Cost Effective

Energy at lowest predictable cost

The Current Energy System



- Over 50% of energy resources are lost in conversion and transport
- Diversity of sources difficult for grid to accommodate
- Reliance on nature to close the cycle on waste by-products

An Integrated Strategy for a Sustainable Future

Persistent Energy
Sources and
Conversion
Processes



Fossil Fuel
Sources and
Conversion
Processes



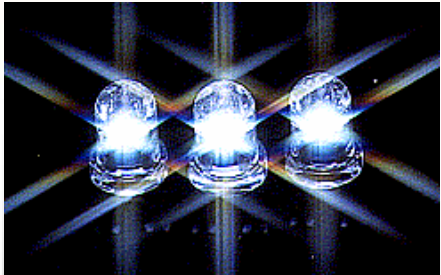
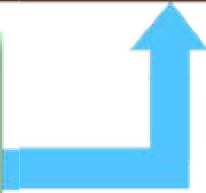
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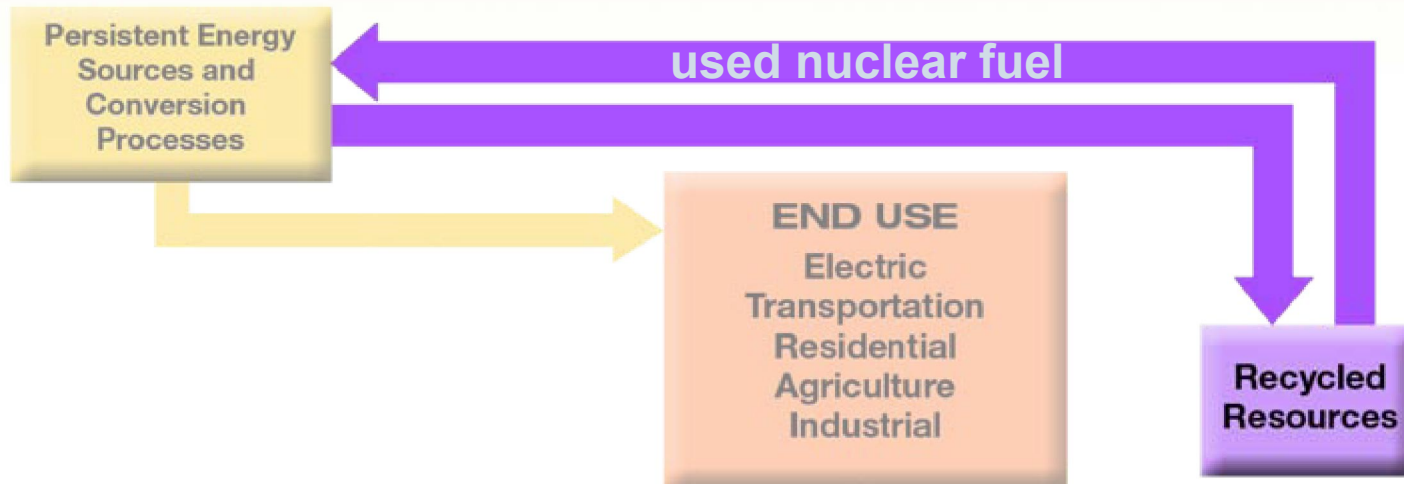


