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DOE FY2016 Congressional Budget Request for EERE

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EESI Briefing: February 25, 2015

Outline

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Overview & Background

- Highlights
- Administration's Goals
- FY2016 EERE Emphasis
- Funding Calculation References
- Thematic Grouping of Accounts



Highlights (FY2016 Request vs. FY2015)

- DOE total request up \$2.5 B (9%)
- EERE up \$809 M (42%)
- Largest EERE program increases are for manufacturing and vehicles
- Revenue Offset: Request would repeal \$4 billion in FY2016 fossil fuel tax incentives
 - Fossil fuel incentives elimination effort promised at G-20 Climate Meeting
 - For annual dollar estimates: See Treasury Dept., *General Explanations of the Administration's Fiscal Year 2016 Revenue Proposals*, Table 2



Administration's Goals

- Reduce oil imports 1/2 by 2020
- Lead the world in clean energy technologies
 - Double renewable energy production by 2020
 - Double energy productivity by 2030, relative to 2010
 - Non-residential buildings 20% more efficient by 2020
 - 80% clean energy power generation by 2035 (includes nuclear and efficient gas)
 - Cut greenhouse gases 17% below 2005 level by 2020



FY2016 EERE Emphasis

Entire EERE effort: Transformation to Clean Energy Economy

- International Competitiveness (Manufacturing & Jobs)
- Climate Change (Reduced Carbon)
- Oil Imports (EVs & Biofuels)



Funding Calculation References

- All funding changes shown in the presentation follow those in the DOE request.
- The differences are calculated between the FY2016 request and the FY2015 appropriation.
- For simplicity, many figures are rounded-off.
- DOE still presents a thematic grouping of major program accounts, first used in FY2014 request.



Thematic Grouping of Accounts

- Current appropriation accounts are grouped by renewable energy, energy efficiency, grants, and management.
- The request preserves the major program accounts (e.g., “Solar Energy,” “Building Technologies,” etc).
- DOE organizes those accounts into four functional groups, which help reveal program connections:
 1. Sustainable Transportation
 2. Renewable Electricity Generation
 3. Energy Efficiency
 4. Corporate Management



Key Funding Changes, by Theme

- Sustainable Transportation
- Renewable Electricity Generation
- Energy Efficiency
- Corporate Management



Sustainable Transportation (FY2016-FY2015 difference)

Program	Increase	Percent Increase
TOTAL	\$191 M	32%
Vehicles*	\$164 M	59%
Bioenergy	\$21 M	9%
Hydrogen	\$6 M	6%

* Note: Main activity increased under Vehicles is the Electric Vehicle (EV) Everywhere Grand Challenge Program (2012).



Renewable Electricity Generation (FY2016-FY2015 difference)

Program	Increase	Percent Increase
TOTAL	\$189 M	42%
Solar	\$104 M	45%
Geothermal	\$41 M	75%
Wind	\$39 M	36%
Water	\$6 M	10%



Energy Efficiency (FY2016-FY2015 difference)

Program	Increase	Percent Increase
TOTAL	\$388 M	60%
Manufacturing	\$204 M	102%
Buildings	\$92 M	54%
Weatherization/IG*	\$75 M	31%
FEMP	\$16 M	60%

- * Note: Main activities increased under this program are:
- Weatherization Assistance Program (\$35 M, 18%) and
 - Local Government Energy Grants (\$20 M, new)



Corporate Management (FY2016-FY2015 difference)

Program	Change	Percent Change
TOTAL	\$18 M	8%
Facilities	\$6 M	11%
Program Direction	\$5 M	3%
Strategic Programs	\$7 M	33%



Key Funding Changes, by Program

- Major Program Increases
- Small Program Decreases



Major Program Increases (FY2016-FY2015 difference)

Program	Increase	Pct. Increase
Manufacturing	\$204 M	102%
Vehicles	\$164 M	59%
Solar	\$104 M	45%
Buildings	\$92 M	54%
Geothermal	\$41 M	75%
Wind	\$39 M	36%
Bioenergy	\$21 M	9%
Weatherization	\$35 M	18%
State Energy	\$20 M	40%
Local Energy	\$20 M	New Program



Program Decreases

None



Program Highlights: Goals & Funding

- Manufacturing (2 pages)
- Vehicles (2 pages)
- Solar
- Buildings
- Geothermal (2 pages)
- Wind
- Bioenergy
- Grant Programs
- Innovation Hubs



Manufacturing Program, Highlights (FY2016-FY2015 difference)

