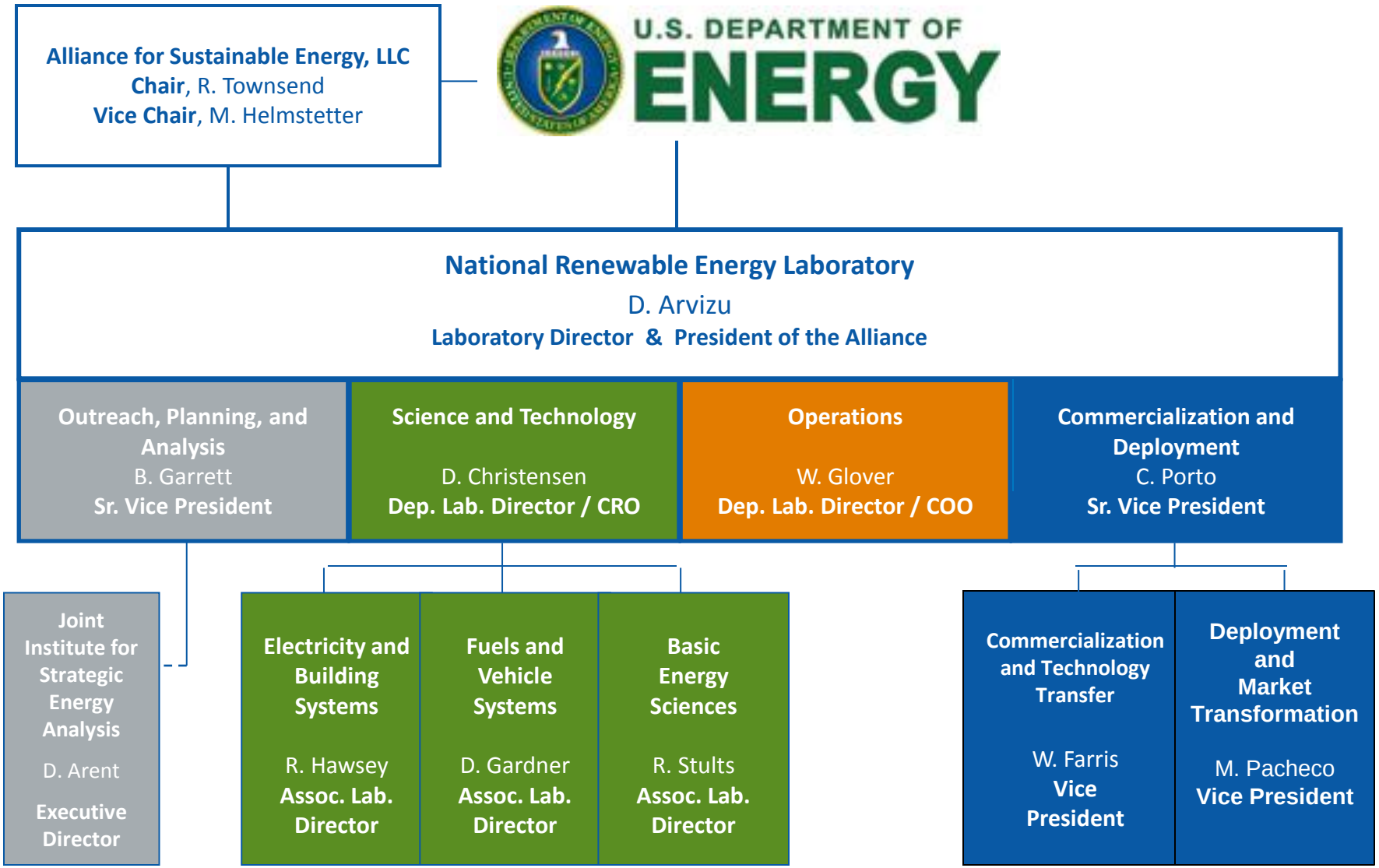
National Renewable Energy Laboratory
Innovation for Our Energy Future

Presentation to STEAB
Commercialization and Deployment at NREL

Casey Porto, Senior Vice President, Commercialization and Deployment

June 8, 2011

How NREL is Organized



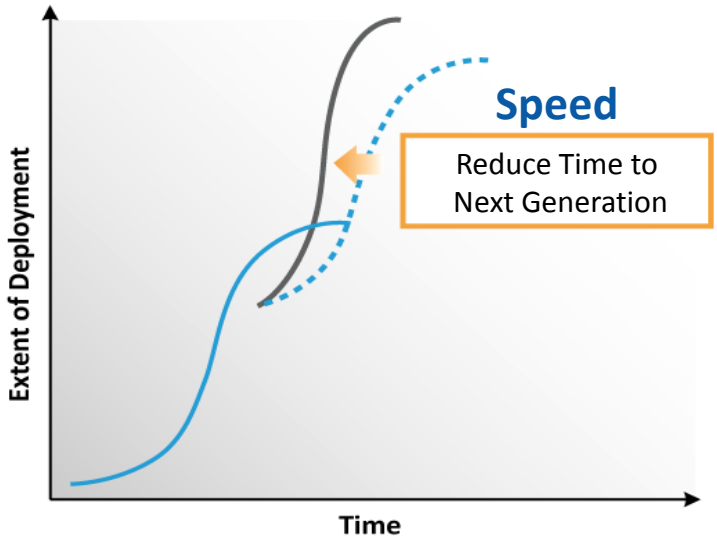
NREL's Mission is Unique

- Only national laboratory dedicated to renewable energy and energy efficiency
- Collaboration with industry and university partners is a hallmark
- Ability to link scientific discovery and product development to accelerate commercialization

Commercialization and Deployment Goals

Commercialization

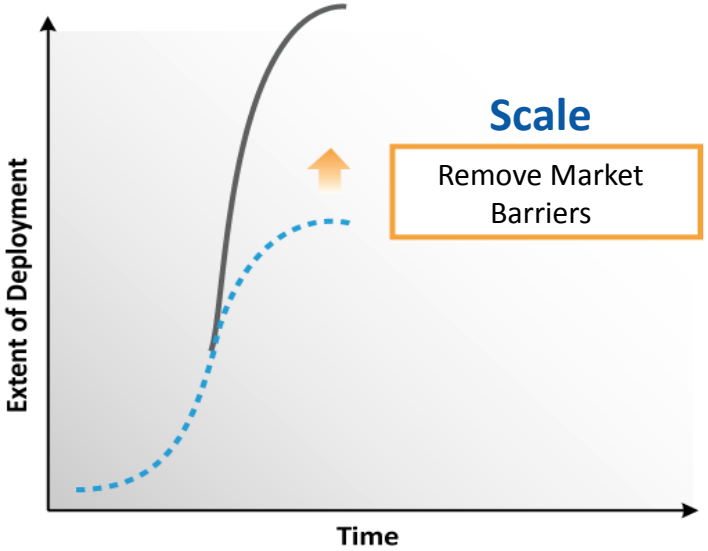
Accelerate the availability (speed) of ***next generation*** technologies



Examples
- **Cellulosic ethanol by 2012**
- **Cost-competitive photovoltaics by 2015**

