Overview of Clean Energy Development and Policies

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ICF International
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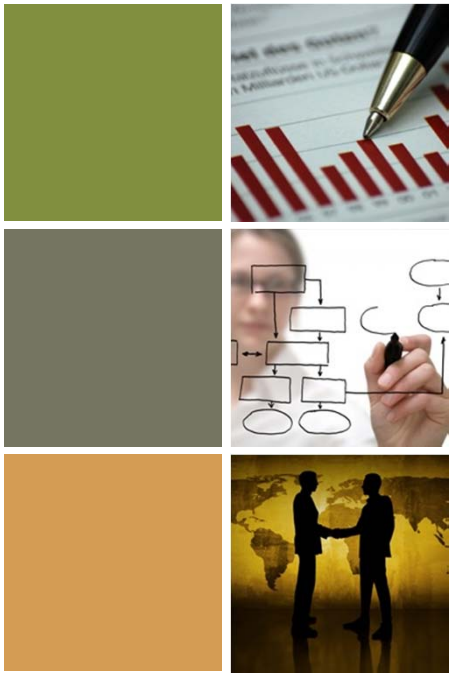
Overview

- ICF Background
- Clean Energy – Definition and Drivers
- Overview of Clean Energy Development
- Policies for Clean Energy Development
- Outlook
- Contacts



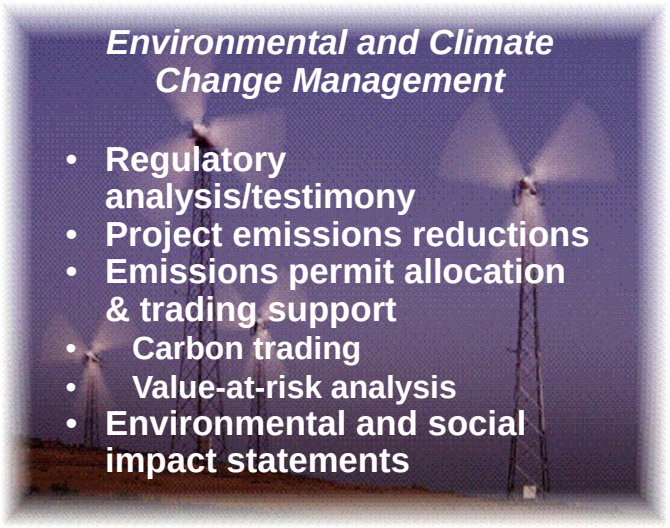
ICF Background

ICF International is among the world's largest management and policy firms specializing in energy and environment

Asset Acquisition & Deployment

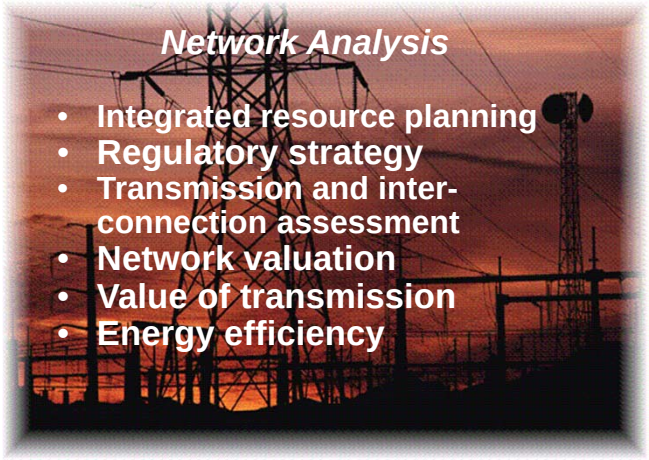
- Wholesale power market and renewables analysis
- Asset valuation, due diligence
- Fuel market analysis
- Asset & portfolio optimization
- Solicitations for new capacity

About 4,500 professionals and 40+ years of experience helping clients manage the world's natural, physical, and economic resources



Environmental and Climate Change Management

- Regulatory analysis/testimony
- Project emissions reductions
- Emissions permit allocation & trading support
- Carbon trading
- Value-at-risk analysis
- Environmental and social impact statements



Network Analysis

- Integrated resource planning
- Regulatory strategy
- Transmission and inter-connection assessment
- Network valuation
- Value of transmission
- Energy efficiency

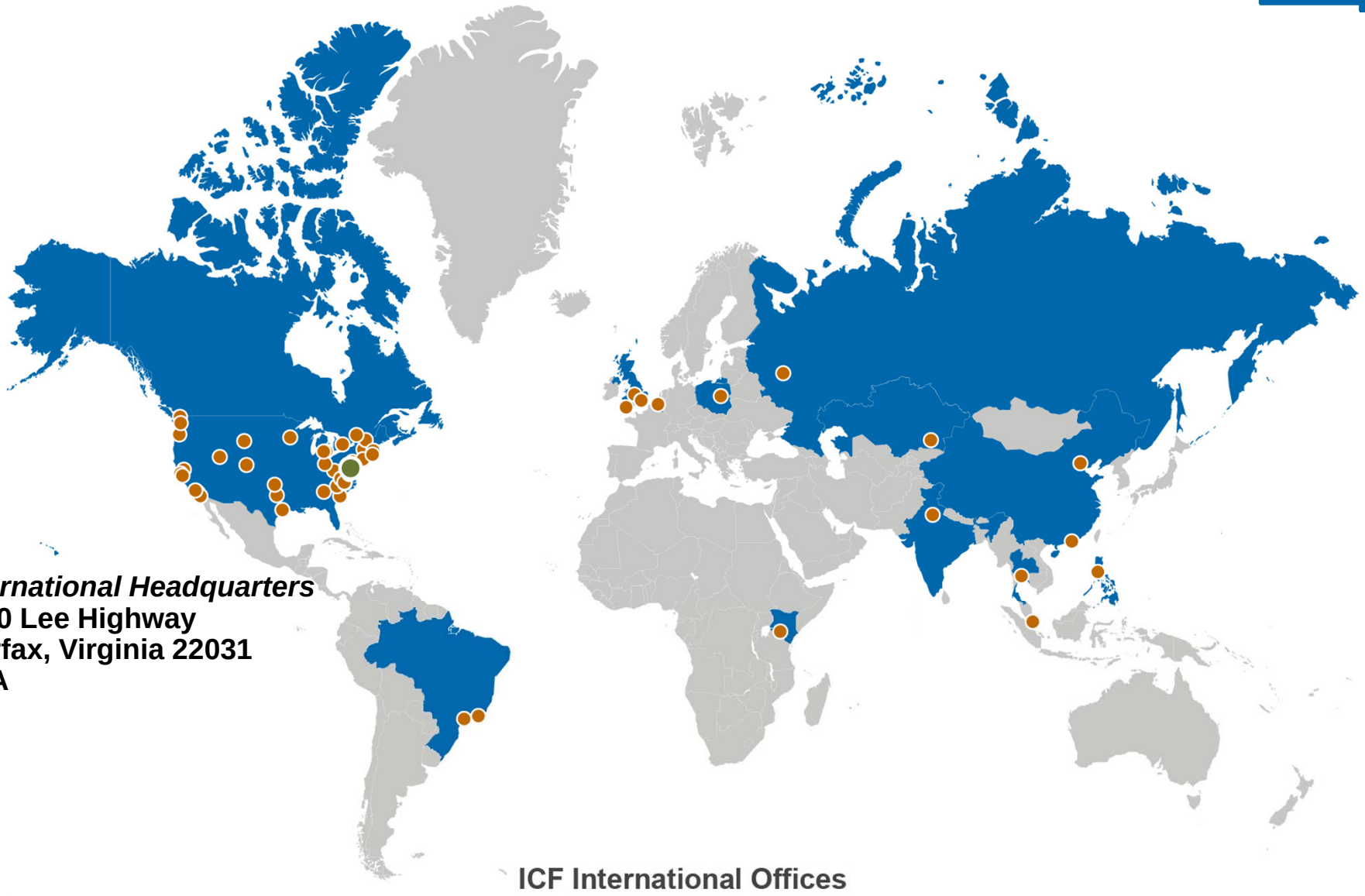
Related Services

- Transport
- Information mgmt systems
- Environmental risk
- Economic & community development
- Emergency management