- Goals & Objectives
 - Anchors the Clean Energy Manufacturing Initiative (started in 2013)
 - Improve competitiveness in global markets for products (e.g., solar PV modules, LED lights, batteries, wind turbine blades)
 - Increase competitiveness by raising industrial energy productivity (Race to the Top)
 - 50% energy savings through advanced materials & processes
 - 40 gw (million kilowatts) of combined heat and power by 2020
 - Help leading companies cut energy intensity by 25% over 10 years
- \$204 M (69%) increase:
 - + \$149 M (161%) for Advanced Manufacturing R&D Facilities:
[which include Clean Energy Manufacturing Innovation Institutes, Critical Materials Hub, Manufacturing Demonstration Facility]
 - + \$49 M (58%) for R&D Projects (includes Advanced Incubator)
 - + \$7 M (28%) for Industrial Technical Assistance



Manufacturing Program: Advanced Manufacturing R&D Facilities, + \$149 M (\$241 M total)

- The increase is for two (\$70 M each) new Clean Energy Manufacturing Innovation Institutes (CEMIs) & support for four existing institutes
 - New Institutes focus may include manufacturing of: advanced materials, two-dimensional roll-to-roll, and/or high efficiency modular chemical process
 - Four existing institutes: Next Generation Power Electronics (2013), Advanced Composites (2014), Smart Manufacturing (2014), and one to be announced in FY2015
 - Institutes are part of the President's National Network for Manufacturing Innovation (NNMI)
 - Institutes focus on technologies applicable to multiple industries and markets
 - Institutes bring together government, industry, & academia
 - Each Institute to be financially sustainable within 5-7 years
- \$25 million for the Critical Materials Hub (final year)—led by Ames National Lab (Iowa)—to develop processes and materials to reduce or eliminate need for rare earth elements and other key materials
- \$20 million of further support (final year) for Manufacturing Demonstration Facility at Oak Ridge National Lab



Manufacturing Program: Advanced Manufacturing R&D Projects, + \$49 M

- The \$49 million increase would provide a total of \$133 M for Advanced Manufacturing R&D Projects, of which:
- \$113 million for new projects of \$15 to \$20 million each, covering up to six “foundational” areas:
 - Chemical process intensification and smart manufacturing—two likely areas of focus
 - Grid and resource integration—including advanced combined heat and power, waste heat recovery, advanced insulation materials, and integration of energy infrastructure (grid and natural gas)
 - Next generation electric machines—including ultraconductive materials
 - Sustainable manufacturing—including water-energy nexus
- \$20 million for the Advanced Manufacturing Incubator—focused on “fundamental” applied R&D projects for small- and medium-sized manufacturing companies



Vehicles Program, Highlights (FY2016-FY2015 difference)

- Goals & Objectives
 - Parity for Plug-in EV affordability & convenience by 2022
 - 50% cut in combined battery & drive cost, from 2012 to 2022
 - Cut battery cost from \$300/kwh in 2014 to \$125/kwh 2022
 - Reduce vehicle materials weight by 30% from 2002 to 2022
 - Cut electric drive cost from \$16/kw in 2013 to \$8/kw by 2022
 - Grid Modernization Crosscut
 - 1.8 million barrels per day (16%) cut in oil use trend by 2020
 - 62 miles per gallon (mpg) fuel economy for cars by 2025
- \$164 M (59%) increase, esp. for EV Everywhere Grand Challenge:
 - + \$41 M (39%) for Batteries & Electric Drives:
[advanced batteries, power electronics, charging stations]
 - + 28 M (100%) for Outreach and Deployment
 - + 35 M (98%) for Materials Technology
 - + 17 M (85%) for Fuels and Lubricants



Vehicles Subprogram Changes (FY2016-FY2015 difference)

- Batteries & Electric Drives (+ \$41 M)
 - Reduce weight and costs
 - Develop rare earth-free motors and magnets
 - Improve wide bandgap power electronics
 - Atomic/molecular coatings for lithium-ion electrodes
- Materials Technology (+ \$35 M)
 - Carbon fiber composites & alloys (steel, aluminum, magnesium)
 - Lightweight materials compatible with manufacturing infrastructure
 - High temperature materials for valves & turbochargers
- Outreach and Deployment (+ \$28 M)
 - Initiate Alternative Fuel Vehicle Community Partner projects
 - Up to five IAFVCP projects, with 50% cost share
- Vehicle Systems (+ \$28 M)
 - PEV vehicle-grid integration, wireless charging, codes/standards, modelling/simulation; Supertruck II (idling, HVAC)



