Nuclear Energy

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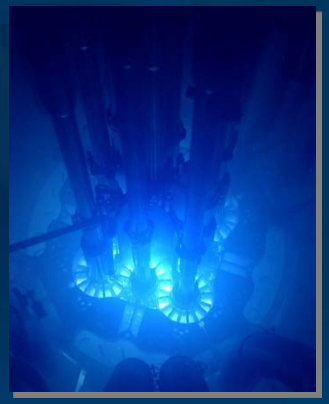
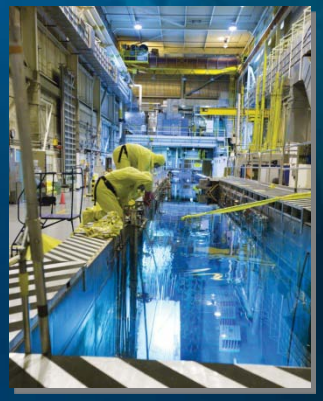




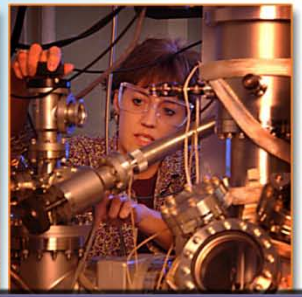
Idaho National Laboratory

INL— The National Nuclear Laboratory

Developing world-class Nuclear Energy capabilities

Fostering education, research, industry, government and international collaborations to produce the needed investment, programs and expertise

Preeminent Internationally-Recognized Nuclear Energy RDD&D Laboratory



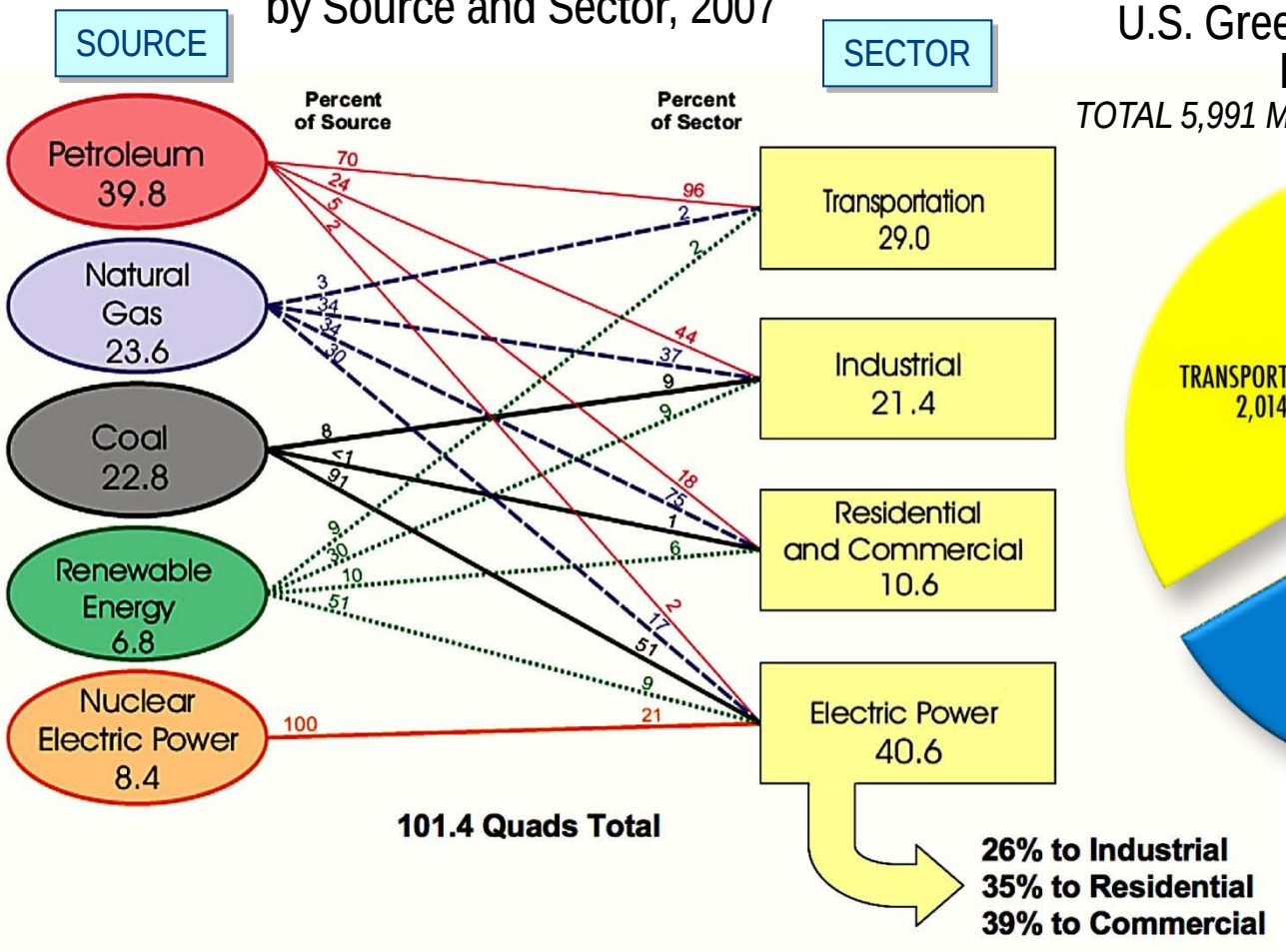
Major center for National and Homeland Security technology RDD&D