ICF's International – Global Clients

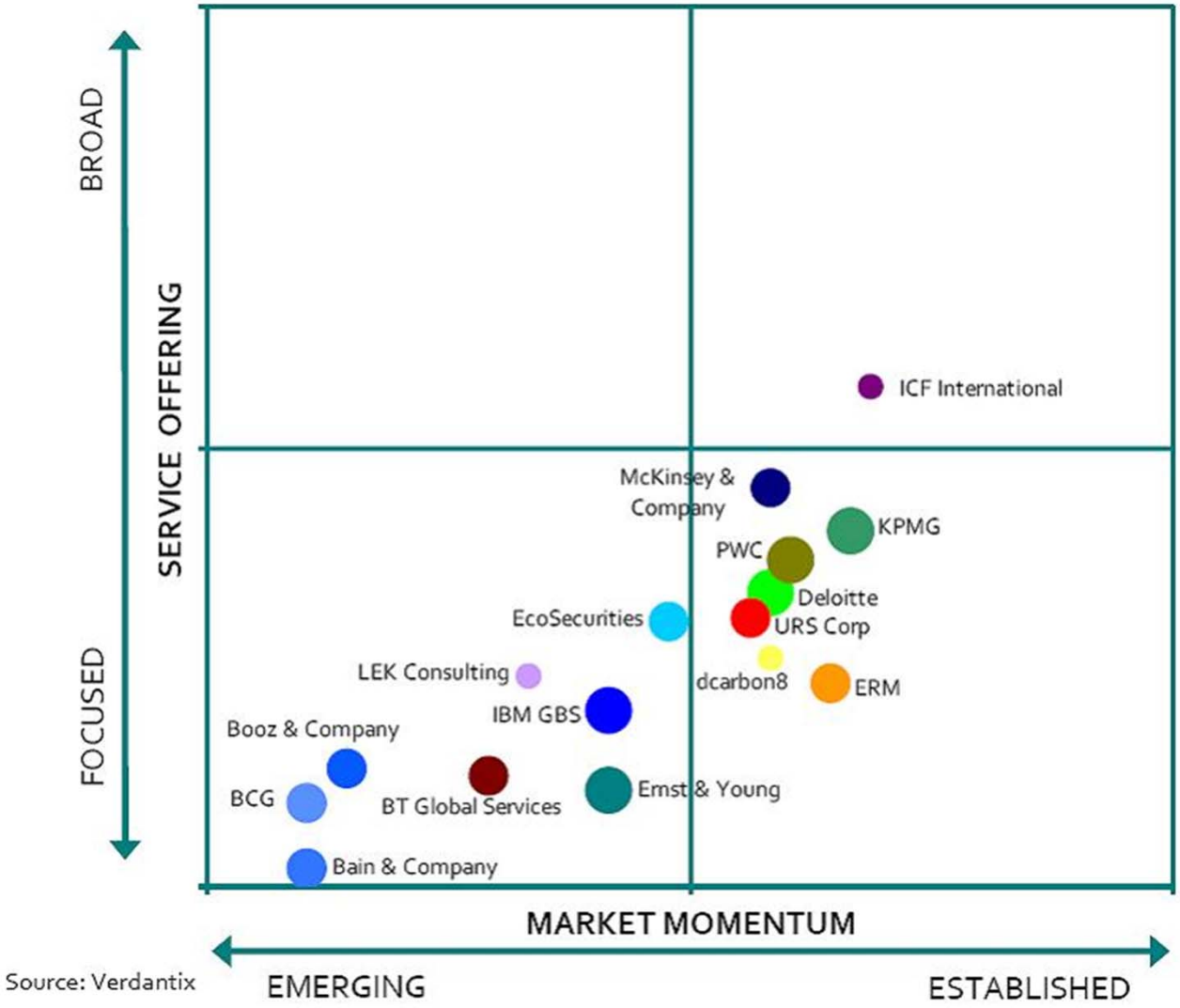
- Active AID partner
  - Global energy efficiency support (EECDP)
  - China Sustainable Buildings Program
  - Low Emission Asian Development (LEAD)
- Other global clients include:
  - International Organizations: IPCC, European Commission, World Bank, African Development Bank, EBRD, International Energy Agency, United Nations agencies
  - National and Local Governments: Governments of Australia, Canada, India, Ireland, Mozambique, Russia, United Kingdom, Ukraine, and United States
  - More than 70 companies in the FT Global 500
  - Utilities – public and private
  - Private Equity and Investment Banks

ICF's Global Presence

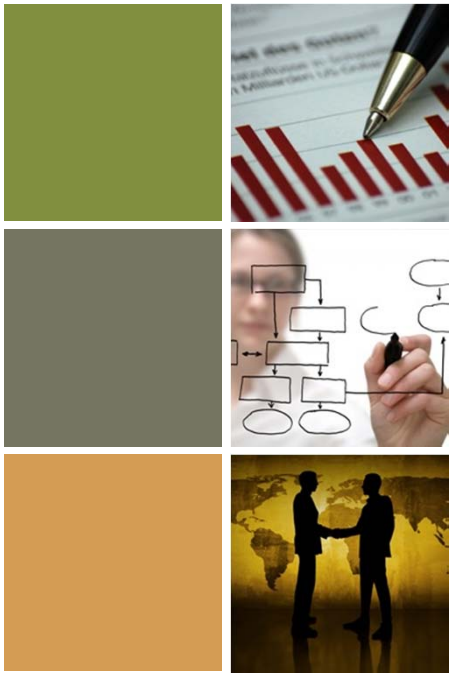


International Headquarters
9300 Lee Highway
Fairfax, Virginia 22031
USA

ICF Rated Top Carbon Advisory Firm



Source: Verdantix



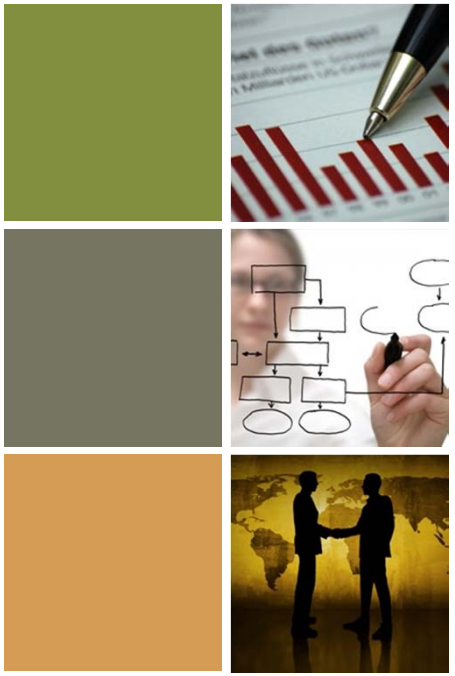
Clean Energy

What is Clean Energy?

- Energy resources and technologies that provide *better* social and environmental benefits than existing or BAU options
  - Depends on specific challenges and drivers in each country
  - Contextual – regional and country specific; current technologies/resources
  - Changes over time (as drivers, challenges, and technologies evolve)
- Typically, focus has been on renewable energy sources and technologies, but can also include
  - Energy Efficiency
  - Cleaner fossil fuels (local pollution reduction, switching to natural gas, biomass cofiring, carbon capture and storage (CCS), etc.)
  - Cookstoves, minigrids, etc.