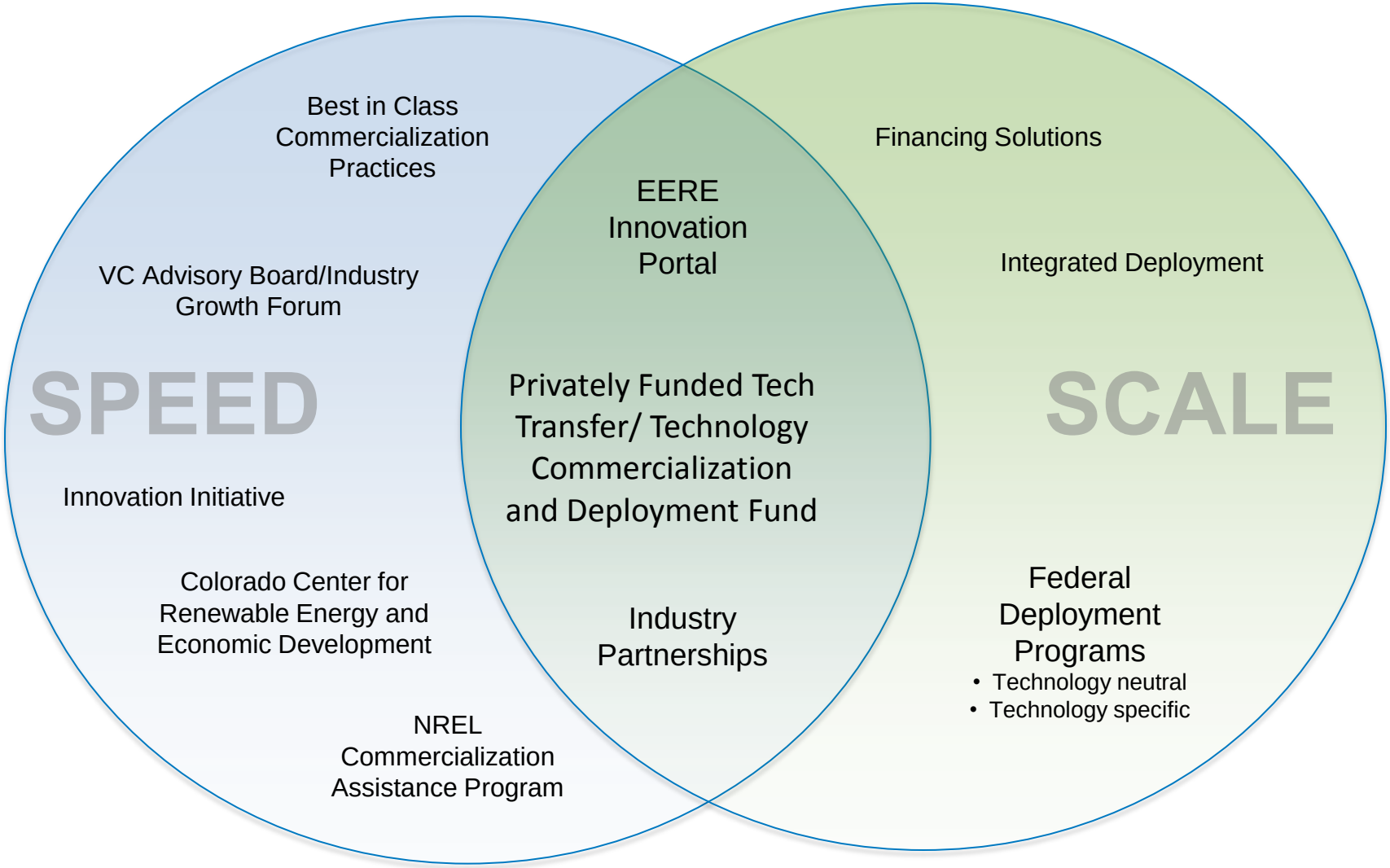
Deployment

Increase market adoption (scale) of ***current generation*** technologies

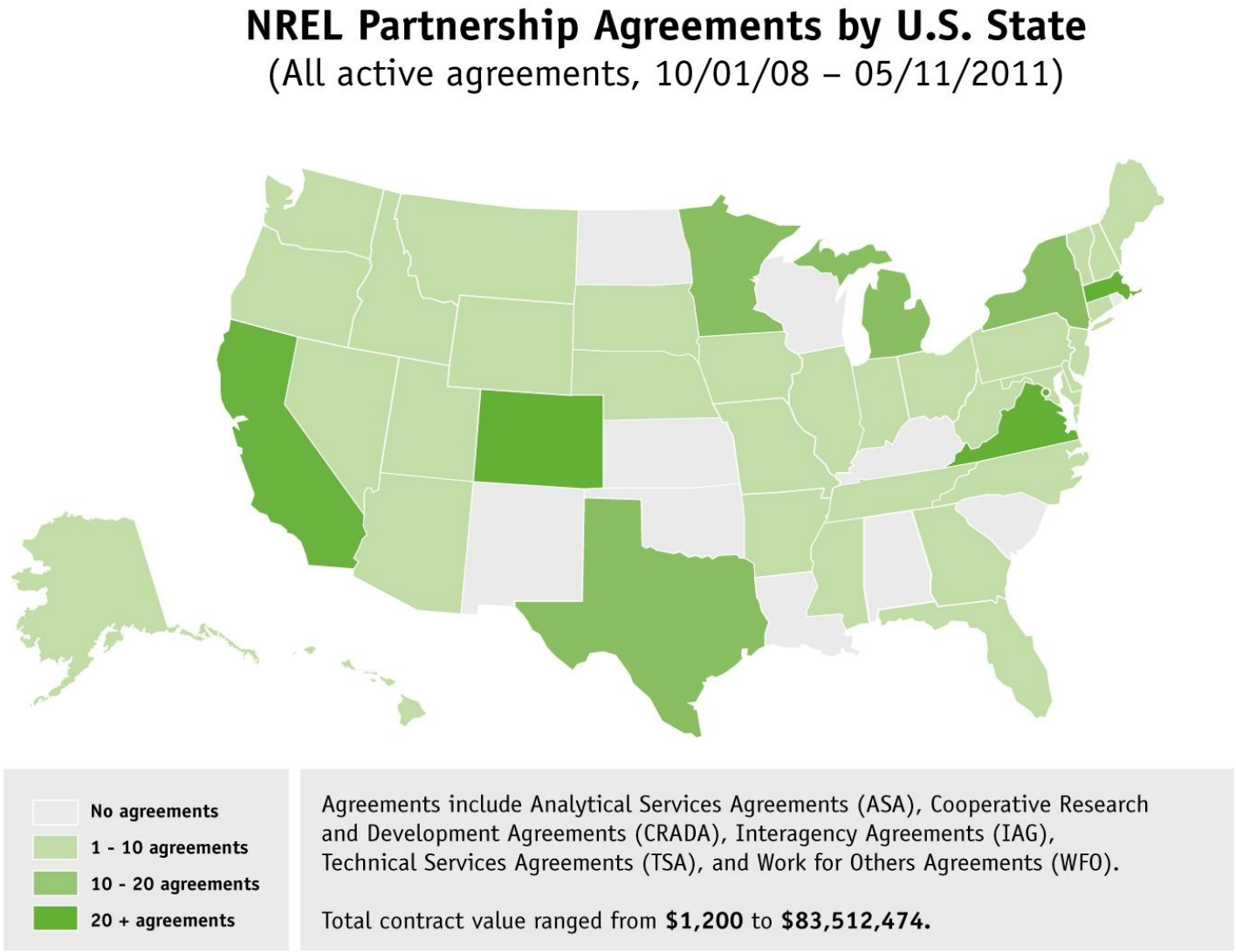


Examples
- **Full E10 market penetration**
- **Compact fluorescents and adv. windows**

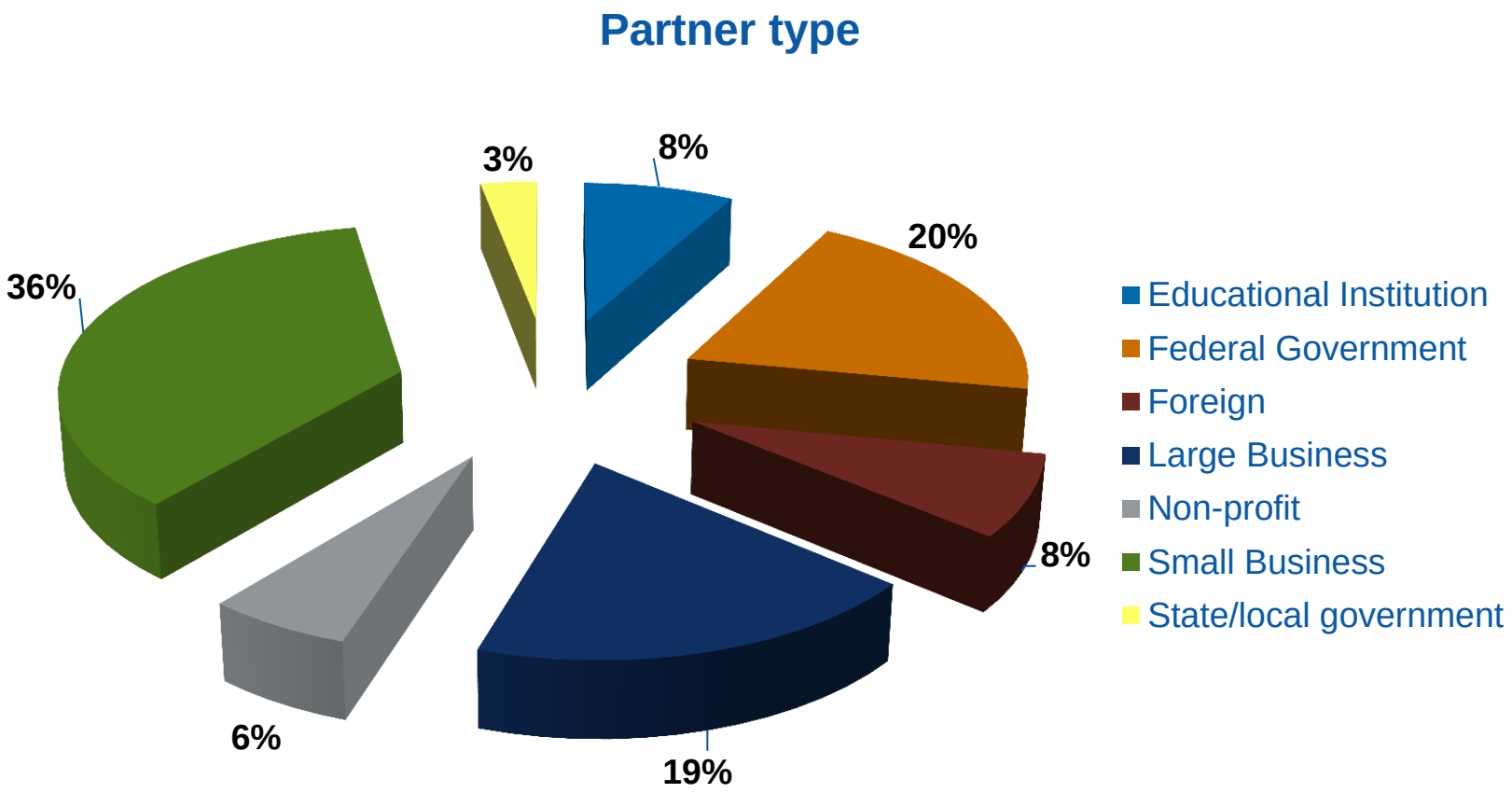
Commercialization and Deployment Programs and Activities