Lead clean energy systems RDD&D laboratory and a regional resource

Research - Development - Demonstration - Deployment

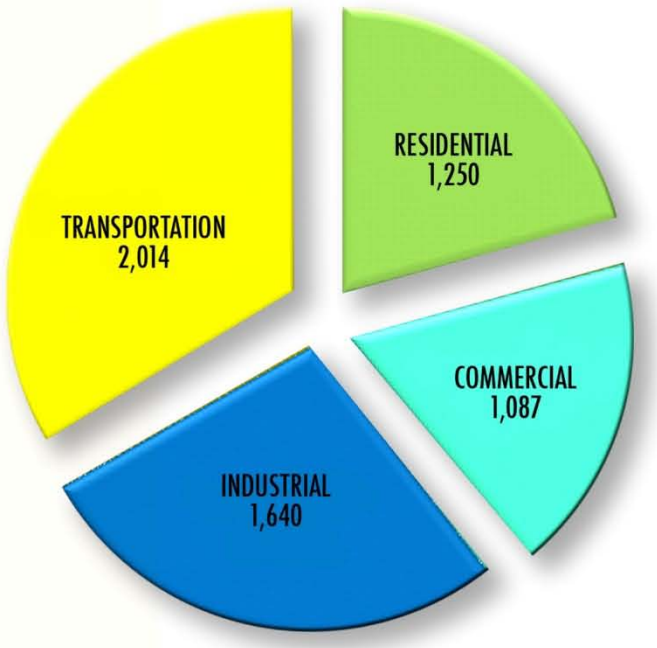
U.S. Energy Landscape

U.S. Primary Energy Consumption
by Source and Sector, 2007



U.S. Greenhouse Gas Emissions
by Sector, 2007

TOTAL 5,991 Million Metric Tons CO_2-equivalent



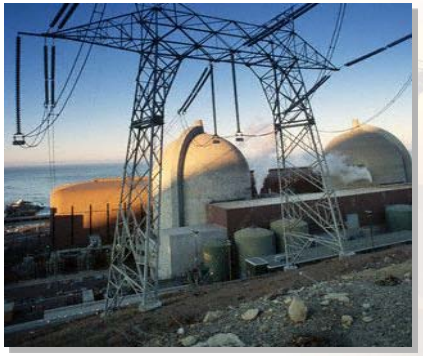
Use of Nuclear Energy in the U.S. Today — Electricity Generation

- **104 reactors in operation**
- **20% of electricity, 17th in the world, far behind France, Japan, Switzerland, Sweden and South Korea**
- **70% of U.S. emission-free electricity**
- **Low life-cycle carbon footprint**
- **Outstanding public and worker safety record**
- **High capacity factor**
- **Stable, low fuel costs**
- **Well understood operations and maintenance costs**
- **New builds moving forward**