Solar Program, Highlights (FY2016-FY2015 difference)

Goals & Objectives

- 6 cents/kilowatt-hour for utility-scale photovoltaic (PV) plants, a 75% cost cut from 2010 to 2020 (SunShot Initiative)
- Installed PV capacity cost targets of \$1 M/megawatt-hour(mwh) for utility-scale (\$1.25 M/mwh commercial, \$1.50 M/mwh residential)
- Concentrated solar power (CSP) installed cost of \$3.5 M/mwh (includes storage), equivalent to 6 cents/kwh
- Grid Integration Initiative

Solar, + \$104 M (45%)

- + \$33 M (75%) for Systems Integration (grid, dispatchability)
- + \$27 M (76%) for Photovoltaic R&D (reliability, cell efficiency)
- + \$27 M (65%) for Balance of Systems (barriers, new markets)
- + \$16 M (27%) for Manufacturing Innovations (process, tools)



Buildings Program, Highlights (FY2016-FY2015 difference)

Goals & Objectives

- 50% cut in energy use for new buildings, from 2010 to 2030

Buildings, + \$92 M (54%)

- + \$57 M (102%) for Emerging Technologies, R&D on sensors, controls, and grid integration; and new air conditioning & refrigeration technologies
- + \$25 M (111%) for residential buildings, to support retrofits & building codes for new construction
- + \$16 M (29%) to accelerate federal equipment standards & model building codes
- Note: Major long-term barriers (Cong. Staff, see CRS report R40670 by Paul Parfomak)



Geothermal Program: Hydrothermal + \$24 M (\$37 M total)

Goals & Objectives:

- Cut cost from 22 cents/kwh to 10 cents/kwh by 2030
- Develop 30 gw of new, undiscovered resources

Program Activities:

- Complete phase 1 of Play Fairway Analysis (PFA)
 - Identify target “blind” resource areas (2-3 miles deep)
 - Adapt tools to predict heat & permeability
 - Adapt oil/gas/mining technology to higher temperatures & pressures
- For target areas, launch phase 2 of PFA
 - Conduct further seismic, gravity, and other sensing surveys
 - Conduct other geological studies & exploratory “slimhole” drilling
- Subsurface engineering crosscut (SubTER)
 - Safe, adaptive control of subsurface fractures and fluid flow
 - Use intelligent wellbores, induced seismicity, permeability manipulation
 - Coordinated with USGS, NSF, DOE Nuclear, DOE Fossil



Geothermal Power Program: EGS + \$13 M (\$45 M total)

Description:

- EGS (enhanced geothermal systems) are engineered reservoirs
 - Pressurized fluid injected into hot rock opens existing fractures
 - Increased permeability lets fluid circulate into production well
- 2006 MIT Study (Idaho National Lab)
 - Existing fields: cut failure rate, add to capacity & lifetime
 - At six miles deep, enough usable heat nationwide for 100 gw
 - Study focused on resource, technology, and economics
- Some debate over fracking aspect
 - Concerns: earthquakes, leakages/spills
 - Responses: DOE seismicity protocol, best practices (Newberry)

Goals & Program Activities:

- Develop 100 gw of resources
- FY2016 focus on first field lab drilling (FORGE); further CO2 tests



Wind Program, Highlights (FY2016-FY2015 difference)

Goals & Objectives

- Land-Based: 5.7 cents/kilowatt-hour (kwh) for energy cost of utility-scale turbines by 2020 and 4.2 cents/kwh by 2030
- Offshore: cut energy cost from 21 cents/kwh in 2010 to 17 cents/kwh by 2020 (unsubsidized); install three demonstrations by 2017
- Increase installed windfarm capacity from 65 million kilowatts (gw) in 2014 to 125 gw by 2020 and 300 gw by 2030

Wind, + \$39 M (36%)

- + \$24 M (68%) for Technology RD&T & Resource Analysis
 - New initiatives: rotor design, drivetrain, and atmosphere-to-electrons (A2e) smart technology demonstration partnerships
- + \$17 M (150%) to Mitigate Market Barriers
 - Transmission access, radar, environmental, and permitting barriers
 - Largest share of increase is for eagle/wildlife impact mitigation



Bioenergy Program, Highlights (FY2016-FY2015 difference)

