



Courtesy Ben Phillips

Geothermal Resource Council Annual Meeting
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Geothermal Technologies Office

Accelerate EGS

- Build upon R&D and demonstration project successes
- EGS Integrated R&D FOA
- **Frontier Observatory for Research in Geothermal Energy (FORGE) FOA kicked off**

EGS

New Geothermal Opportunities

- Play Fairway Analysis
- Pathway to next-step drilling validation

Subsurface Engineering Crosscut

- Intra-DOE efforts to address common subsurface challenges and better leverage RD&D

HRC

Additive Value

- Low Temperature Mineral Recovery
- Hybrid systems and Desal

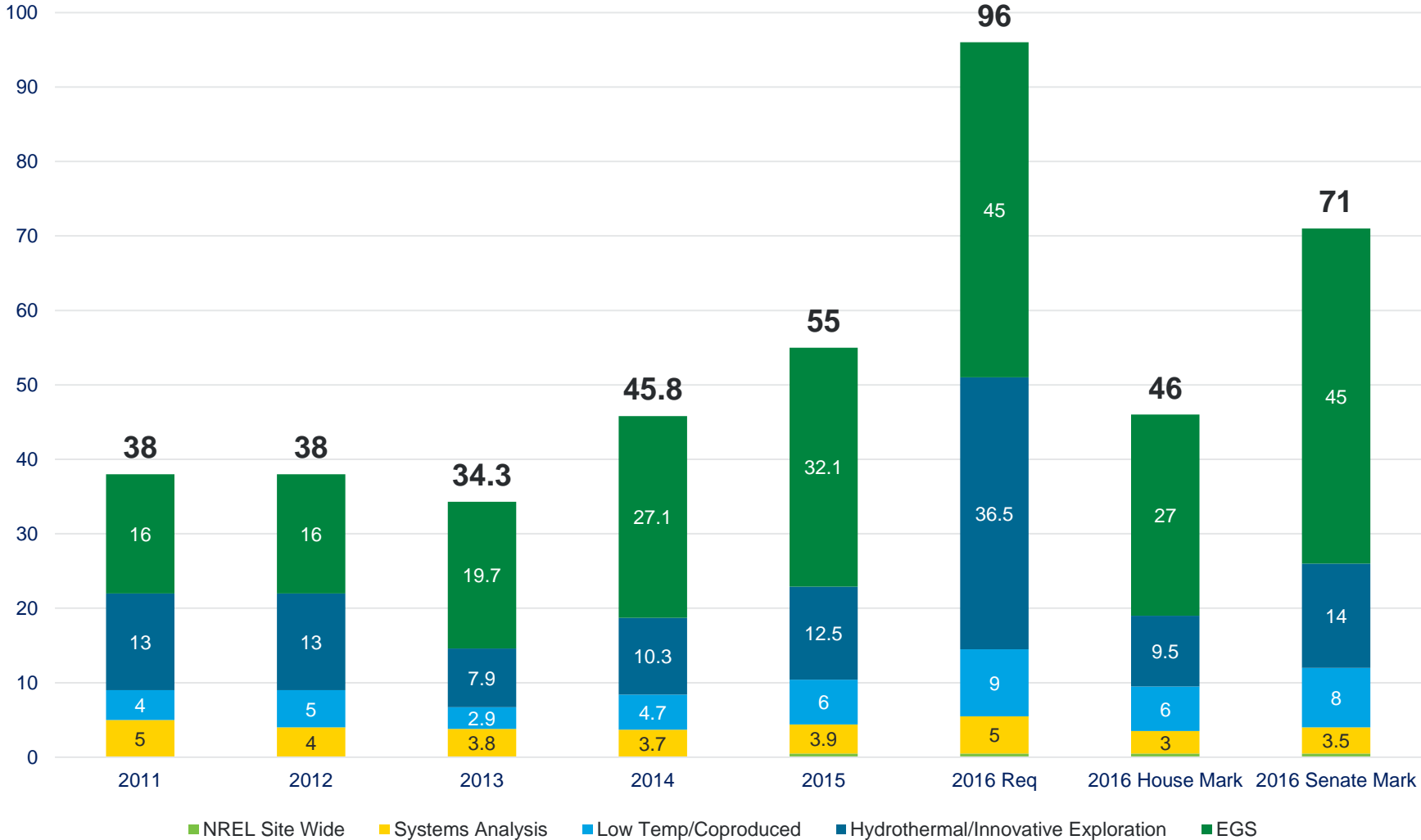
Looking Forward

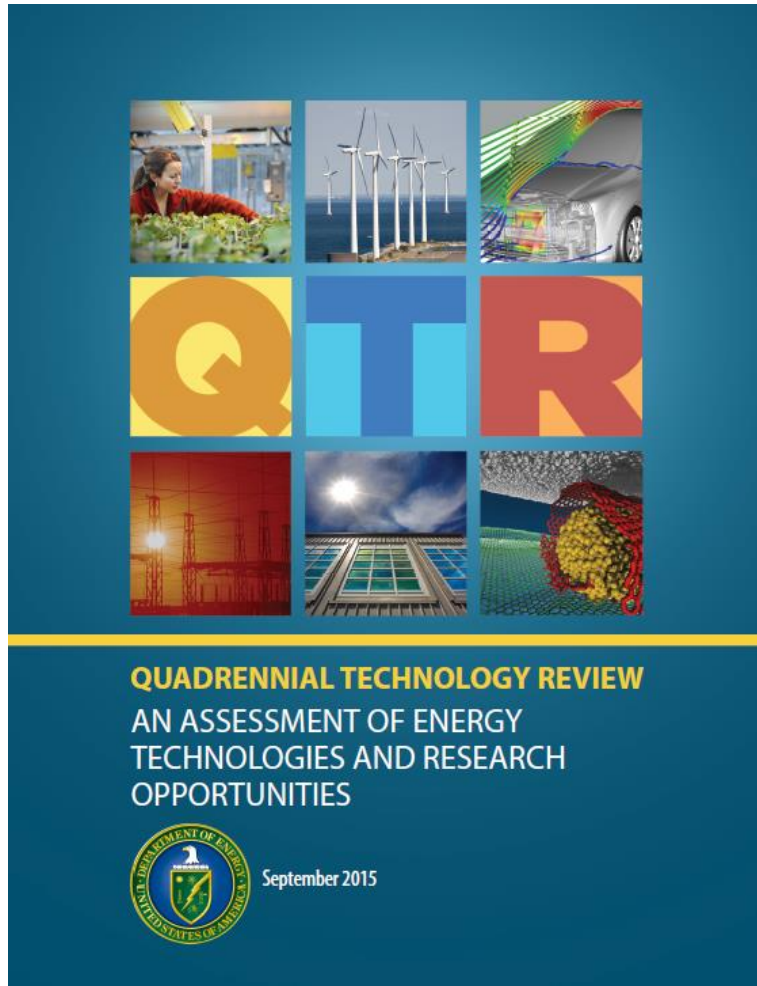
- GeoVision Study

SALT

GTO Funding History

(dollars in millions)





- Develop **advanced remote resource characterization tools** to identify geothermal opportunities without surface expression
- Purposeful **control of subsurface fracturing and flow**
- Improve and **lower \$/MW subsurface access technologies**
- Develop **mineral recovery and hybrid systems** to provide second stream of value