Map of Partnership Agreements



Technology Partnership Agreements



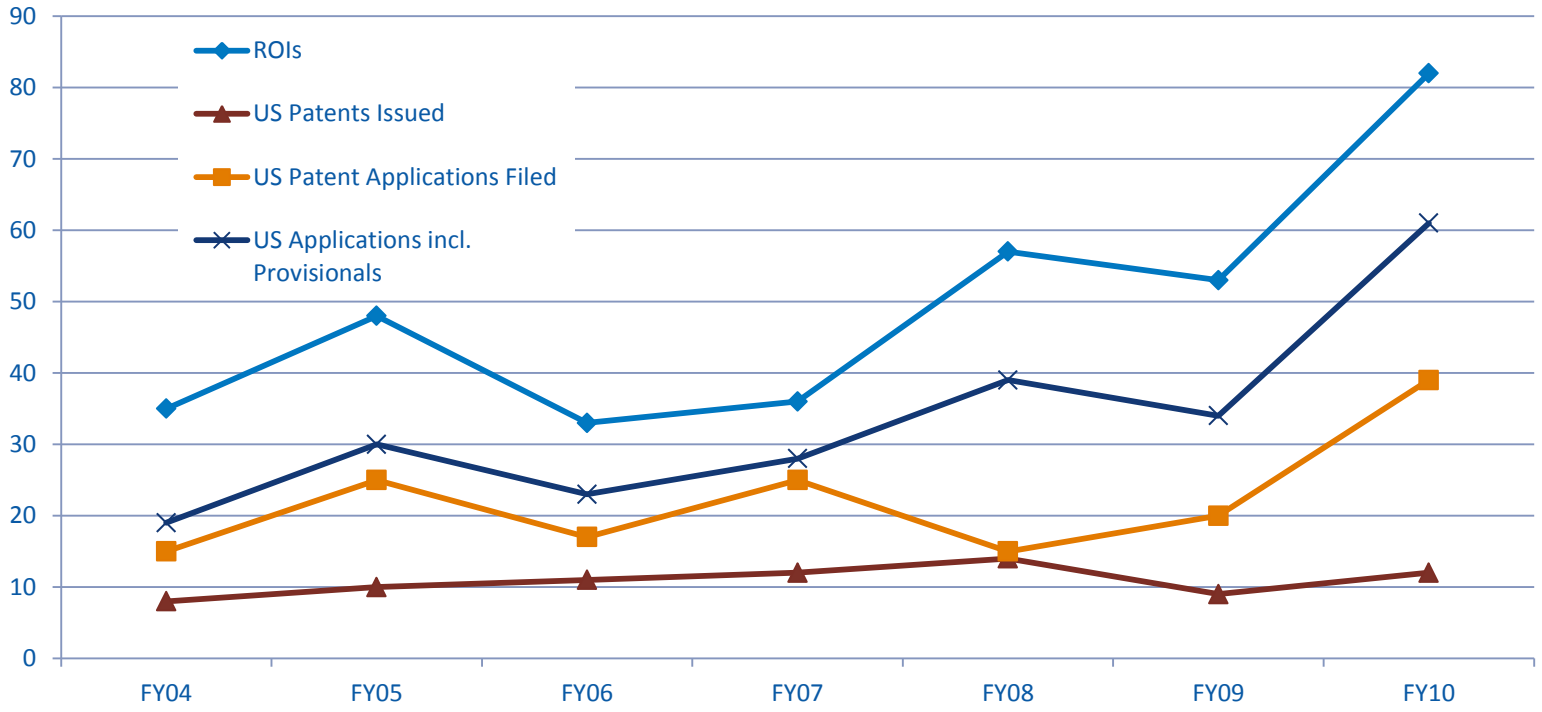
Partnership Cycle Times

	Baseline FY04 – 08	Process improvement period 05/01/09 – 02/08/10	02/09/10 – 12/13/10
CRADAs	118.5 days	83 days	59.3 days
Funds-In Agreements	124.5 days	83 days	79 days

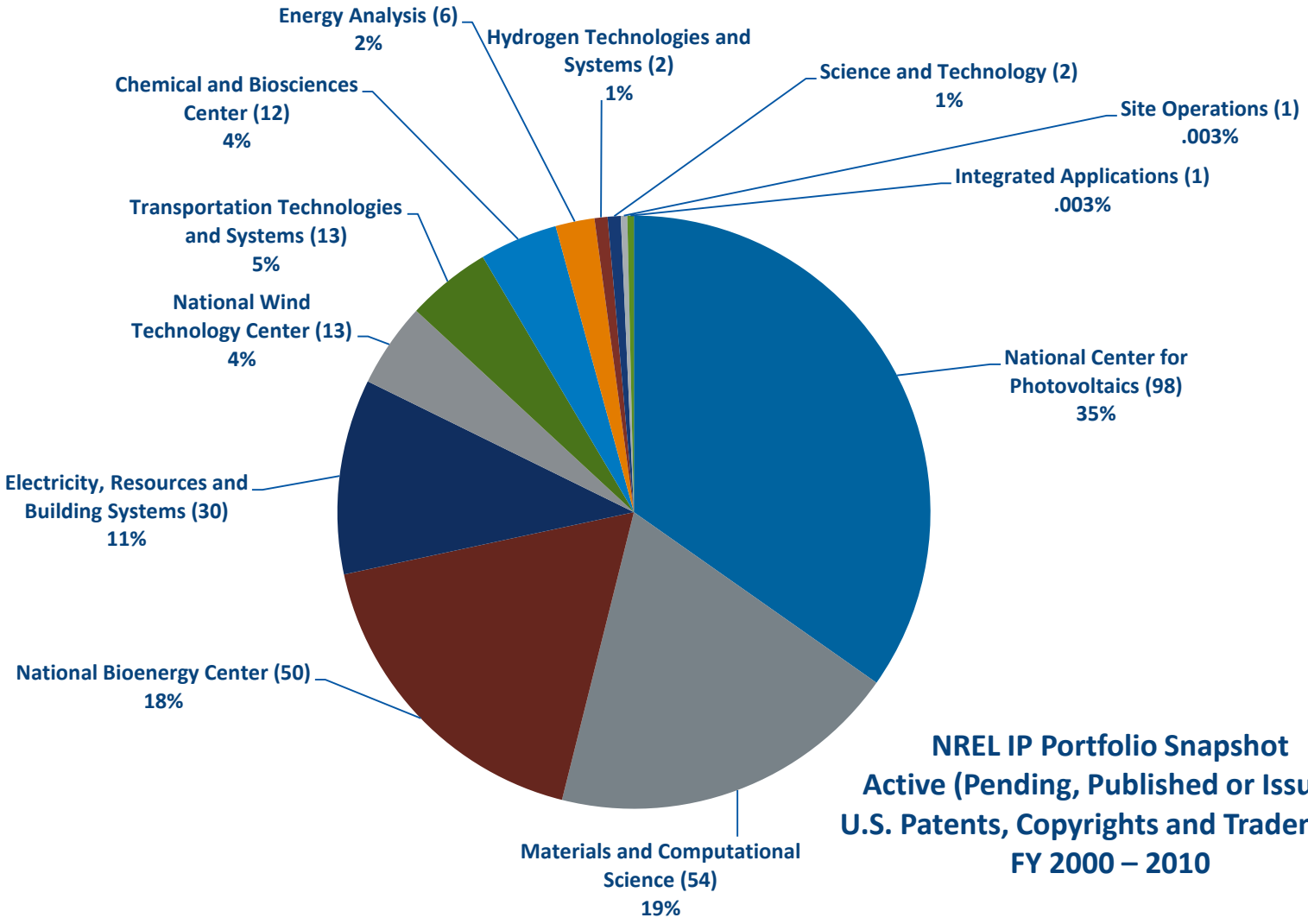
- Cycle times for CRADAs reduced by 50%.
- Cycle times for Funds-In Agreements reduced by 37%.