Excellent baseload power source

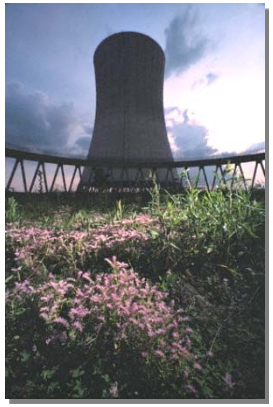
U.S. Commercial Nuclear Power Reactors—Years of Operation

Source: U.S. Nuclear Regulatory Commission



Nuclear Energy Opportunity

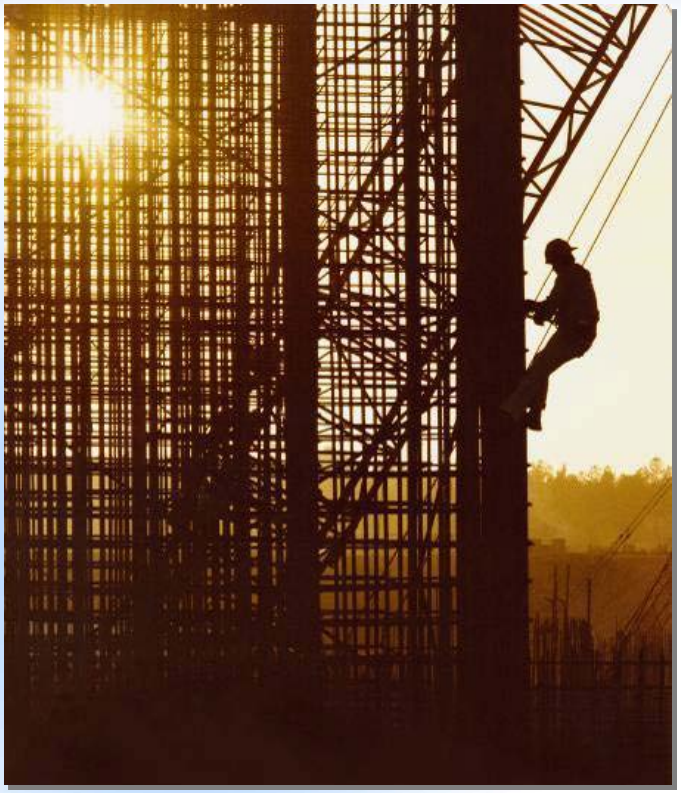
- **Increased share of carbon free electricity generation**
- **Extension of the environmental and energy security benefits of nuclear energy to the transportation and industrial sectors**

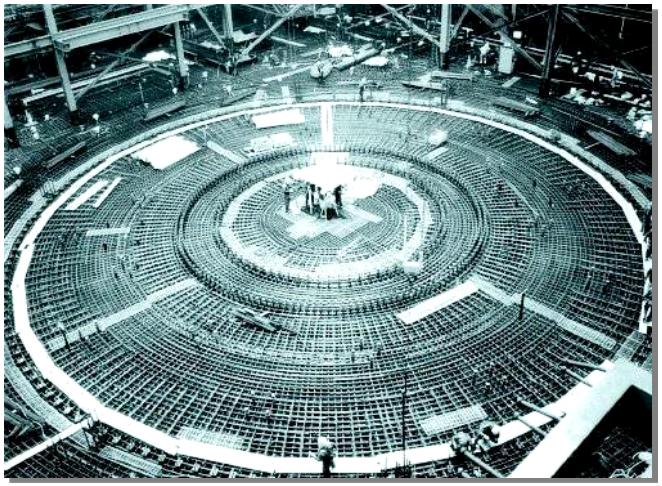


Nuclear Energy Assessment

Cost

- Large capital costs
- Fuel cost low and not volatile
- Operating and management cost understood
- Used fuel disposition uncertain
- Subsidies — Government's role in technology deployment