Goals & Objectives

- \$3 per gallon of gasoline equivalent (gge) for “drop-in” fuels (to replace gasoline, diesel, jet fuel) by 2017
- \$3/gge for biofuel from algal biomass by 2030

Bioenergy, + \$21 M (9%)

- + \$8 M (10%) for Demonstration & Market Transformation: three biorefinery pilot projects, or one new demonstration project—to broaden pathways for converting biomass to hydrocarbon fuels
- + \$7 M (21%) for Feedstocks: increase yield of algal biomass (phase 2) conversion to biofuel intermediate oil



Grant Programs (FY2016-FY2015)

- +\$35 M, Weatherization Program
 - + 19 M, for additional 3,000 retrofits
 - + 15 M, test financial models for multifamily buildings
- +\$20 M, State Energy Program (SEP)
 - + \$15 M, for competitive grants that promote regional, sectoral, and national public-private partnerships for innovative scale-up & best practices
- +\$20 M, Local Energy Program
 - New program, structured like SEP to enhance local government capacity for energy planning, analysis, and program implementation
 - Competitive grants would support best practices, technical assistance, and leadership-by-example



Innovation Hubs (FY2016 requested amount)

Hub focus: innovation & commercialization

- Critical Materials Hub (Manufacturing Program), + \$25 million (final year)
- Buildings Efficiency Hub (became PSU Consortium), zero funding (end of project)





Additional Reference Material

Context: Innovation & Demonstration Projects

- Innovation Valley of Death. Long-standing policy debate over the federal role in filling the gap between R&D and market commercialization.
- Demonstration projects tend to be very expensive.
- ARPA-E was created to spur development of “breakthrough” technologies.
- Loan guarantee program for innovative technologies still open, some funding available to cover subsidy costs.
- Budget deficit concerns tend to limit spending.