Inventions and Patents, FY04 – 10

	FY04-08 (median)	FY09	FY10	FY11 (est.)
ROIs:	36	53	70	90
U.S. Patent Applications Filed:	17	20	39	45
U.S. Patents Issued:	11	9	12	18
U.S. Applications including Provisionals:	28	34	61	80



NREL IP Portfolio Snapshot



NREL IP Portfolio Snapshot
Active (Pending, Published or Issued)
U.S. Patents, Copyrights and Trademarks
FY 2000 – 2010

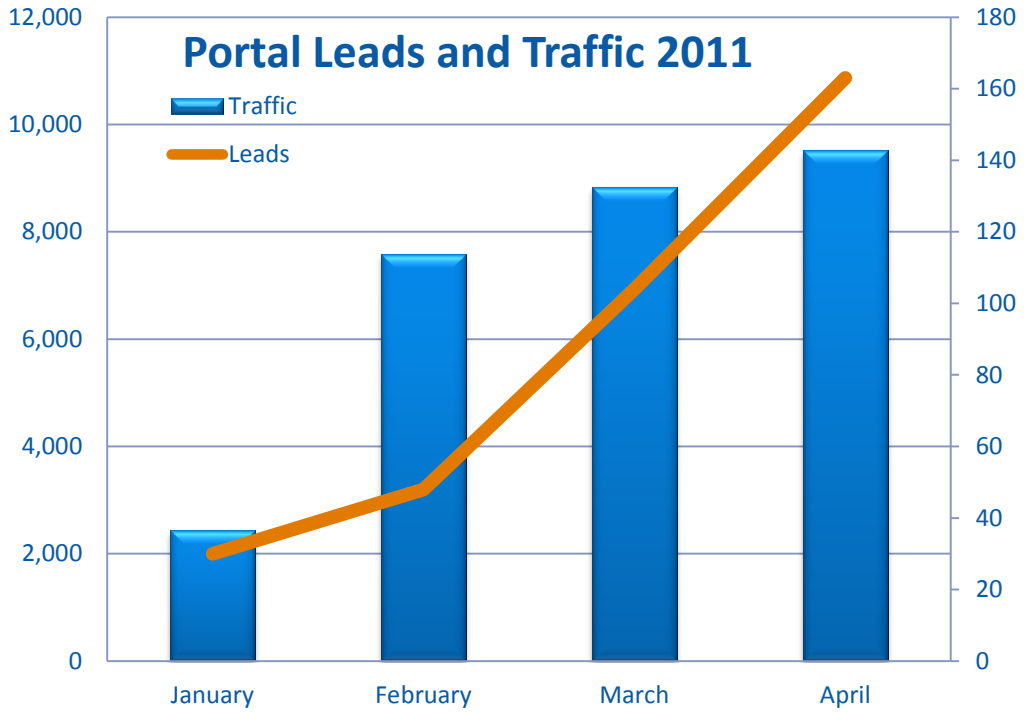
Energy Innovation Portal

Information on energy efficiency and renewable energy technologies created as a result of U.S. Department of Energy funding

- 15,000 patents
- 400+ marketing summaries
- 12 DOE laboratories, NASA, and three University partners
- 14 technology areas

http://techportal.eere.energy.gov

Leads from the Energy Innovation Portal



Innovation & Entrepreneurship Center

IEC leads NREL's innovation at the intersection of the public and private sectors relating to entrepreneurship, new ventures, and growth capital. IEC goals:

1) Creating an *Innovative and Entrepreneurial Environme*nt that is a seamless part of the fabric of NREL

2) Promoting NREL as a key catalyst for economic development by *Accelerating and Improving the Yield* of regional clean energy innovations

3) Fostering broad based *Investor Relationships* for clean energy entrepreneurs

4) Enhancing NREL's *Small Business Program*

NREL Industry Growth Forum

- The premier clean energy investment event
  - **Hands-on-management and coaching** for evolving clean energy companies
  - **Relationship platform** for companies seeking funding

NREL NATIONAL RENEWABLE ENERGY LABORATORY | INDUSTRY GROWTH FORUM

INNOVATE • PARTNER • NETWORK • INVEST

The 2010 Forum featured:

- Presentations from 34 emerging clean energy companies
- Provocative panels led by thought leaders
- One-on-one meetings
- Strategic investors

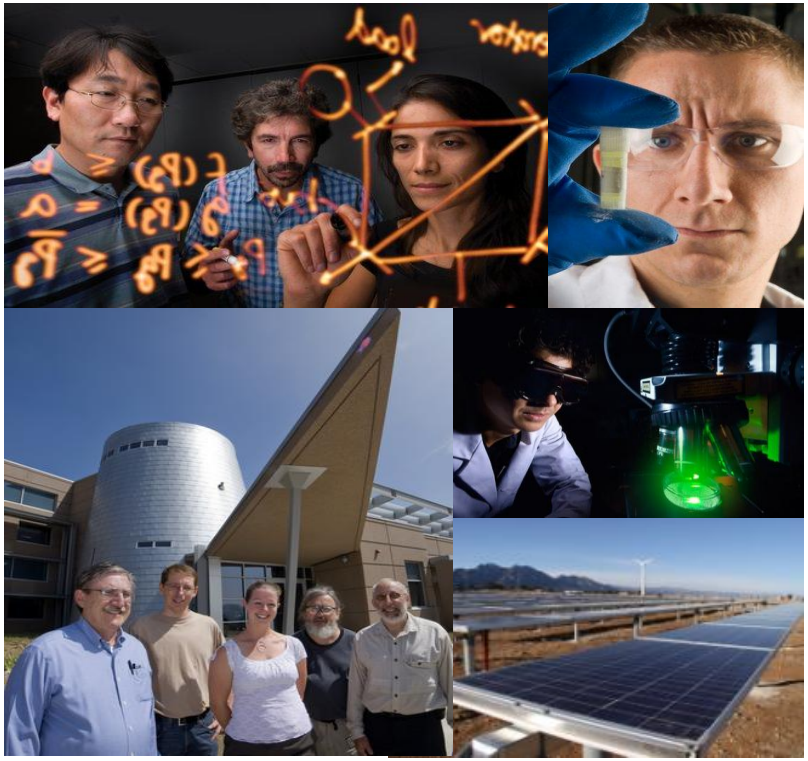
Since 2003, more than half of the companies participating in the Forum have received funding, cumulatively raising more than ***$3.4 billion*** in growth financing* and creating more than **3,000 U.S. jobs****

*Source: New Energy Finance
**Source: Hoovers

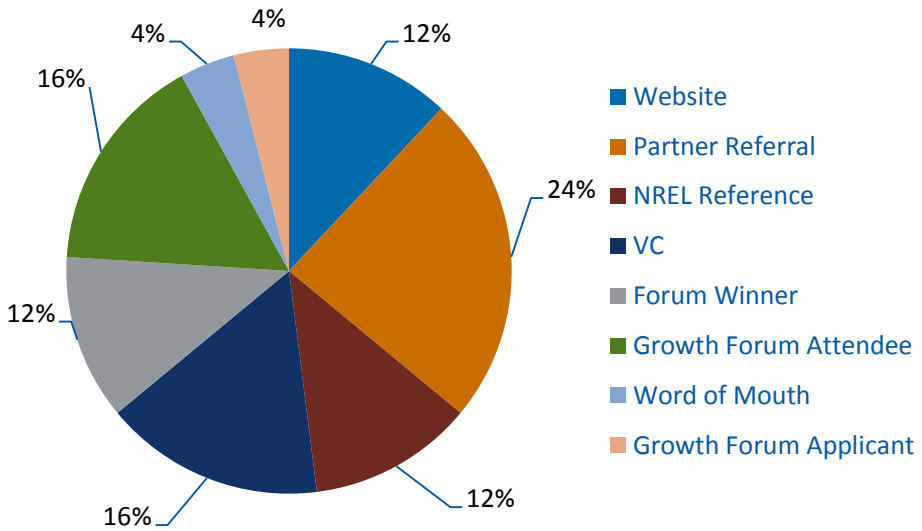
Join us November 8, 9, and 10, 2011 in Denver, Colorado for the 24th NREL Industry Growth Forum