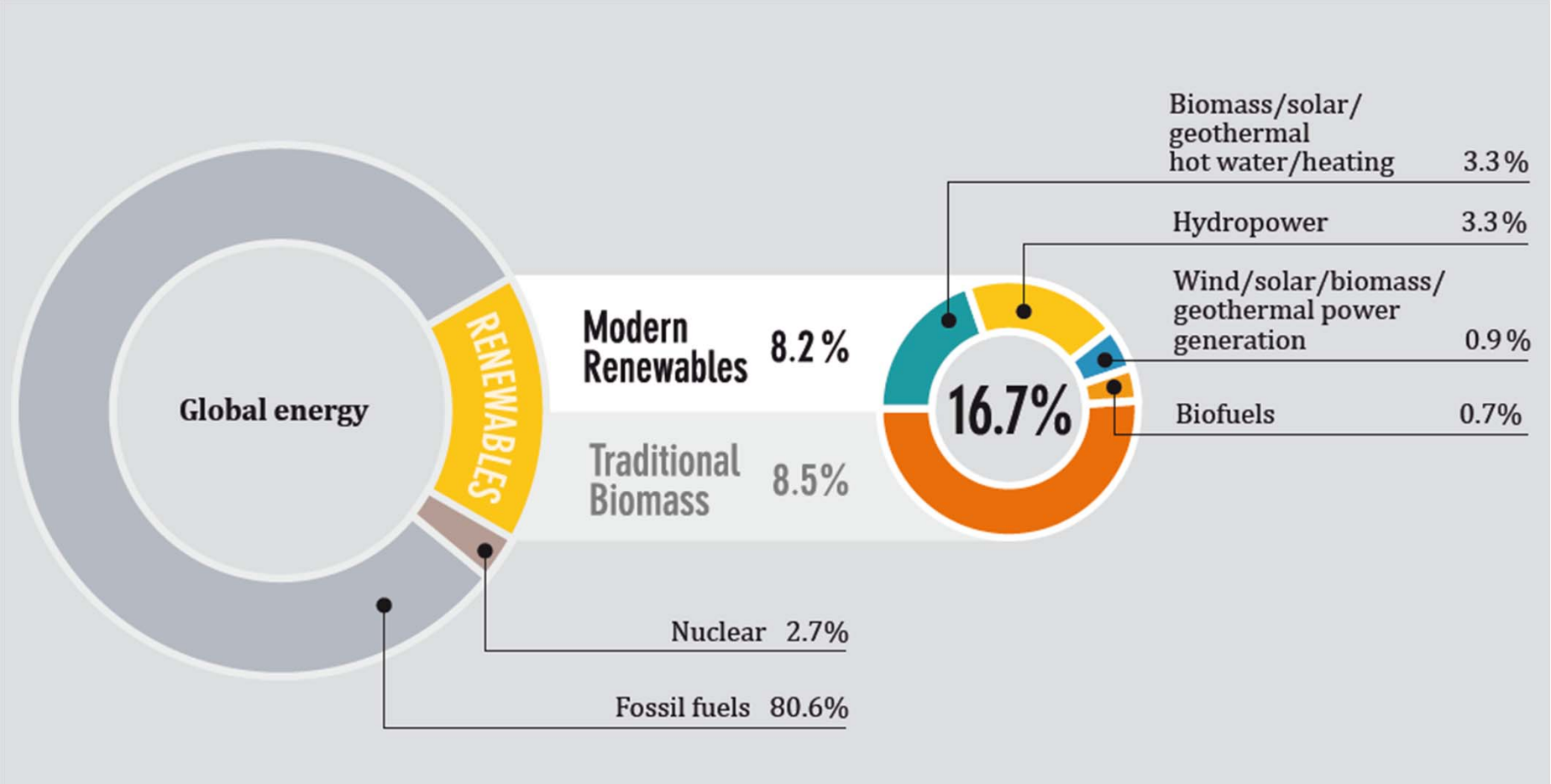
Drivers for Clean Energy

- Promoting sustainable infrastructure
  - Energy consumption in developing countries will increase; Issues of technology lock-in
- Providing basic needs for all citizens
  - About 1.3 billion in Asia and Africa still do not have access to electricity
- Energy security, access to resources, affordability
- Reducing local social/environmental impacts
  - Local issues often drive policy development
- Global Climate Change
  - Scale of problem seems to be worse than predicted
  - Mitigation and adaption measures are being undertaken