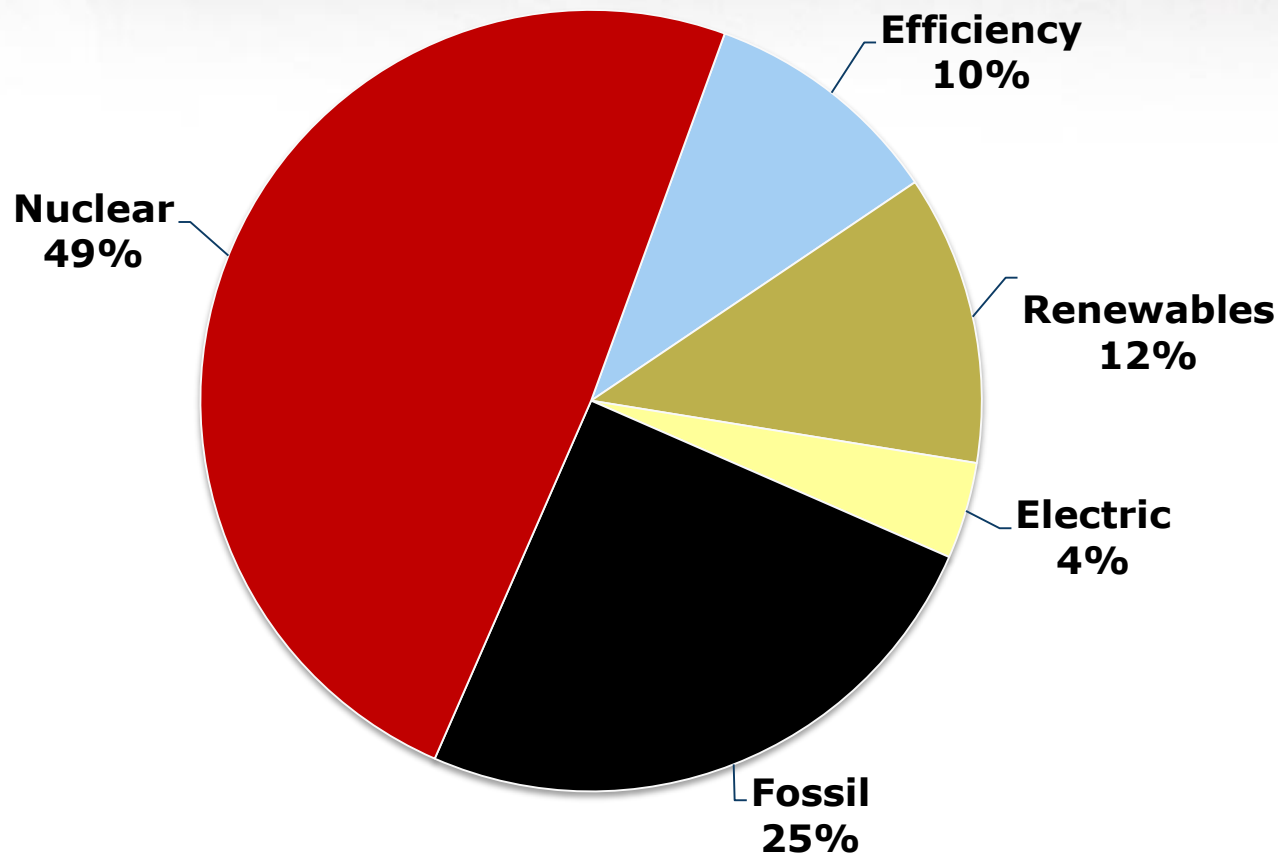


Historical Spending Context for Major Energy Technologies R&D

- Chart of Energy R&D Shares, FY1948-FY2014
- Table with Energy R&D funding for FY2014, FY2015, and FY2016 request
- Chart of Energy R&D funding for FY2014, FY2015, and FY2016 request



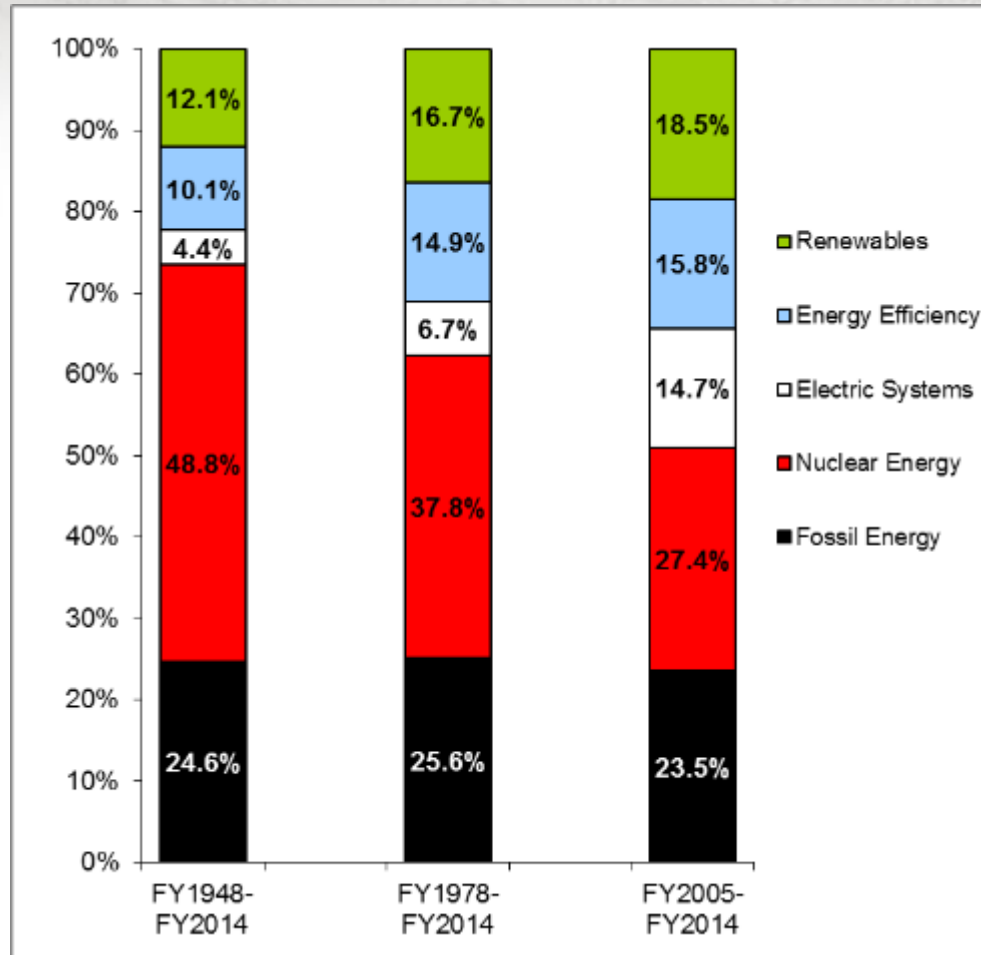
DOE Energy R&D Funding Shares, FY1948-FY2014



Note: Nuclear includes Fission and Fusion. Source: DOE, Analysis of Federal Incentives, 1980 & DOE History Table. Also, see CRS report RS22858.