NREL Commercialization Assistance Program

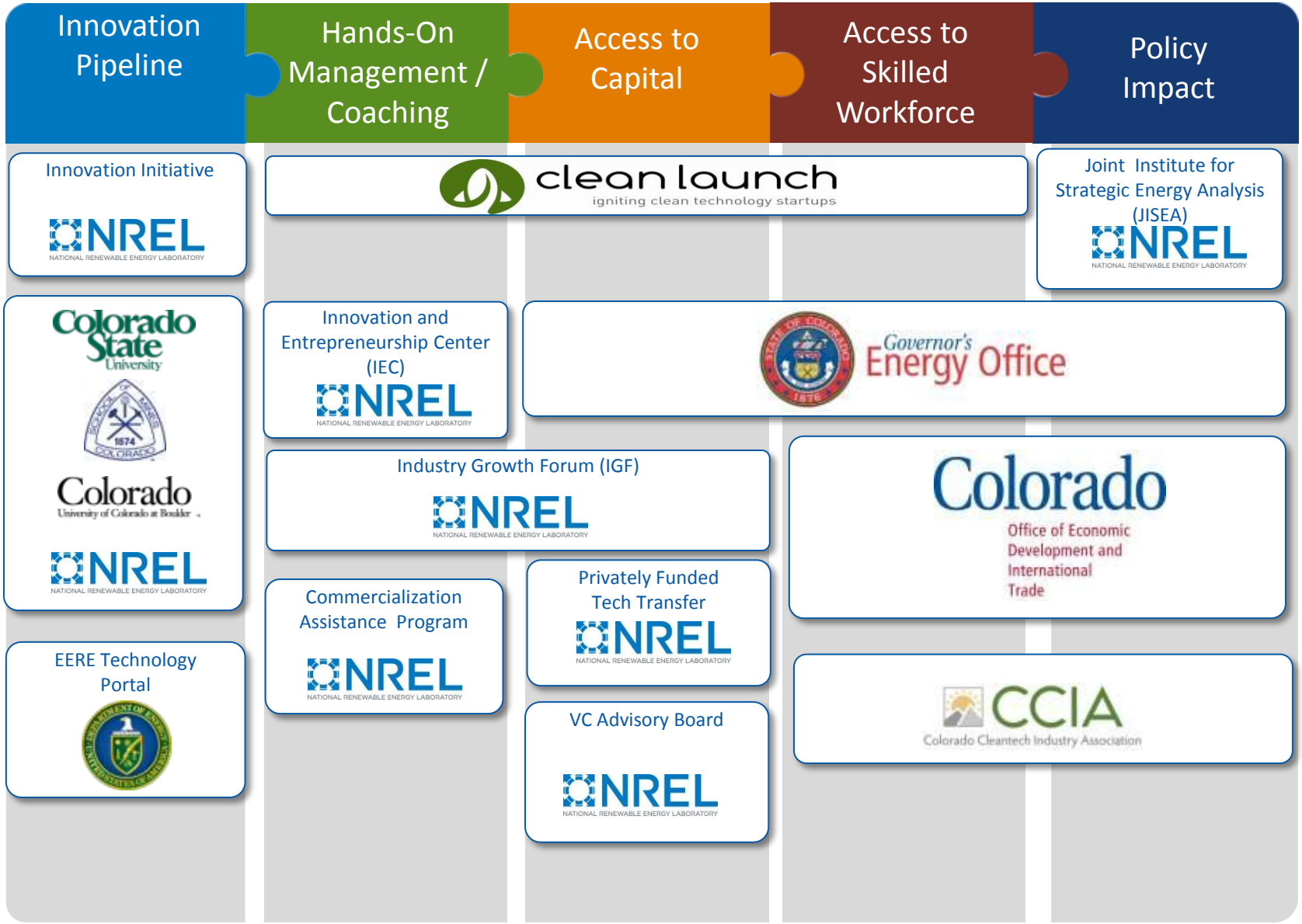
NCAP provides assistance and information to help energy efficiency and renewable energy small businesses with **technology challenges**



Where do NCAP projects come from?



Colorado Center for Renewable Energy and Economic Development—CREED



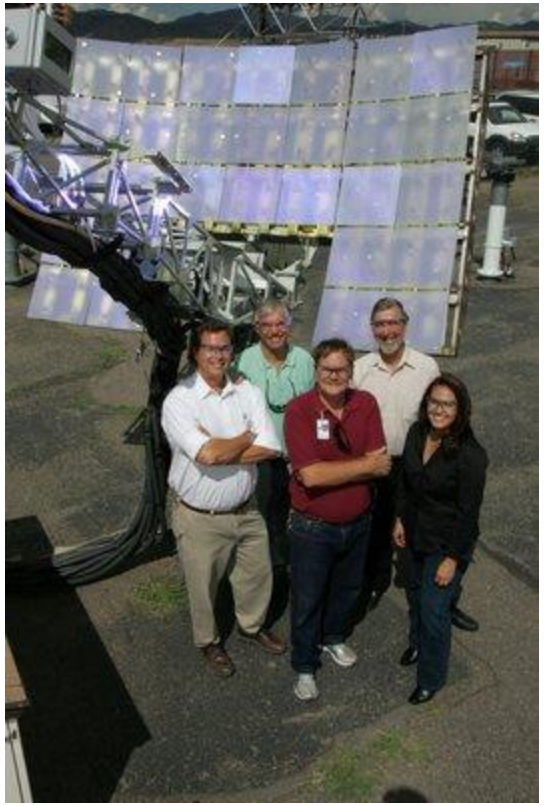
Venture Capital Advisory Board

The NREL Venture Capital Advisory Board advises the laboratory and our collaborators on our strategic plans and programs in the clean energy sector:

- Development of clean energy start-ups and how they can successfully raise financing
- Commercialization of mission relevant technologies
- Speed to market for new technologies
- Identification and fostering of technologies that can serve an unmet market
- Identification and analysis of market trends
- Assessment and commentary on the technology pipeline.

The funds represented on the Board have more than $4 billion under management.

Technology Commercialization Funds



The Ultra-Accelerated Weathering System won an R&D100 Award and received TCDF funds.

The TCDF program provides funding for technology maturation to bridge the "valley of death" that many promising nascent technologies face when research funding ends, but the technology requires further development before a commercial partner will invest.

Under the TCDF program, commercial partners cost-share project development costs, which typically range from $150,000 to $1 million.

Privately Funded Technology Transfer (PFTT)

- Non-Federal resources used to fund commercialization activities.
- Demonstrates contractor commitment to technology transfer.
- The Black Silicon Portfolio was licensed only *six months* after the PFTT program's inception at NREL.
- Eight technology bundles are currently in the NREL program.
- Multiple technology maturation projects are underway.