END USE
Electric
Transportation
Residential
Agriculture
Industrial

Fossil Fuel
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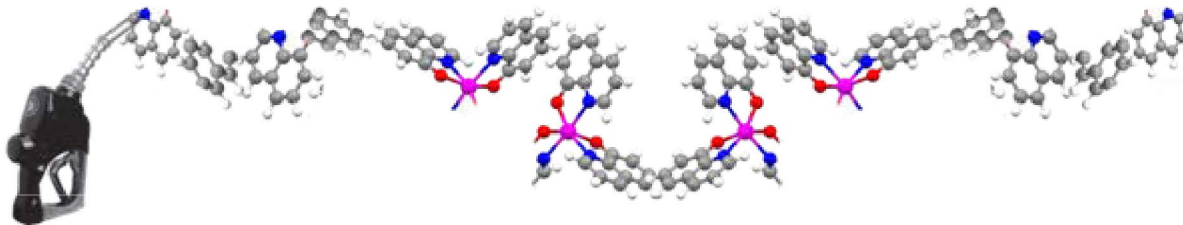
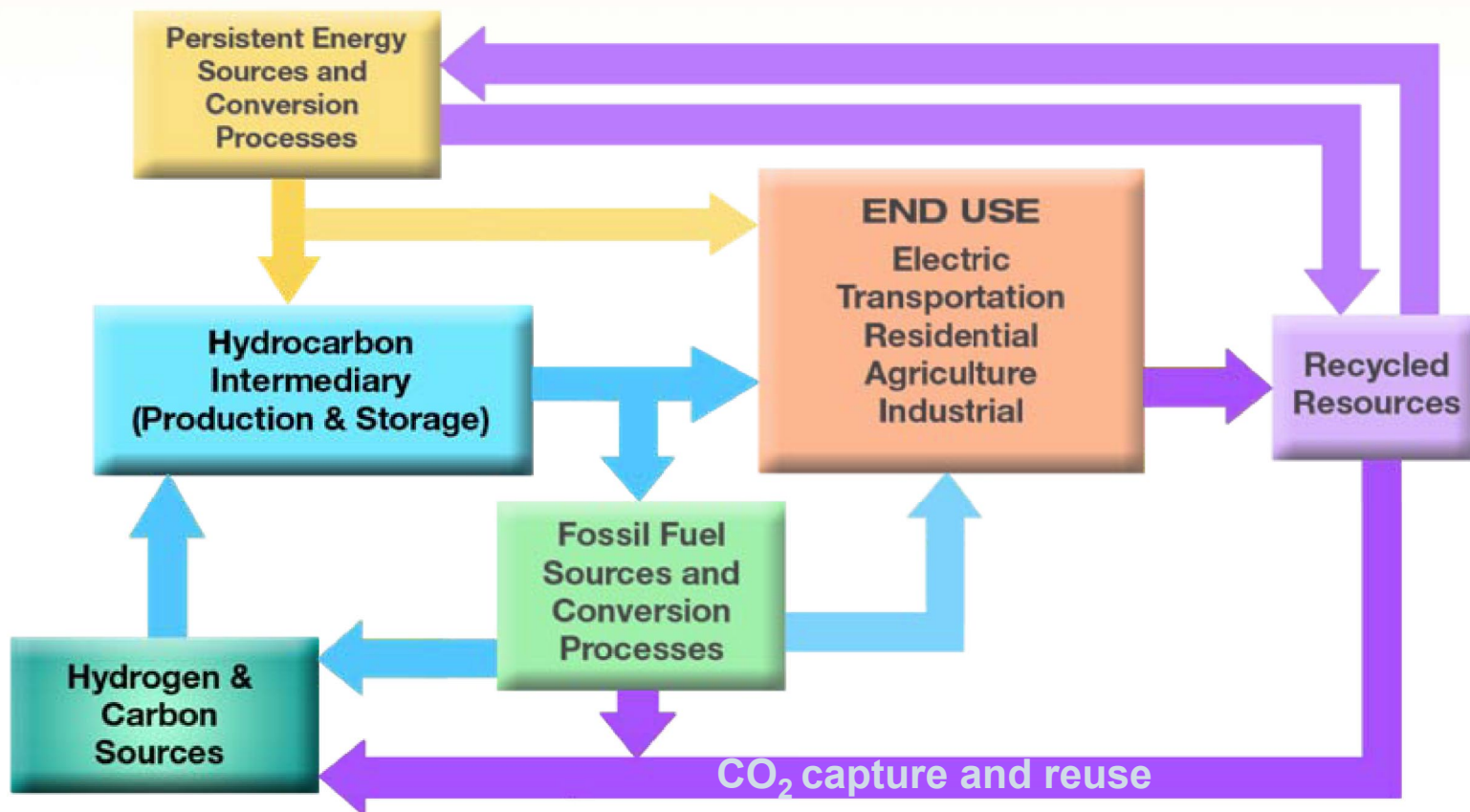
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An Integrated Strategy for a Sustainable Future



A Transition Strategy for Fuels

- Hydrogen as an energy carrier is decades away
- Conversion to liquid hydrocarbons speeds use
 - relatively safe - toxicity, flammability
 - high mass and volumetric energy density
 - existing infrastructure distribution system adaptable
- The transition strategy provides fuel and reduces GHG emissions while using existing energy infrastructures
 - requires a systems view
 - requires improved system efficiency
 - extends life of petroleum resources
 - is carbon neutral