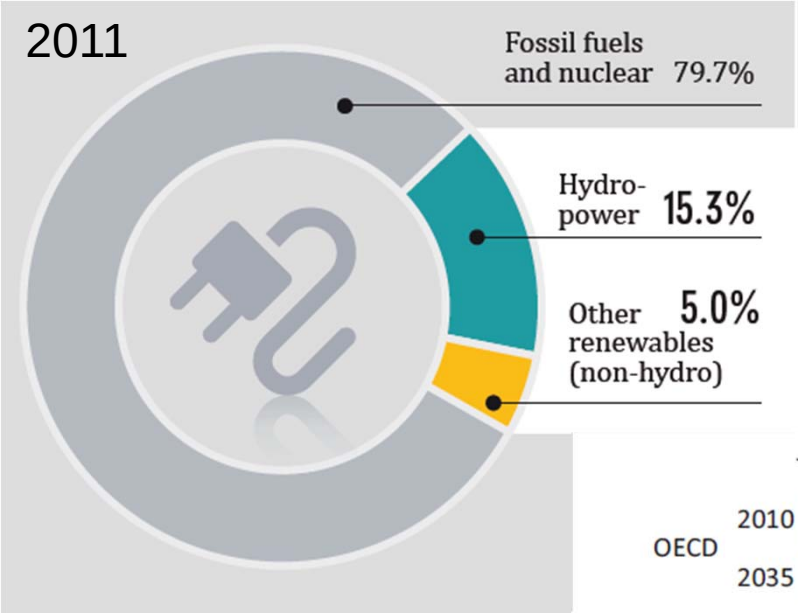
State of Clean Energy

Modern renewables are only 1/12th of current global energy, and need to grow



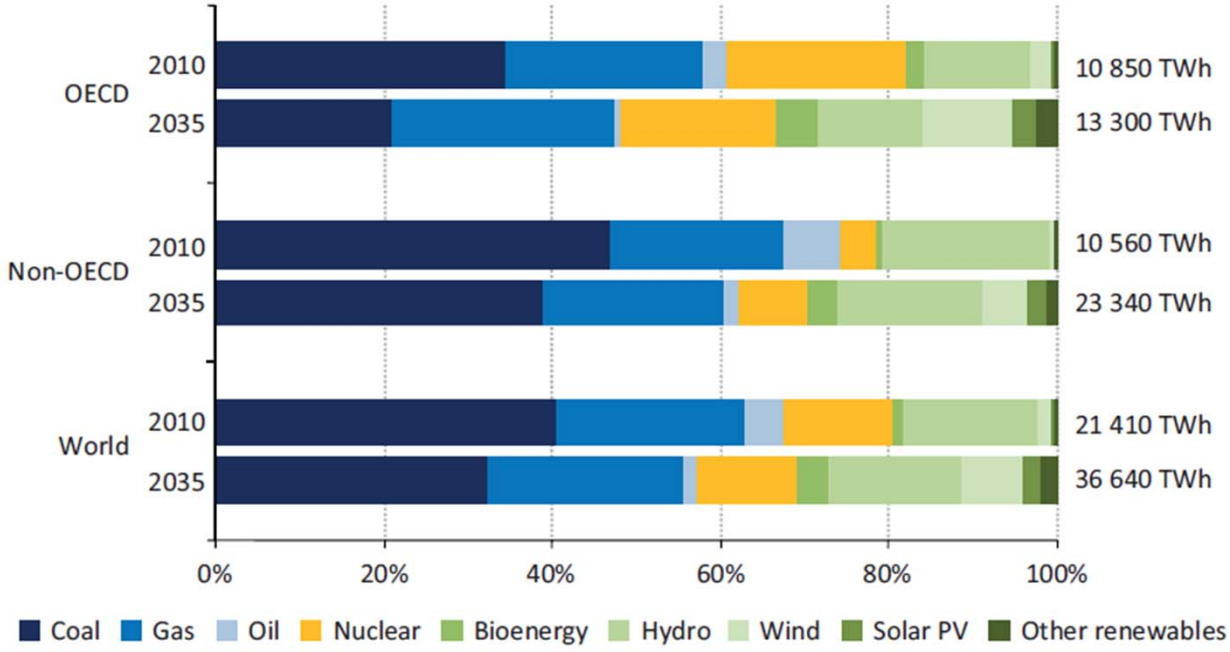
Renewables 2012, REN21

Renewables in Power is mostly Hydro, but Wind and Solar expect to rise



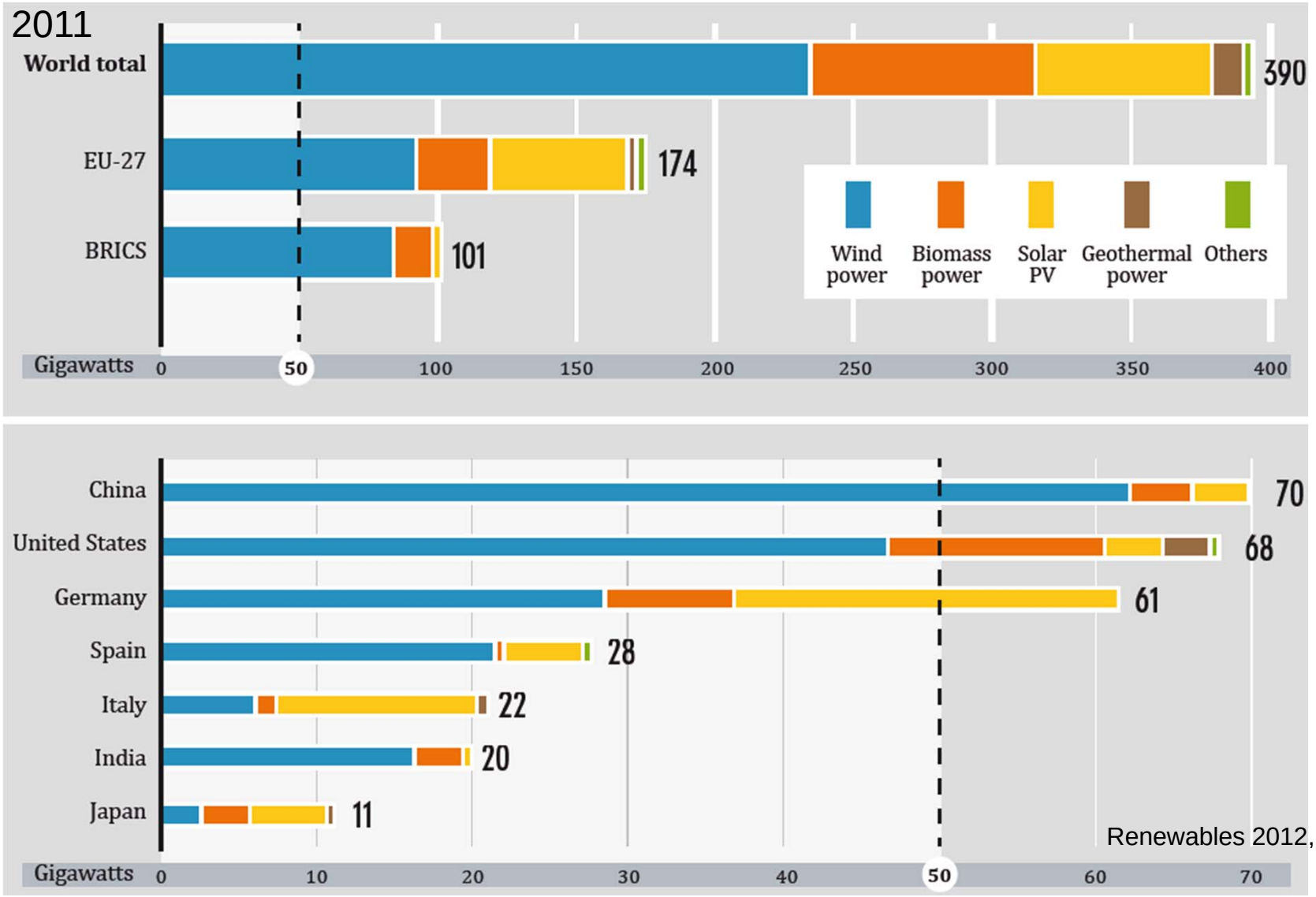
Renewables 2012, REN21

- Limited penetration of non-hydro renewables in the global power sector
- Under the New Policies Scenario, IEA expects non-hydro renewables to be about 15% by 2035



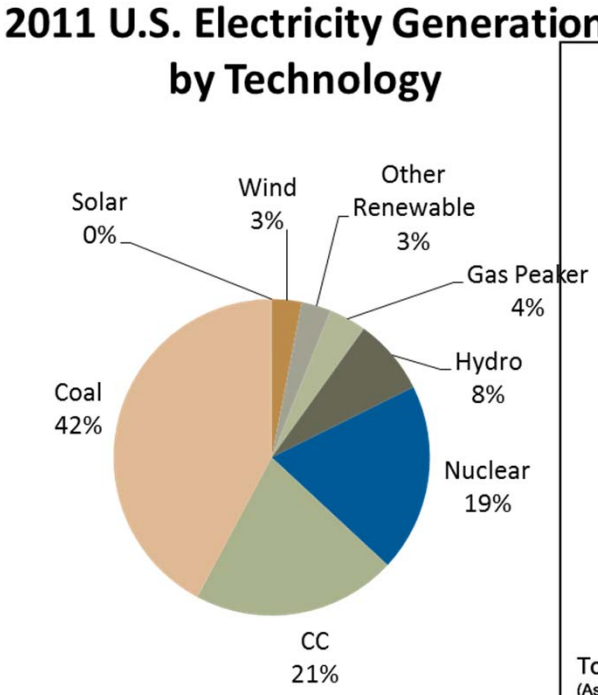
IEA WEO 2012

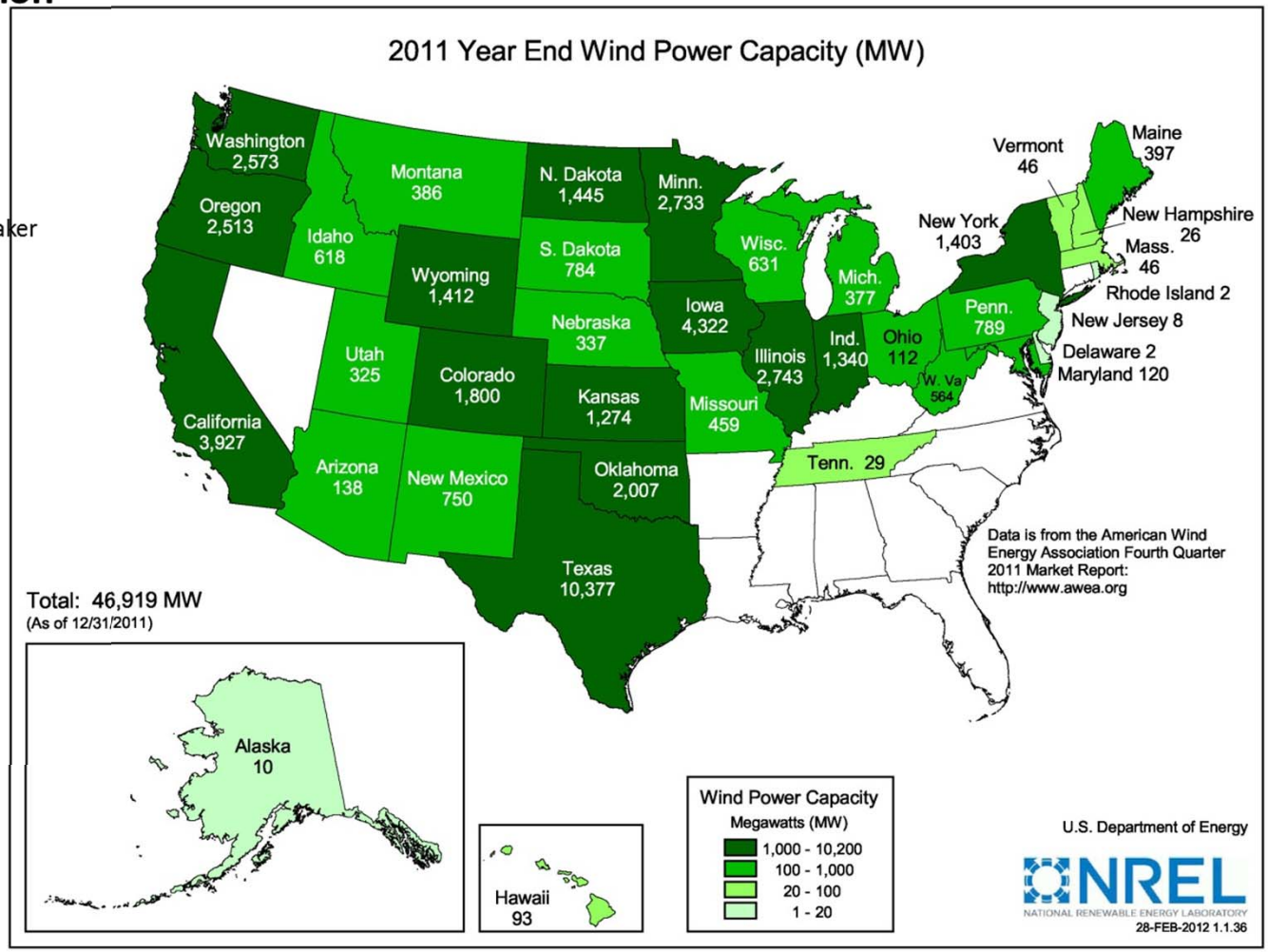
China, U.S., and Germany leads with Wind Power