Charts of Energy R&D Funding Shares: 67-year, 37-year, & 10-year totals



Note: Nuclear includes Fission and Fusion. Source: DOE, Analysis of Federal Incentives, 1980 & DOE Budget History Table. Also, see CRS report RS22858.



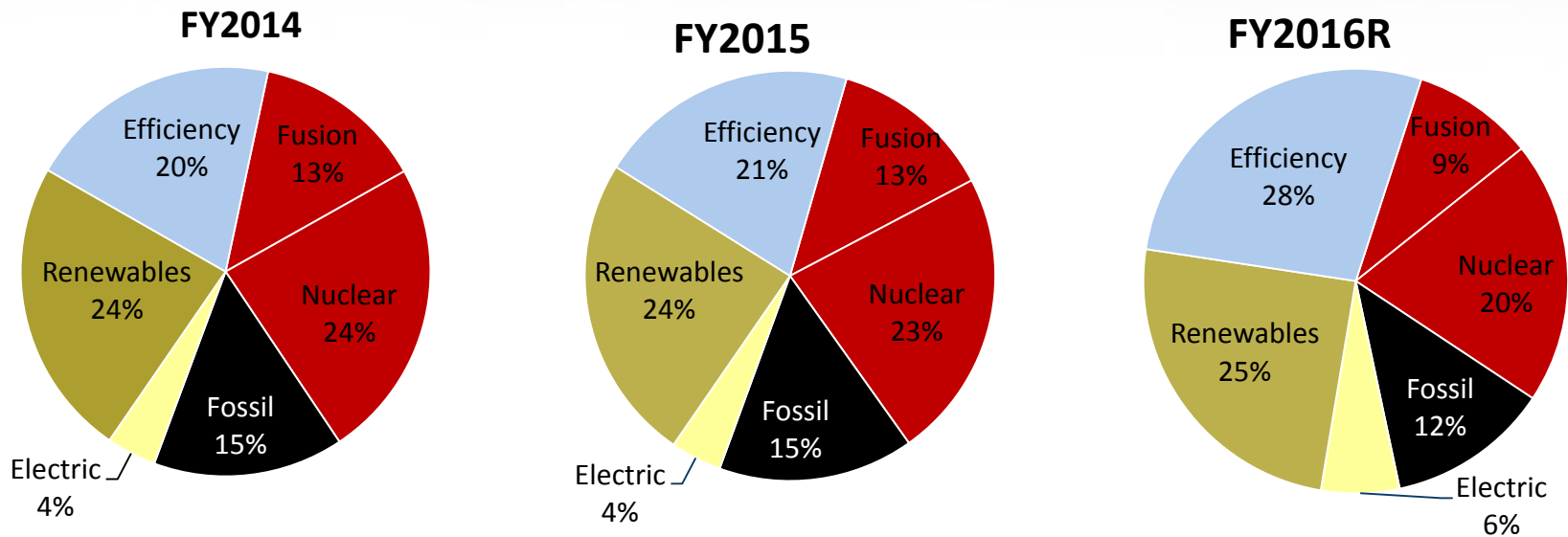
DOE Energy R&D Funding Shares for FY2014, FY2015 and FY2016 Request (\$ millions)

		FY2014	FY2015	FY2016R
Fusion		505	468	420
Nuclear		888	833	908
Fossil		562	561	560
Electric		147	147	270
Renewables		884	885	1,122
Efficiency		750	748	1,250
Totals		3,736	3,642	4,530

Source: DOE FY2016 budget request. Nuclear Fusion is funded under the Office of Science, all others under Energy Resources Supply and Conservation.



Energy R&D Funding Shares: FY2014 Final, FY2015 Final, & FY2016 Request



Source: DOE FY2016 Cong. Budget Request. Fusion is funded under Office of Science, all others under Energy Resources Supply and Conservation.



Framework of Issues for Staff

- Role of government
- Budget deficit
- Trade deficit & competitiveness
- Energy security
- Energy prices
- Pollution & greenhouse gas emissions



Further information available to Congressional Staff:

- CRS R43567, DOE FY2015 appropriations
- CRS R43121, DOE FY2014 appropriations
- CRS R42498, DOE FY2013 appropriations
- CRS RS22858, on R&D funding history
- All are on the CRS web site at:
 - www.crs.gov
 - Fred is at 7-7039, fsissine@crs.loc.gov