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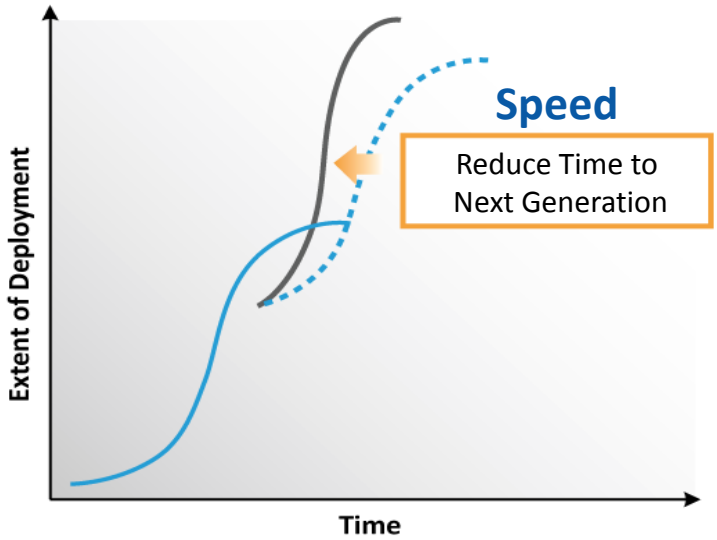

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Deployment

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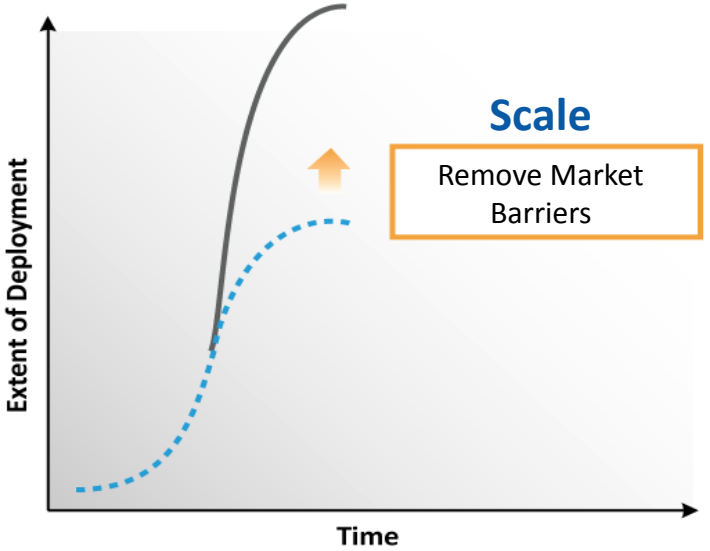

Examples
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Today: Responding to the National Challenge

"Accelerate the commercialization and market penetration of these technologies, technologies that will enable the nation to meet our current and future energy challenges head on." Section C.4 (a) of DOE RFP

In 2008, NREL created the Deployment & Market Transformation directorate to:

- Centralize deployment activities to work across the spectrum of energy efficiency and renewable energy technologies
- Leverage resources across NREL to create synergy and best practices across technical programs

This change expands our capabilities to:

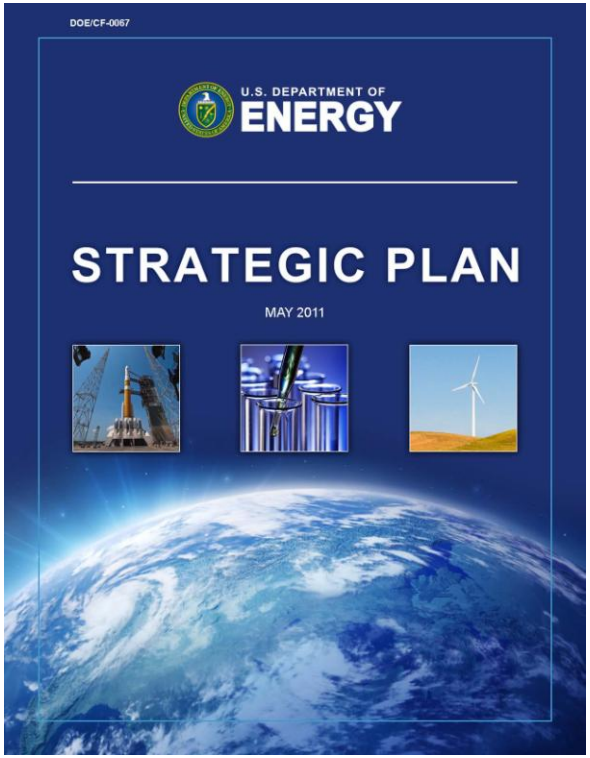
- Help define and understand attributes of a sustainable future energy system
- Accelerate large-scale adoption of proven technologies to meet national energy goals

Deployment is a DOE Priority

"Deploy the technologies we have."

- Drive energy efficiency to reduce demand growth
- Demonstrate and deploy clean energy technologies
- Modernize the electric grid
- Enable prudent development of our natural resources

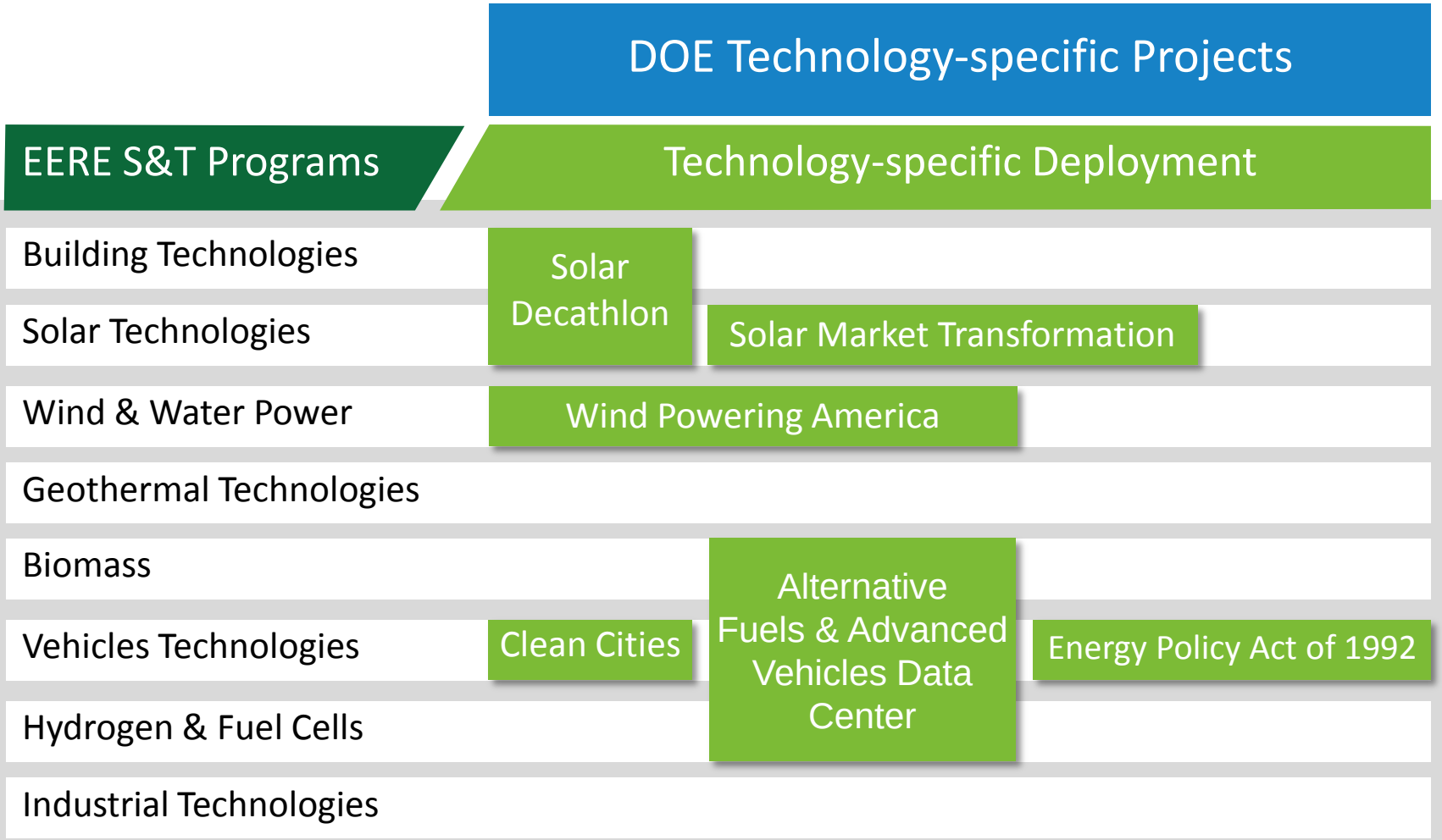
U.S. Department of Energy Strategic Plan, May 2011