Renewables 2012, REN21

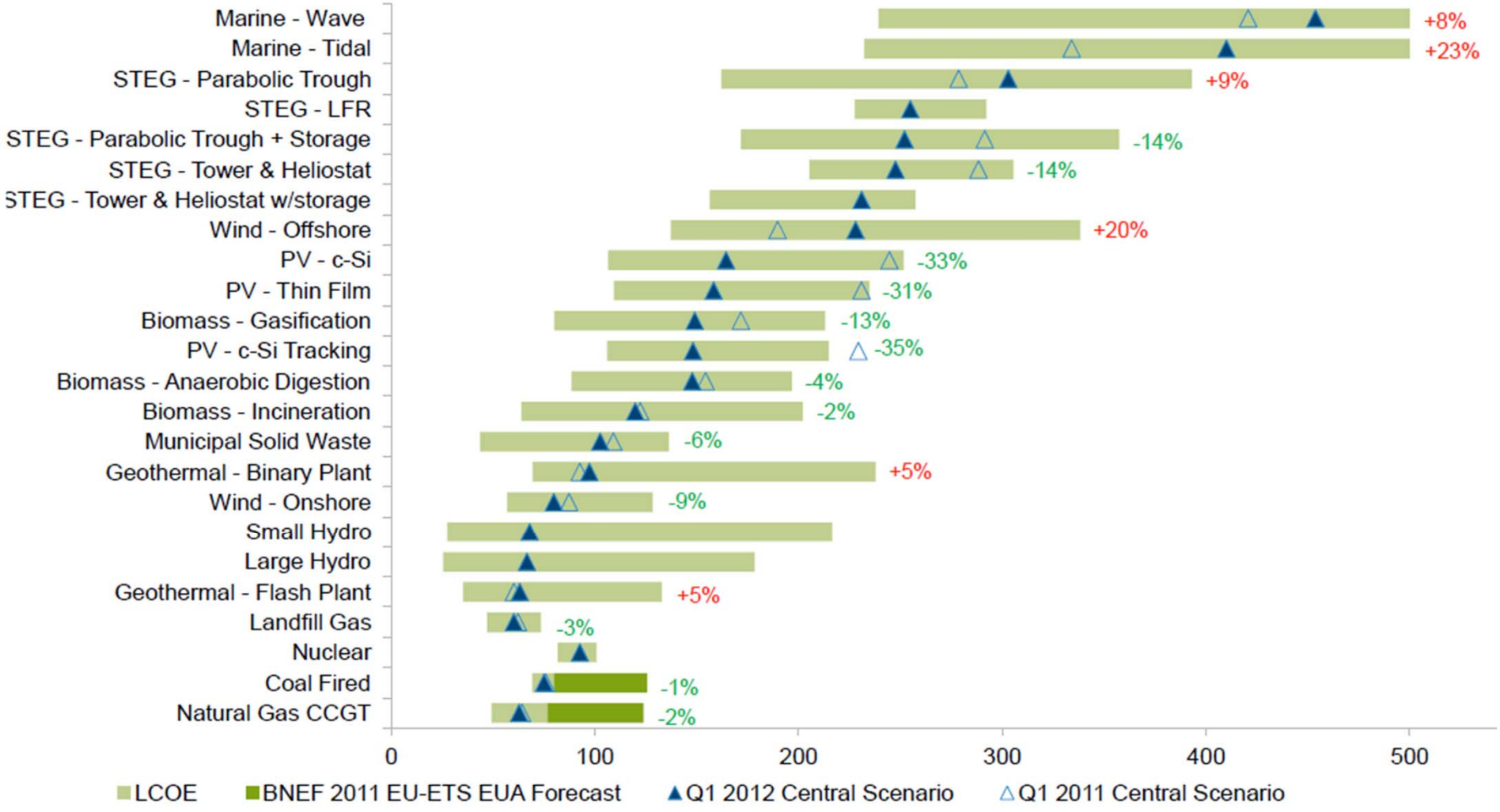
47 GW of wind capacity installed in U.S. Concentrated in the central and western U.S.