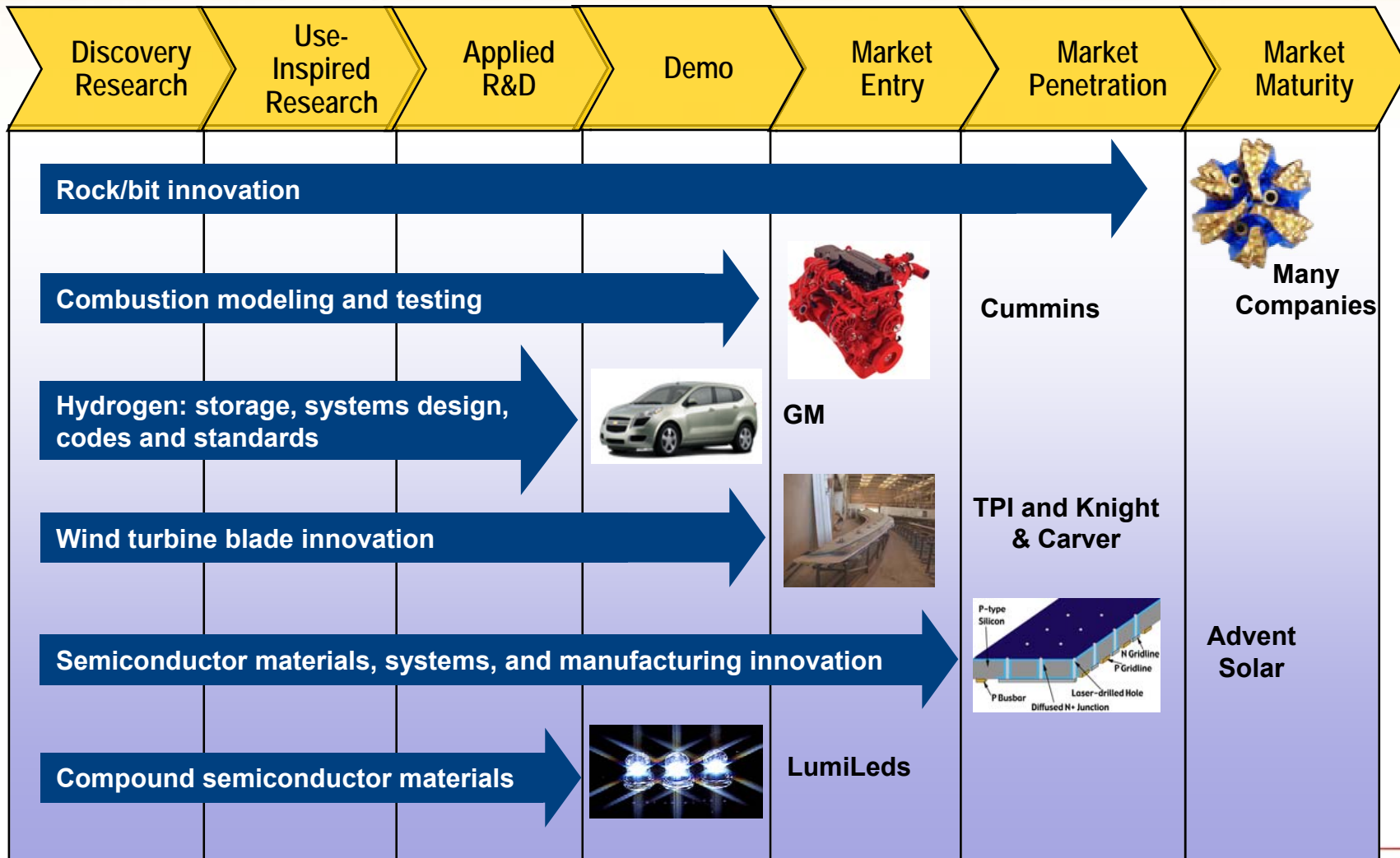
Sandia's Energy Surety Focus Areas

- Energy systems with reduced carbon emissions
- Energy surety microgrids
- Persistent energy technologies
- Hydrogen and combustion science
- Alternative transportation fuels:
solar/nuclear-based and bio-based



Success = Technology Brought to Market

Sandia's Commercialization through Industry Partners



Thank You

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