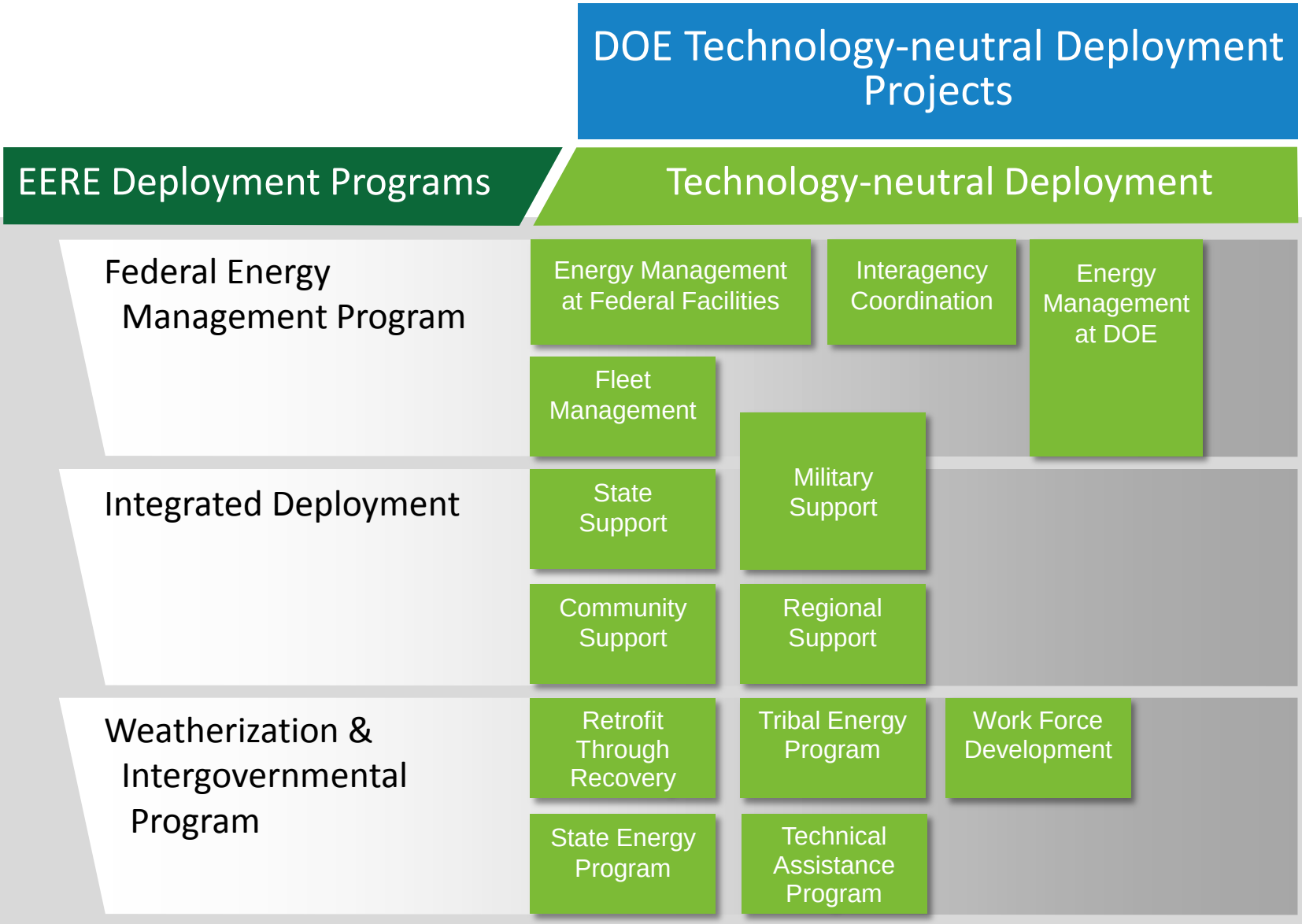
Structured to Support Two Client Types

	Market Transformation Center (MTC)	Integrated Application Center (IAC)
Clients	• Interest in support for a specific technology solution—have made technology decision • Typically in the supply chain for the technology, or part of user community	• Does not have a specific technology solution in mind • Typically communities, facility managers, government agencies
Needs	Tools and processes to accelerate deployment of a family of technologies	A suite of decision support tools and processes to select among options
NREL Support	Focuses on removing barriers to adoption of the specific technology	Provides assessments, analyses, project development, financing approaches, workforce development
Example Programs	• Alternative Fuels Data Center • Clean Cities • Solar Decathlon • Solar Market Transformation • Wind Powering America	• Technical Assistance Program • FEMP • Integrated Deployment • WIP

Technology-specific Alignment with EERE



Technology-neutral Alignment with EERE



Non-Technical Barriers to Adoption of EE and RE

- Need for additional capacity at the state and local level
- Inadequate means to access expertise, tools, and know-how
- Marketplace status quo
- Lack of a deployment framework and consensus w.r.t. DOE Labs' role, metrics, and goals in Deployment
- Human factors and limited public awareness of energy issues

Communities need easy access to information and tools to plan their energy future.

Greensburg after May 2007 Tornado

- City destroyed by tornado May, 2007
- Strong local and federal government partnership and commitment
- Demonstrates absence of typical infrastructural barriers

Kiowa County Memorial Hospital March 2010

- ✓ 1st U.S. city requiring govt. buildings to meet LEED Platinum standard
- ✓ Voluntary building standard that exceeds industry EE std by ~ 30%
- ✓ Greensburg Sustainable Building dbase provides details on 23 different building projects in Greensburg

Best Practices of Technology Deployment

NREL addresses barriers through best practices that deliver market relevant support

Focus on Stakeholder Needs

- Access depth and breadth of the lab's world-class technical expertise
- Develop a comprehensive understanding of regulatory, political, social, economic, and market issues
- Identify the right regional solutions

Measure Impact on Deployment

- Work closely with DOE to establish market adoption targets
- Get stakeholder buy-in on targets
- Track progress: leveraged federal investment, customer satisfaction, and scale of deployment/investment/jobs

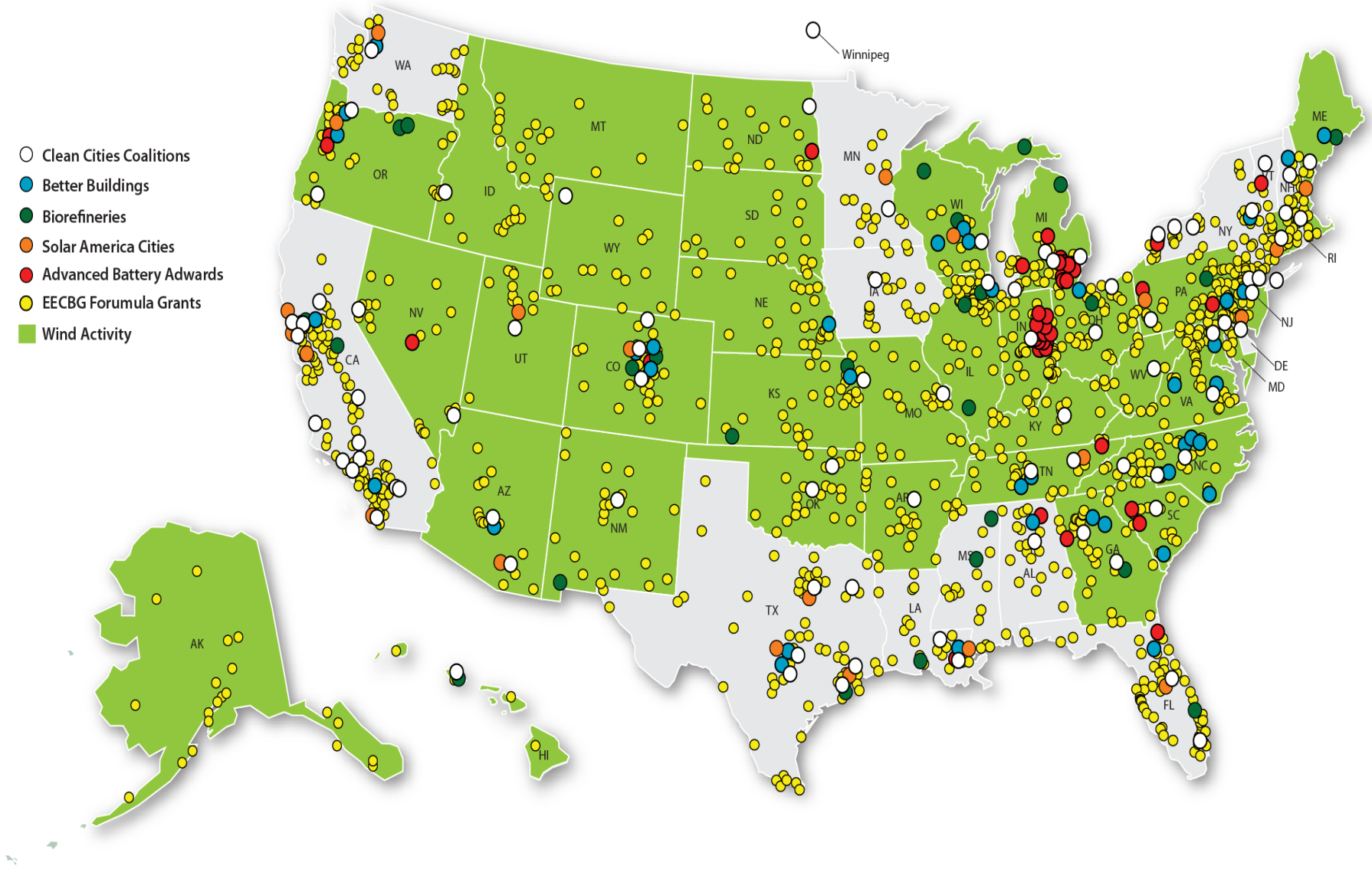
Partner with Governments

- Lead by example by collaborating with state, local, and federal agencies
- Implement, evaluate, and document projects to accelerate deployment
- Customize technical assistance methods based on community and local market needs