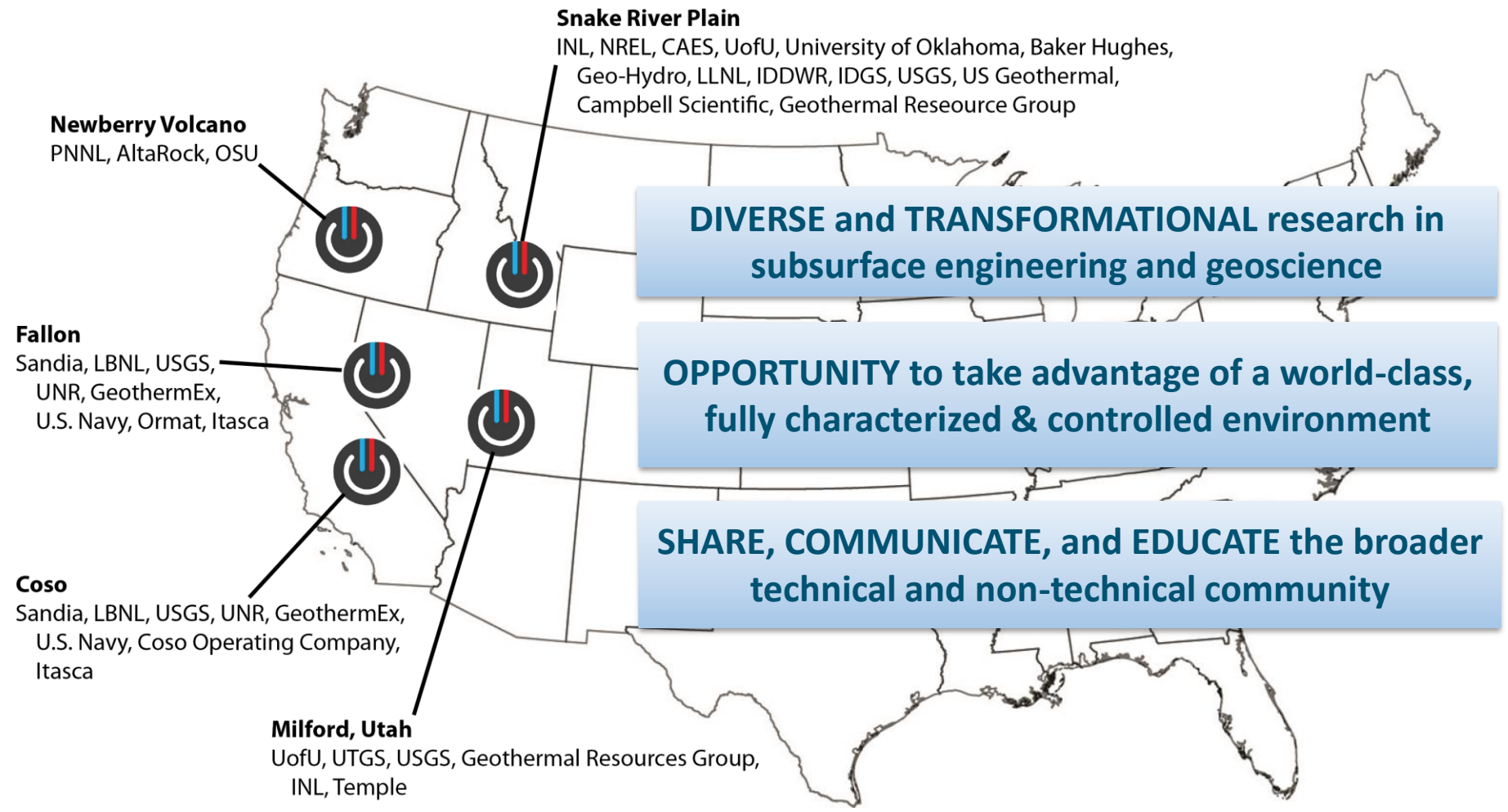
<http://www.energy.gov/qtr>

SHARE, COMMUNICATE, and EDUCATE the broader technical and non-technical community