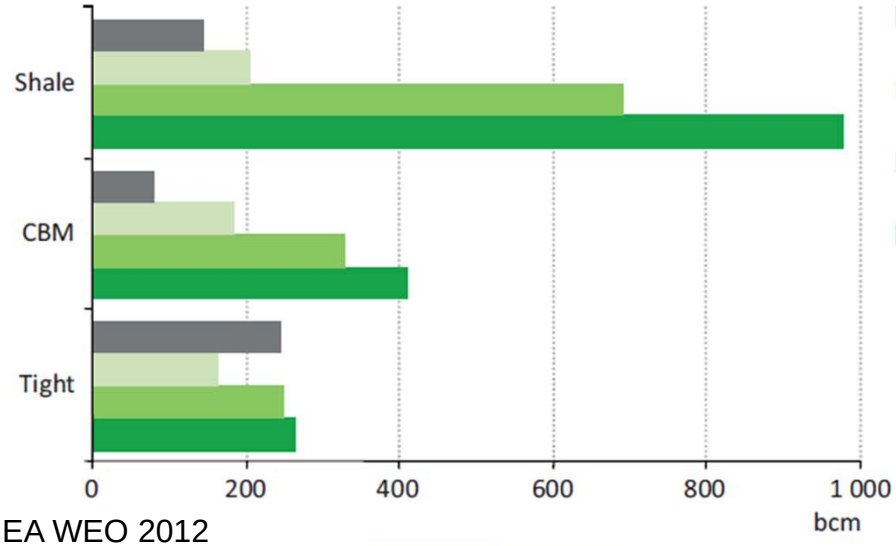
Competitive Trends for Renewables

Levelized cost Q1 2012 vs Q1 2011



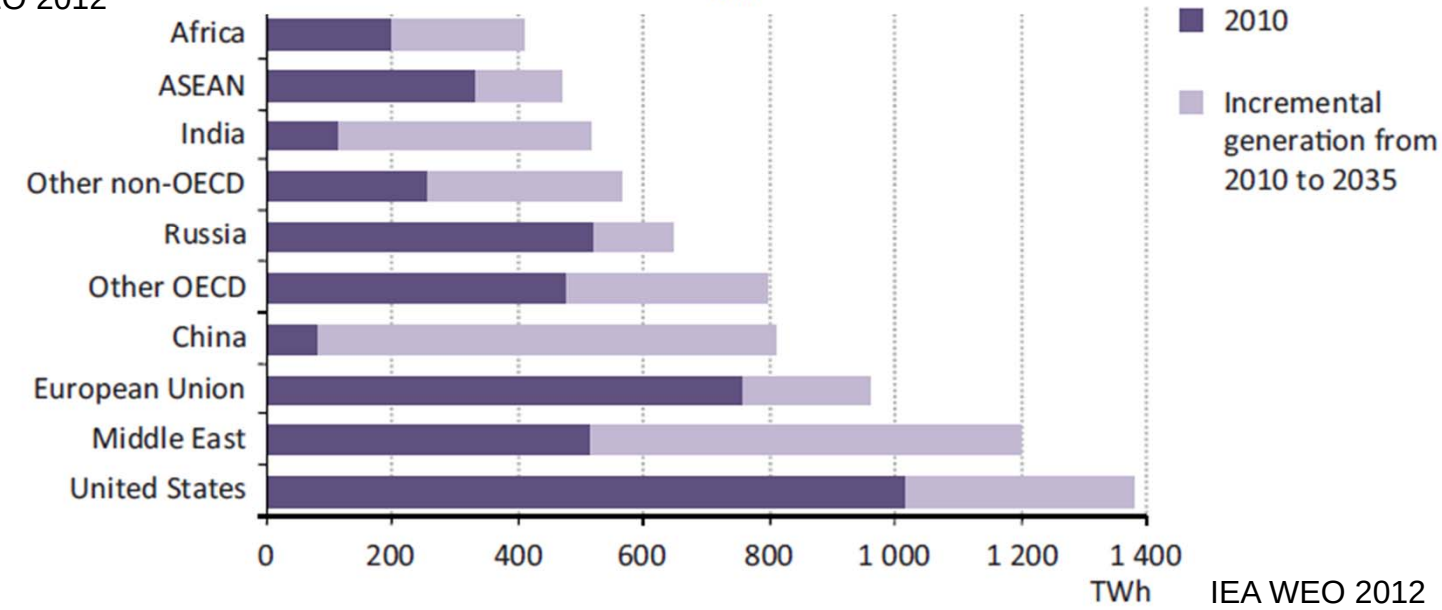
Bloomberg New Energy Finance, 2012

Gas Supply and Gas-Power will increase



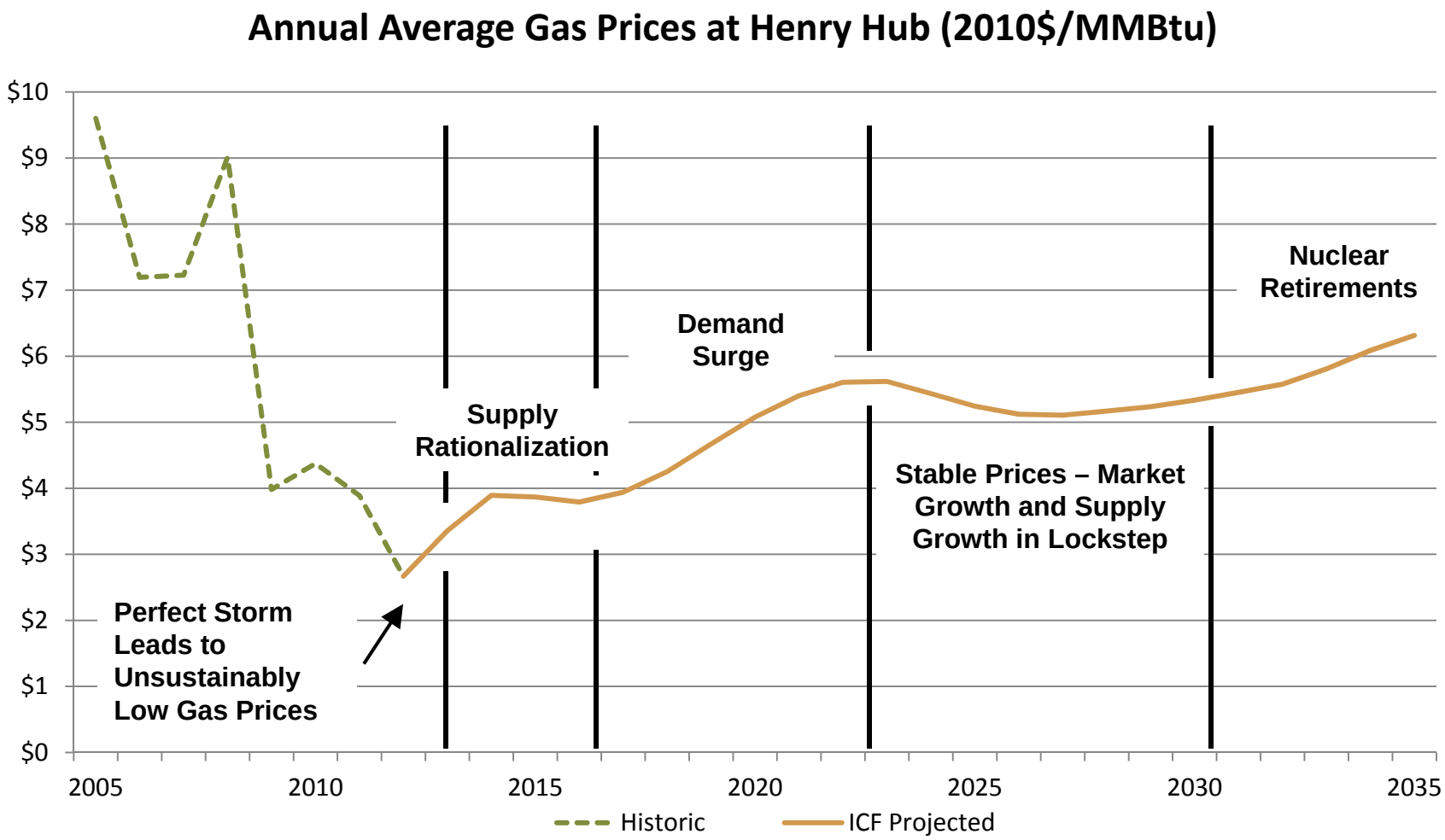
IEA WEO 2012

- Significant potential for unconventional gas
- Large discoveries in offshore Africa



IEA WEO 2012

Gas Prices in U.S. Remain Low in Near Term, then Increase as the Market Grows



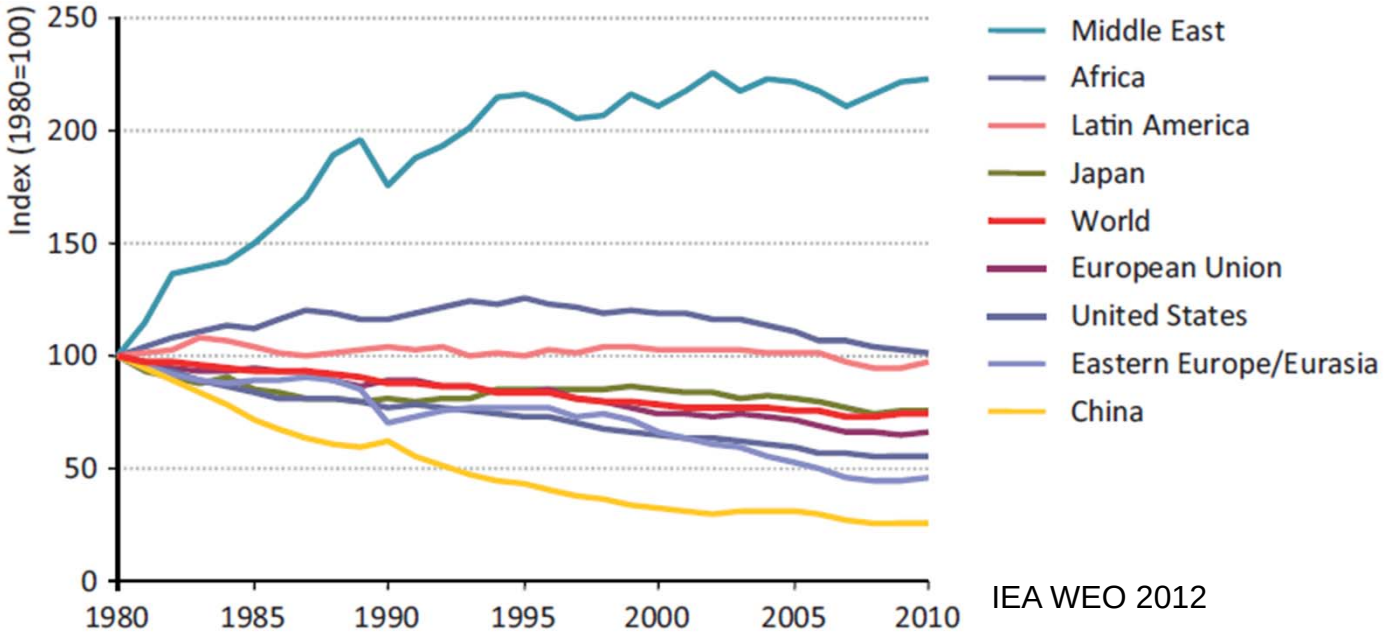
Source: ICF International.