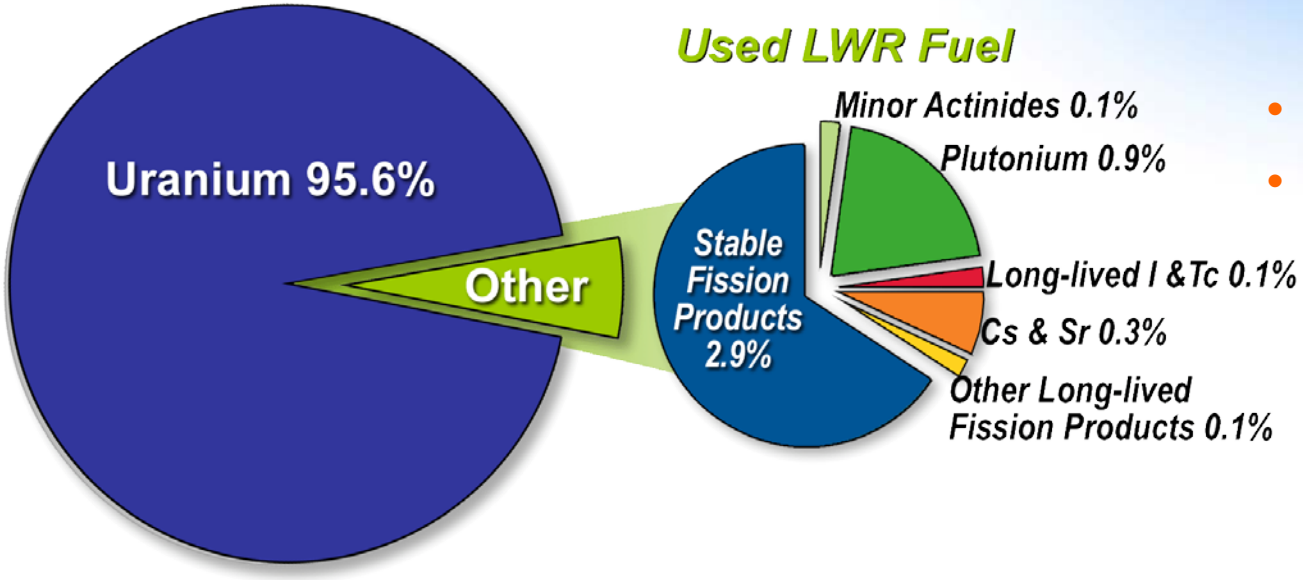
Construction

- Supply chain choke points — Heavy components and nuclear equipment manufacturing
- Time to license and construct

Nuclear Energy Assessment

Workforce

- **50% of current nuclear — industry workforce >47 years**
- **Not just scientists and engineers — all skills**