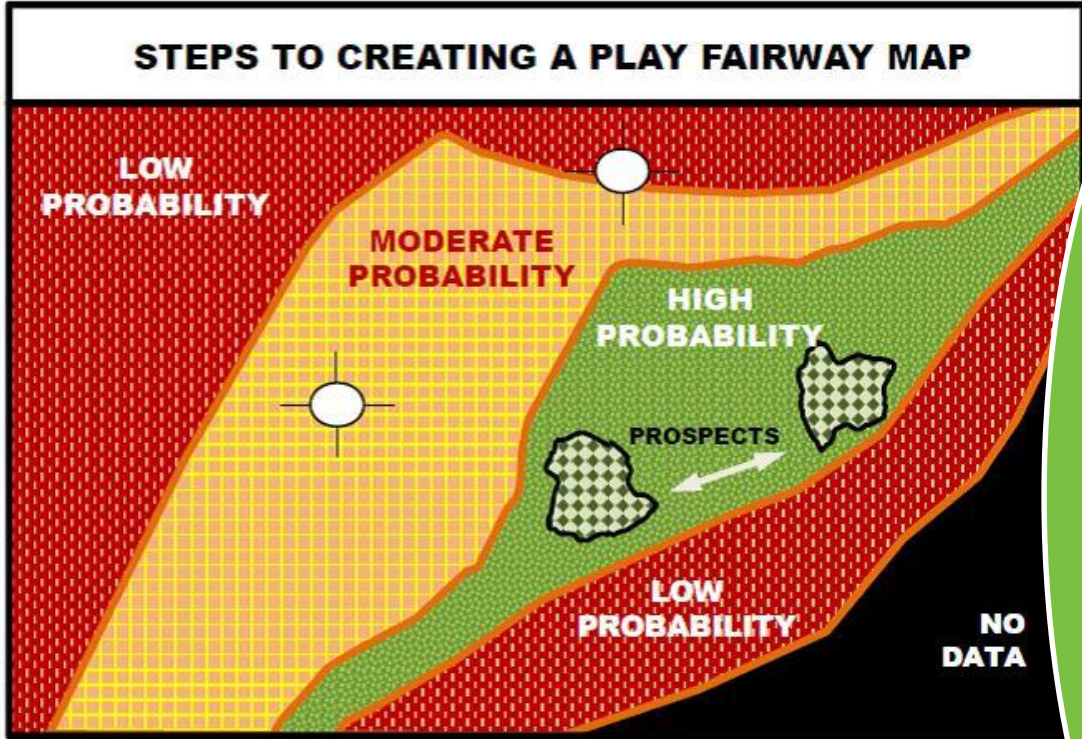
- ❑ Gain a **fundamental understanding** of the **key mechanisms controlling EGS** success
- ❑ **Develop, test** and **improve** new **fundamental** and **techniques** in an ideal EGS environment.
- ❑ Make **Integrated comparison** of **technologies** and **tools** in a controlled environment
- ❑ Rapidly **disseminate technical data** and **communicate** to the research community, developers, and other interested parties.

FORGE Teams

Broad Collaboration & Data Rich Sites



Play Fairway Analysis



Goal:
 Identify locations in the area of study that have the highest probability of containing the geologic factors



Wellbore Integrity

Subsurface State of Stress

Permeability Manipulation

New Subsurface Signals

Energy Field Observatories

ENERGY PRODUCTION AND ENERGY SECURITY

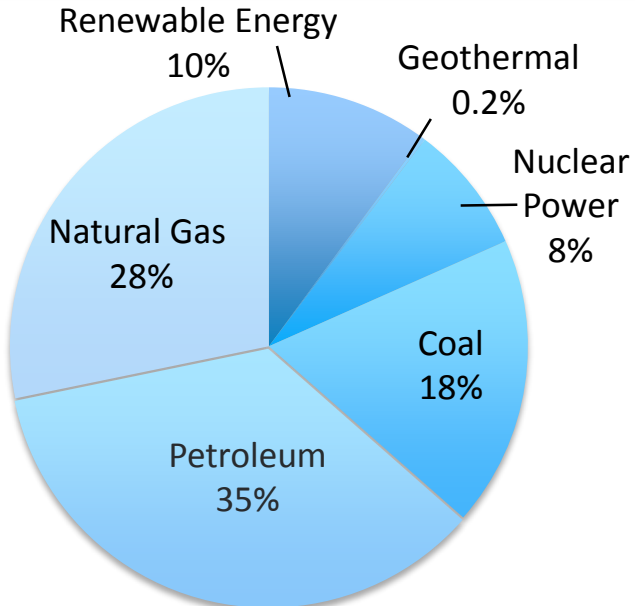
- Increase U.S. unconventional oil and natural gas for multiple uses
- Increase U. S. electricity production from geothermal reservoirs

PROTECT THE ENVIRONMENT

- U. S. leadership
- Public confidence
- Increase revenues (taxes and royalty) to Federal, State, and local governments
- Impact on overall economy

ECONOMIC & SOCIAL BENEFITS

- President's Climate Action Plan: Safely store CO₂ to meet GHG emissions reduction targets
- Safe storage/disposal of nuclear waste
- Reduced risk of induced seismicity
- Protect drinking water resources