Create an Integrated Deployment Model

- Think holistically about transforming energy system and energy usage
- Develop comprehensive approach, scalable at local, state, federal, and national levels
- Support deployment of specific technologies and integration of multiple technologies

Leverage Overlapping EERE Efforts



RE Program Deployment Goals – FY11

Program	Deployment goals
Fuel Cells	Market Adoption of 12,000 kW of fuel cell power by FY15
Biomass	21 Bil gal by 2022 to meet Energy Independence and Security Act of 2007 RFS requirement
Solar	Domestic market growth to enable 600MW of solar installations in the U.S. by FY11
Wind	Facilitate 1,000 MW in at least 15 states by 2018

EE Program Deployment Goals – FY11

Program	Deployment goals
Vehicles	• Support 500,000 PHEV a year by 2015 • Improve fuel economy of new vehicles to an average CAFÉ standard of 35.5 MPG by 2016 • Achieve a petroleum reduction of 2.5 bil gal/year by 2020
Buildings	Residential: Support ramp up of retrofitting industry to 1.3 Mil homes by 2013 Commercial: Ramp up retrofits to save 20% by 2020
FEMP	• Reduce agency energy intensity 3% annually or 30% by FY2015 from a 2003 baseline • 5% of Federal electricity consumption is generated from renewable sources in FY 2010-2012; 7.5% by FY 2013; half from new renewable source
WIP	500,000 energy retrofits in homes occupied by low-income families
Industrial	Partner with leading industrial companies, plants, and supply chains to reduce their energy intensity by 25% over a 10 year period. Partnership activities are estimated to result in energy savings in 2025 of 1,651 trillion BTUs and a carbon savings of 24.5 MMT CO2

Examples of Deployment Products & Services

Technical Support

Workforce Development and Outreach
- Training, workshops, webinars
- Web and new media
- Information portfolio

Technical Advisement
- Codes and standards
- Protocols
- Design review
- 3rd party proposal review

Stakeholder Development
- Partnerships with other agencies
- On-site support

Tool Development

Project Support

Project Identification
- Technical screening
- Option analysis reports

Project Development
- Feasibility assessments
- Financial modeling advice
- Energy expert advice

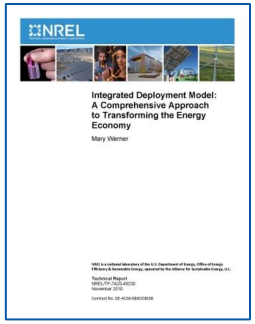
Project Implementation
- Consulting
- Technical RFP advisement
- Technical proposal reviews

Performance Verification

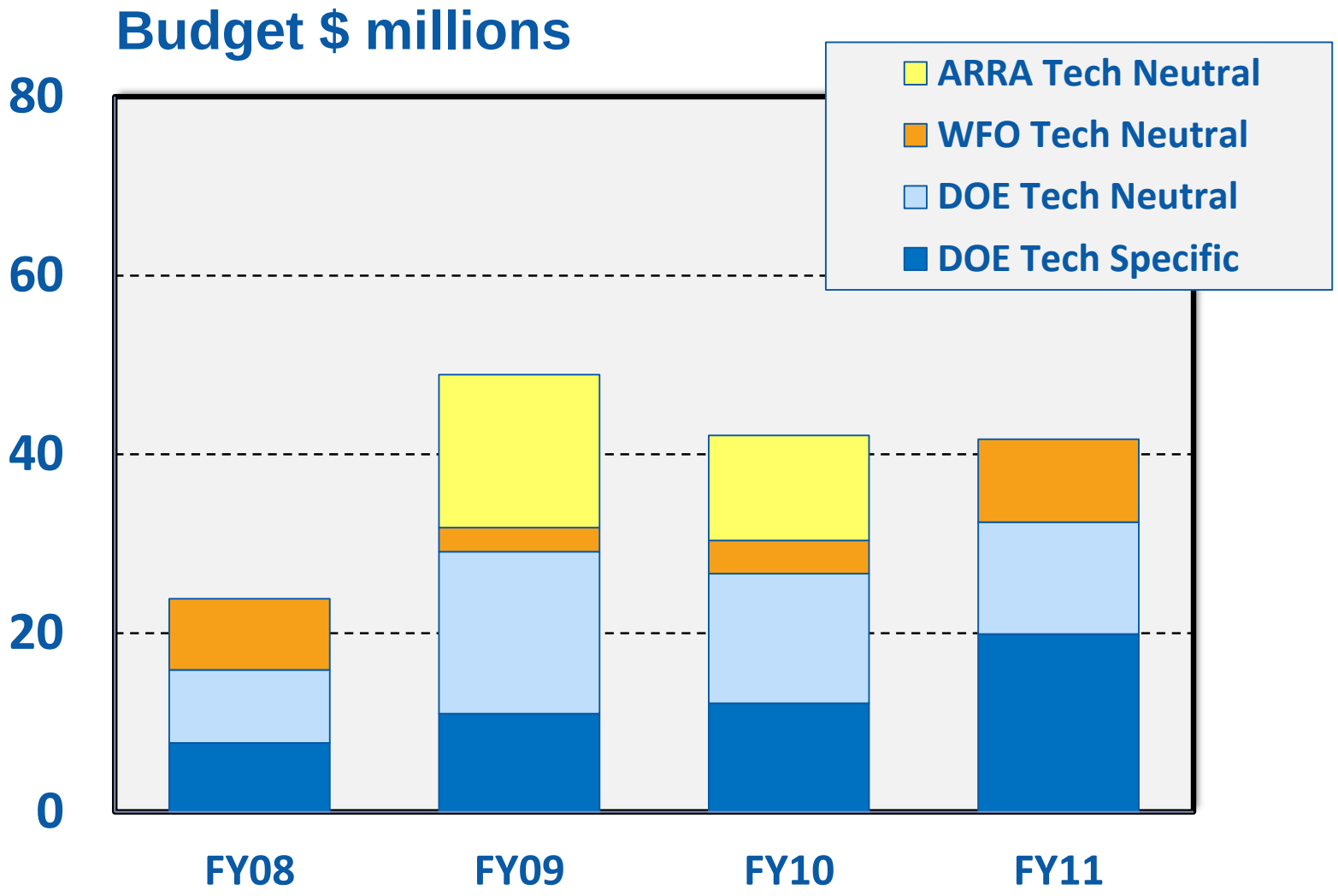
Market Support

Market Identification
- Outreach and opportunity assessments

Market Development
- Expert assistance in market establishment by location



Actual D&MT Funding since FY2008



Other Federal Customers - Examples

Department of Defense
Supporting transformation of Miramar to pilot net-zero energy installations.

Department of State
Directly supporting Energy Service Provider contracting efforts at embassies in Santiago, Chile and Frankfurt, Germany.

Department of Treasury
$7.1 billion in cash grants awarded supporting 10.5 GW of RE as of May 2011.

General Services Administration
Performing detailed building assessments and developing renewable energy master plan for National Capital Region.

Department of Interior
Providing technical assistance and training for wind energy on Bureau of Land Management lands.

Department of Homeland Security
Supporting energy programs by indentifying, assessing, and recommending renewable energy and energy efficiency opportunities.

Department of Commerce
Developing strategic sustainability performance plan, steam and gas metering plan, and fleet assessment.

Department of Agriculture
Supporting implementation of Sections 9003,9005, and 9007 of 2003 Farm Bill

Additional Resources

Learn more about NREL and EERE Deployment and Market Transformation activities:

NREL Applying Technologies Website
www.nrel.gov/applying_technologies/

EERE Deployment Website
www1.eere.energy.gov/deployment/