Environmental Impact

- **Used fuel (waste)**
- **Water consumption**

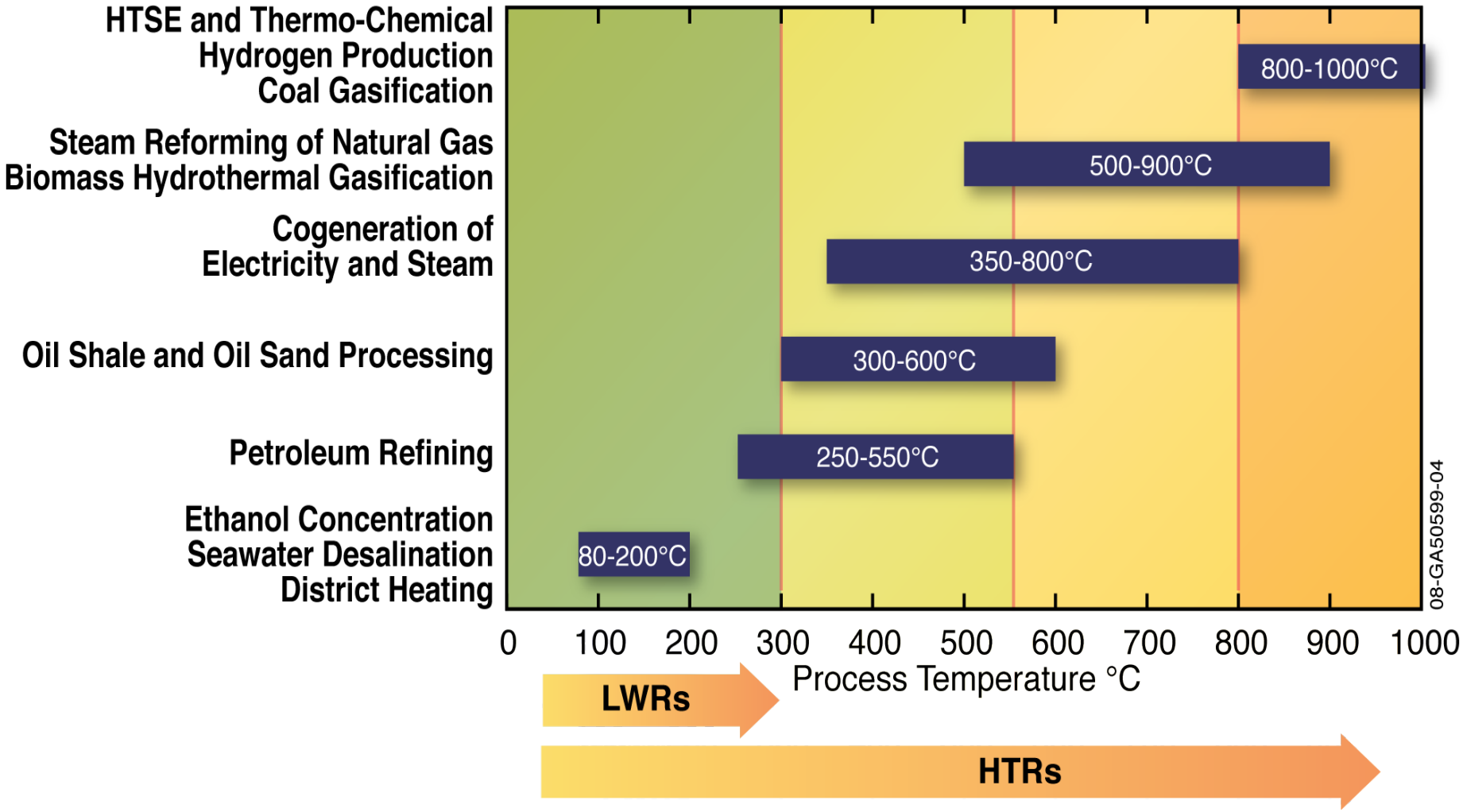
Nuclear Energy Assessment

Proliferation

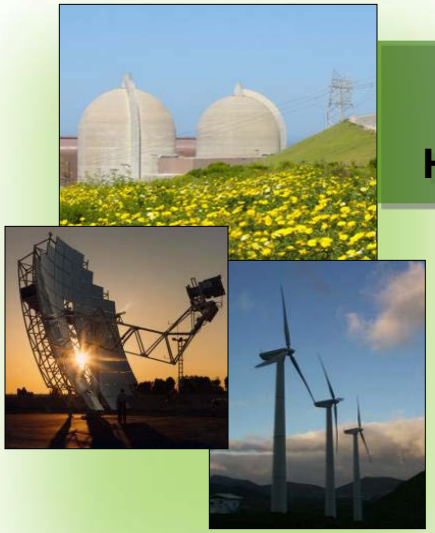
and

Safety

Potential for use of Nuclear Energy Beyond Electricity Generation



Carbon Management through Hybrid Energy Systems — An Example



"Clean Energy Donors"

Electrical Power, Heat, H_2, O_2

Renewable Biomass

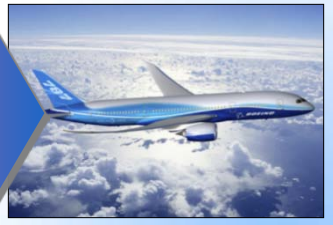
Crude Oil

Coal

Oil Sands / Oil Shale

Carbon Donors

Reduced GHG Fuels



Transportation fuels, fertilizers, and petrochemical products

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