Energy Efficiency is becoming a Cornerstone of Clean Development

Efficiency can be considered the "first fuel" in sustainable energy development because:

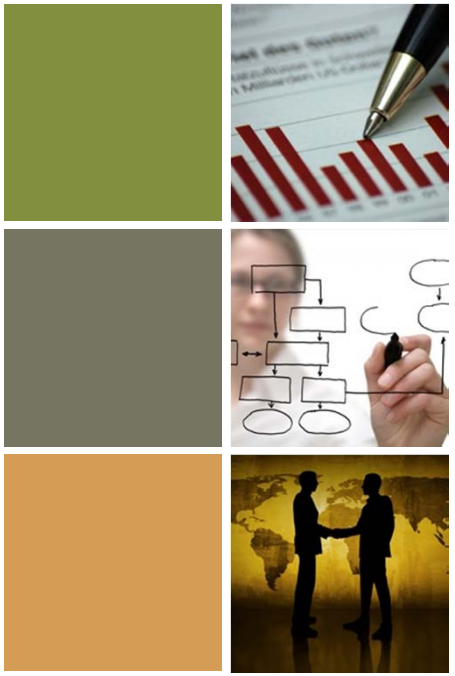
- No clean energy supply policy will succeed unless demand is kept within reach
  - E.g. if clean energy generation produces 100 MWH in year X, but demand grows at 110 MWH, clean energy's market share shrinks
- Efficiency can be less expensive than supply options
  - Typically $20-50/MWh vs. $80/MWh and higher for retail supply (including T&D)
- Efficiency helps moderate energy prices and price volatility

Energy Efficiency Trends



IEA WEO 2012

- Key barriers for greater EE deployment include: measurement, visibility, priority, split or insufficient incentives, limited know-how on implementation, and fragmentation
- Policy is key for EE, and there are a large number of existing and planned policies for EE



Clean Energy Development Policies

Options for Clean Development

	Promote the Positives	Suppress the Negatives	Support the Technologies
Policies	• Renewable Portfolio Standards • Mandates / Targets • Carbon credits • Utility Efficiency Programs • Net metering	• Price on CO_2 emissions (Cap & Trade / Taxes) • Price on air or water pollutants	• RD&D support • Feed in Tariffs • Production Tax Credits • Tax Incentives • Rebates • Advantaged Financing • Government purchases
Regulations	• Transmission Support (FERC Order 1000) • Building Standards • Appliance Standards and Labeling	• Air quality standards • Emission limits • Incentives to reduce T&D losses	• CCS Regulations (Framework/Liability) • Smart Grid Standards for Interoperability

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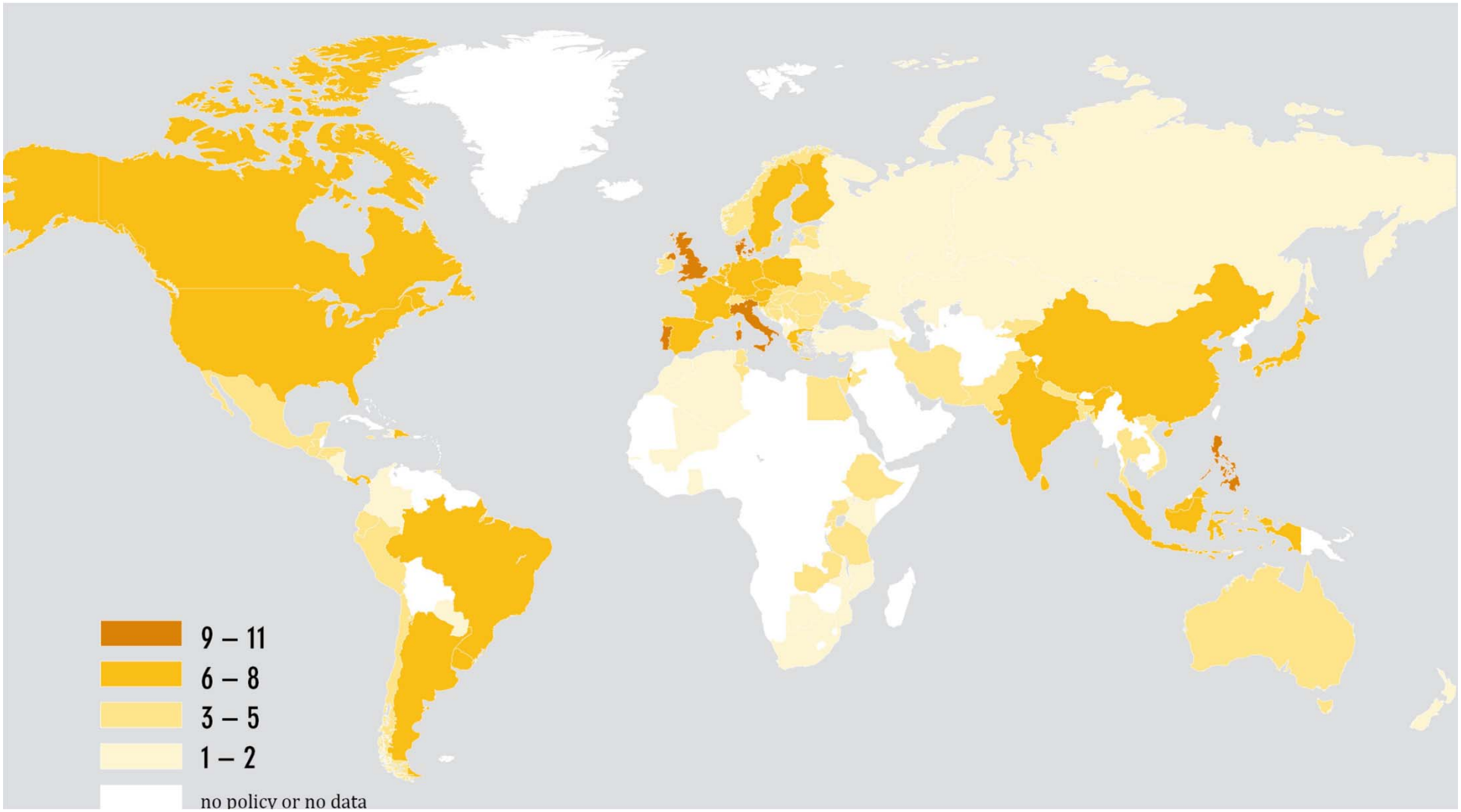
Countries with renewable energy policies