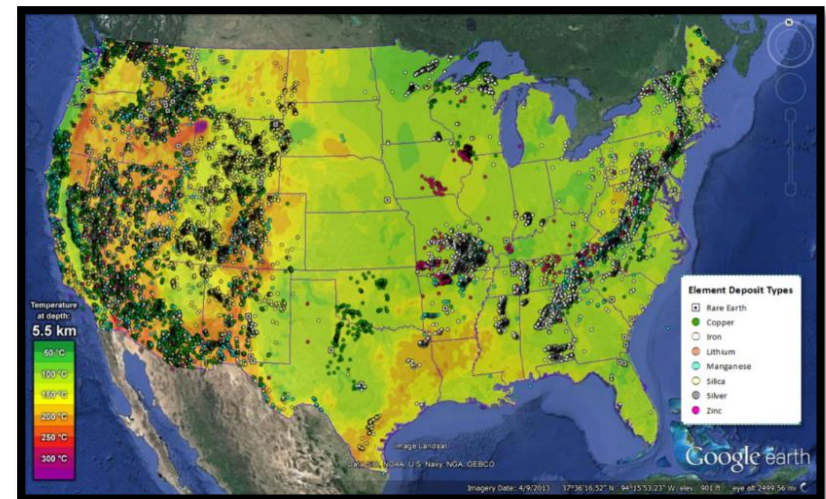


Primary Energy Use by Source, 2014

Quadrillion Btu [Total U.S. = 98.3 Quadrillion Btu]

GTO Mineral Recovery Initiative

- Demonstrate **technical feasibility** and **economic viability** of mineral extraction technology(s) combined with geothermal power production
- **Assessments** of the current rare earth and near-critical metal resource base, with potential extraction volumes/rates including coupled techno-economic analysis.
- **Geochemical modeling** and leaching to **optimize the composition of down-hole fluids** and identify additives that selectively leach high value strategic elements.



By 2016, DOE seeks to develop credible analysis jointly with the GEA/GRC community that:

- I. Articulates clear ***GTO investment strategies*** across different sectors and has a cohesive plan to attain the goals;
- II. Discusses ***geothermal growth scenarios*** for 2020, 2030 and 2050 backed by robust data, modeling and analysis;
- III. ***Addresses all market segments***: existing and potential hydrothermal, electrical and non-electrical usages, new EGS sector, and other value streams; and is
- IV. Supported by *objective and peer-reviewed industry data* and *available to decision-makers*
- V. Is ***aspirational*** and ***inspirational***



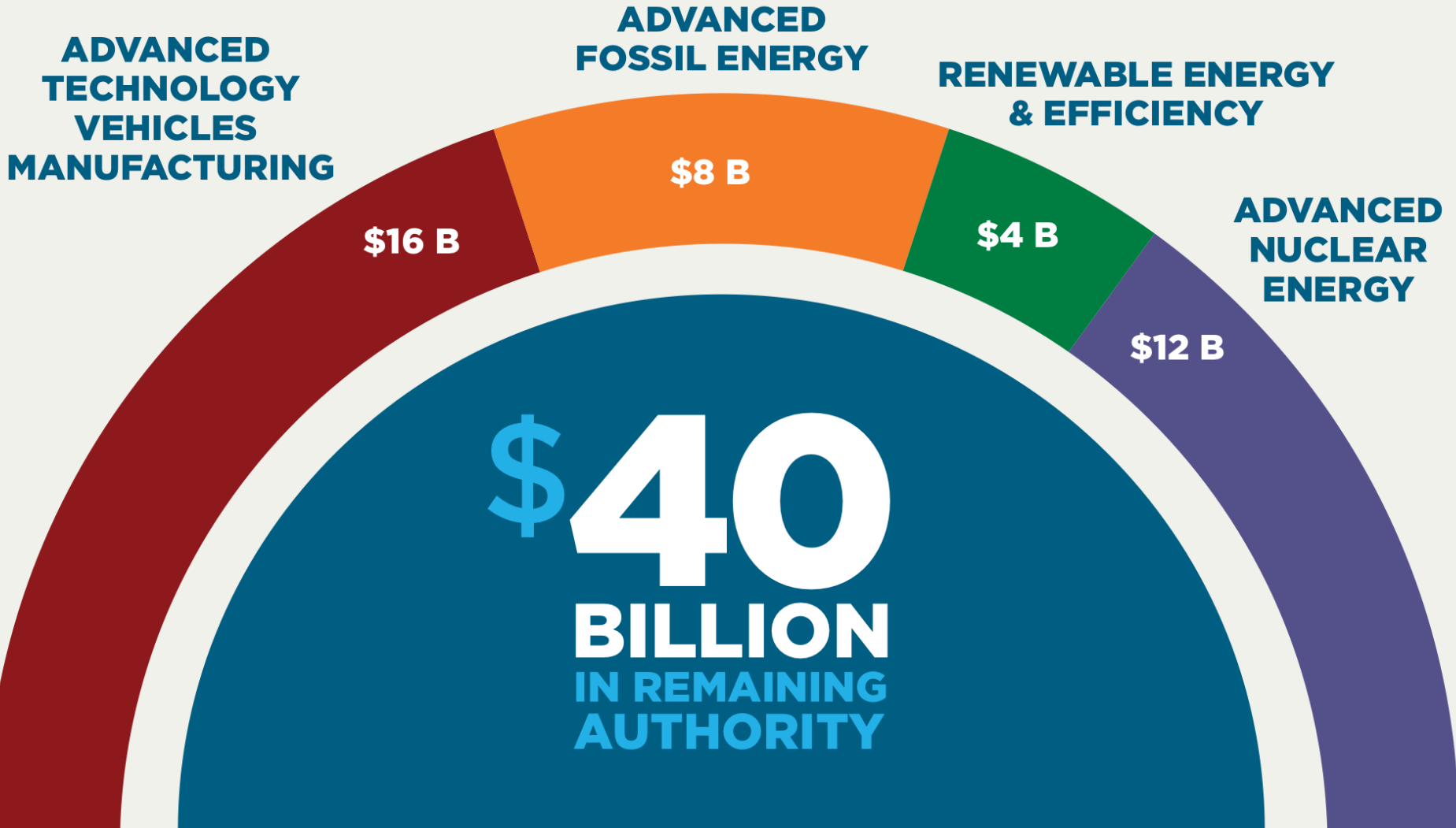
By 2030, the **CLEAN POWER PLAN** will reduce carbon emissions from power plants by **32%** below 2005 levels.



#ActOnClimate #CleanPowerPlan

EPA's Actions

- Achieve significant pollution reductions in 2030
- Deliver an approach that gives states and utilities plenty of time to preserve ample, reliable and affordable power
- Spur increased investment in clean, renewable energy



TITLE XVII

INNOVATIVE CLEAN ENERGY PROJECTS

Advanced Grid Integration & Storage

- Renewable energy generation, including distributed generation, incorporating storage
- Smart grid systems incorporating demand response

Enhancement of Existing Facilities

- Retrofitting existing renewable facilities with innovative technology

Energy Efficiency

- Improve or reduce energy usage in residential, institutional, and commercial facilities, buildings, and/or processes
- Recover, store, or dispatch waste energy or underutilized renewable energy resources

TITLE XVII CLEAN ENERGY PROJECTS ELIGIBILITY REQUIREMENTS

- INNOVATIVE TECHNOLOGY**
Eligible projects must utilize new or significantly improved technology or systems
- GREENHOUSE GAS BENEFITS**
Eligible projects must reduce, avoid, or sequester greenhouse gases
- LOCATED IN THE U.S.**
Eligible projects must be located in the United States but may be foreign-owned
- REASONABLE PROSPECT OF REPAYMENT**
Eligible projects must be able to repay loan principal and interest. LPO conducts due diligence and underwrites each loan similar to a commercial lender

QUALIFYING PROJECTS ARE NOT LIMITED TO THESE TECHNOLOGIES.

Small Business Voucher Pilot

\$1.5M for Geothermal Small Businesses

SMALL BUSINESS FACTS

Driving the spirit of innovation, entrepreneurship and individual initiative.

23 million
small businesses representing



99%
of all employers



account for more than **1/2**
of all private sector jobs



Source: Council on Small Businesses



ELIGIBILITY

- » Must be a for-profit business with no more than 500 full-time-equivalent employees worldwide.
- » Must be U.S.-based and U.S.-owned.

ENERGIZING THE CLEAN ECONOMY

Vouchers are limited to specific R&D areas:



Advanced Manufacturing



Bio-Energy



Buildings



Fuel Cells



Geothermal



Solar



Water



Wind



Vehicles

STEPS FOR SUCCESS