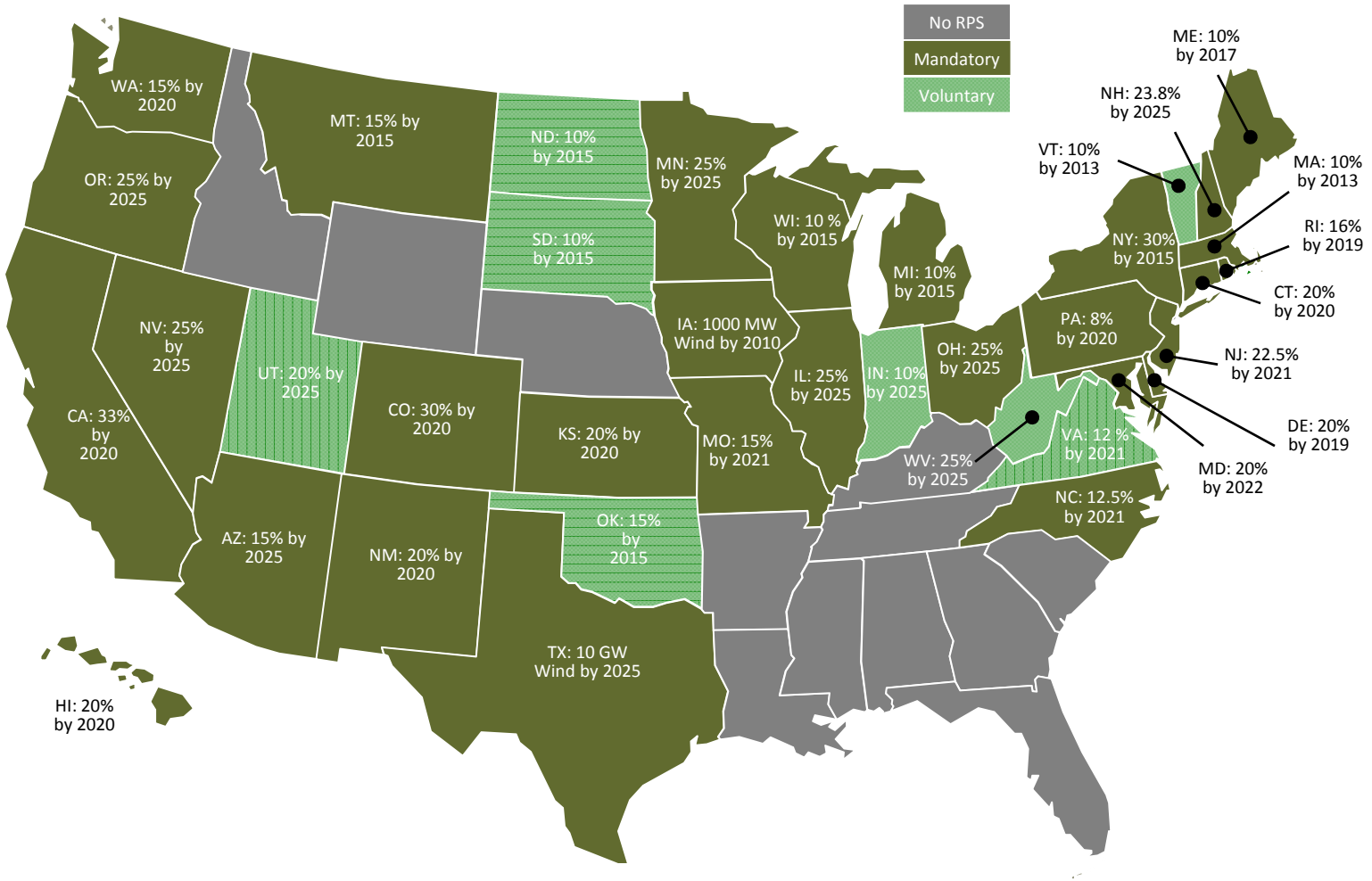
Renewables 2012, REN21

Renewable energy targets growing across the world

- At least 109 countries have some target for renewable energy
- Countries/regions are aiming for an average annual increase of 0.2-1.5% in renewable-based electricity
- Targets appear to be achievable, and will likely be met.
- New targets include
  - India: 3,400 MW of grid-capacity and 130 MW of off-grid in 2011-12
  - Lebanon aims for 12% of final energy from renewables by 2020
  - Scotland released a roadmap for 2020 with a 100% target for electricity
  - South Africa introduced a new 20-year plan calling for renewables to represent 42% of all new capacity installed up to 2030.
  - China increased targets to be met by end-2015 for grid-connected wind from 90 GW to 100 GW (and to 200 GW by 2020)
  - Denmark aims to increase wind in total generation to 50% by 2020, and for 100% of electricity, heat, and fuels to come from renewables by 2050.
  - U.S. state of California set new targets under its existing Renewable Portfolio Standard.

Renewables 2012, REN21

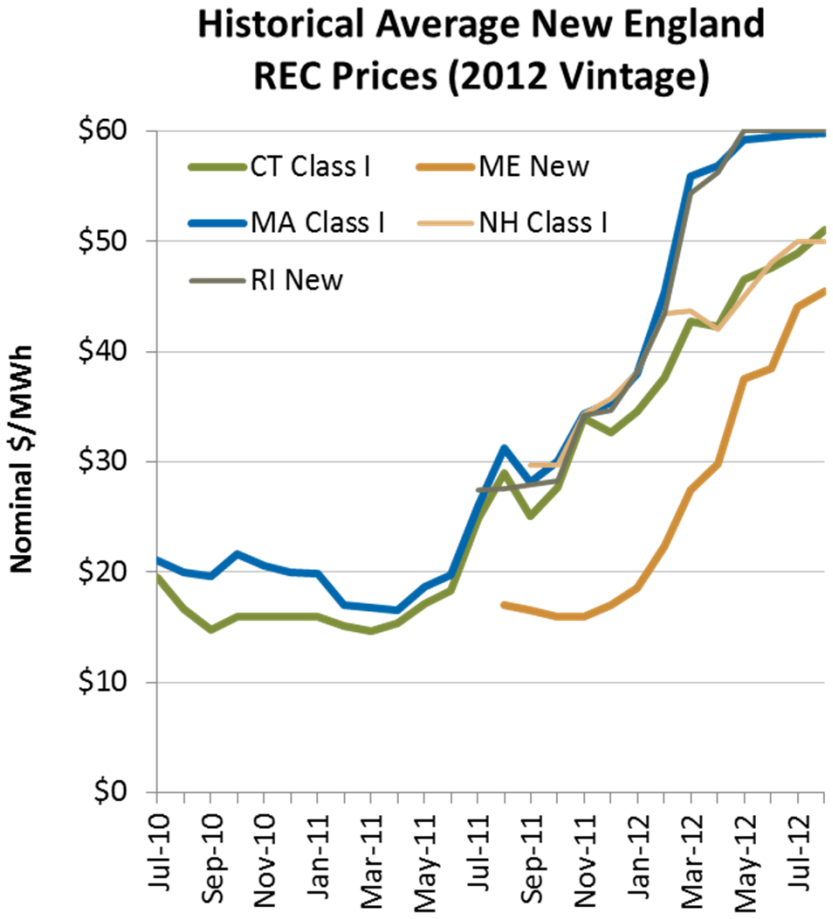
State Renewable Portfolio Standards (RPS) in the U.S.

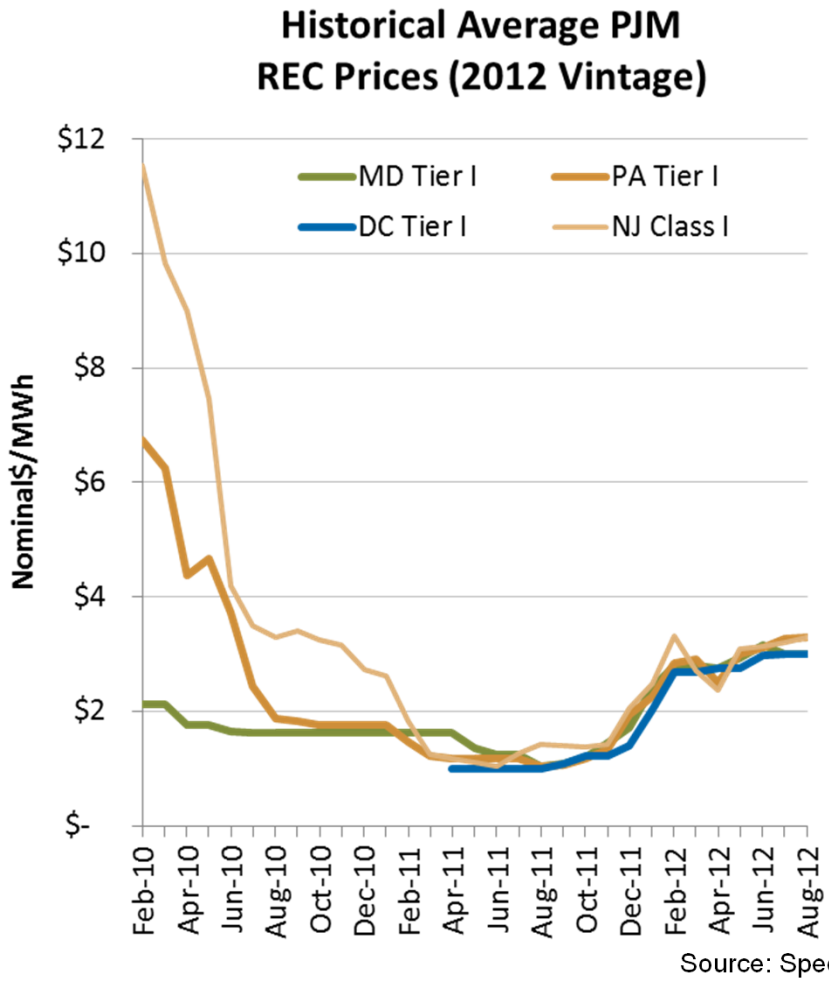


Source: ICF International.

REC Prices dependent on availability of renewable sources

REC prices in New England climbing, while PJM REC prices remain relatively flat and low





Source: Spectron

Upgraded and new transmission may be needed to support renewable energy

- 13,000 miles of transmission under development (75% of total under development) aimed at facilitating renewable energy resource integration
- Total investment cost: $49.0 billion
- Substantial inter-state transmission may be needed in the West and Midwest
- However, California may meet its RPS needs with in-state resources—although expensive

Possible Merchant Transmission Projects in California

West Coast Cable Project (Year 2016)	
Access to hydro and wind resources in Pacific Northwest	Provides about 1,500 MW of Capability into Southern California
Centennial West Clean Line (Year 2018)	
Access to renewable resources in New Mexico, 3500 MW HVDC Line	Federal Right-of-Way Application and Siting Process is underway
Trans West Express (TWE) Project (Year 2016)	
Access to renewable resources in Wyoming; WAPA owns 50% stake in TWE	3000 MW Capacity, HVDC Line, WECC Phase 1 report has been submitted

Source: WECC, ICF

FERC Order 1000: A Big Deal in the U.S.

Regional and Interregional Planning Required

No Federal Right of First Refusal

Must Take "Public Policy" and Economics Into Account

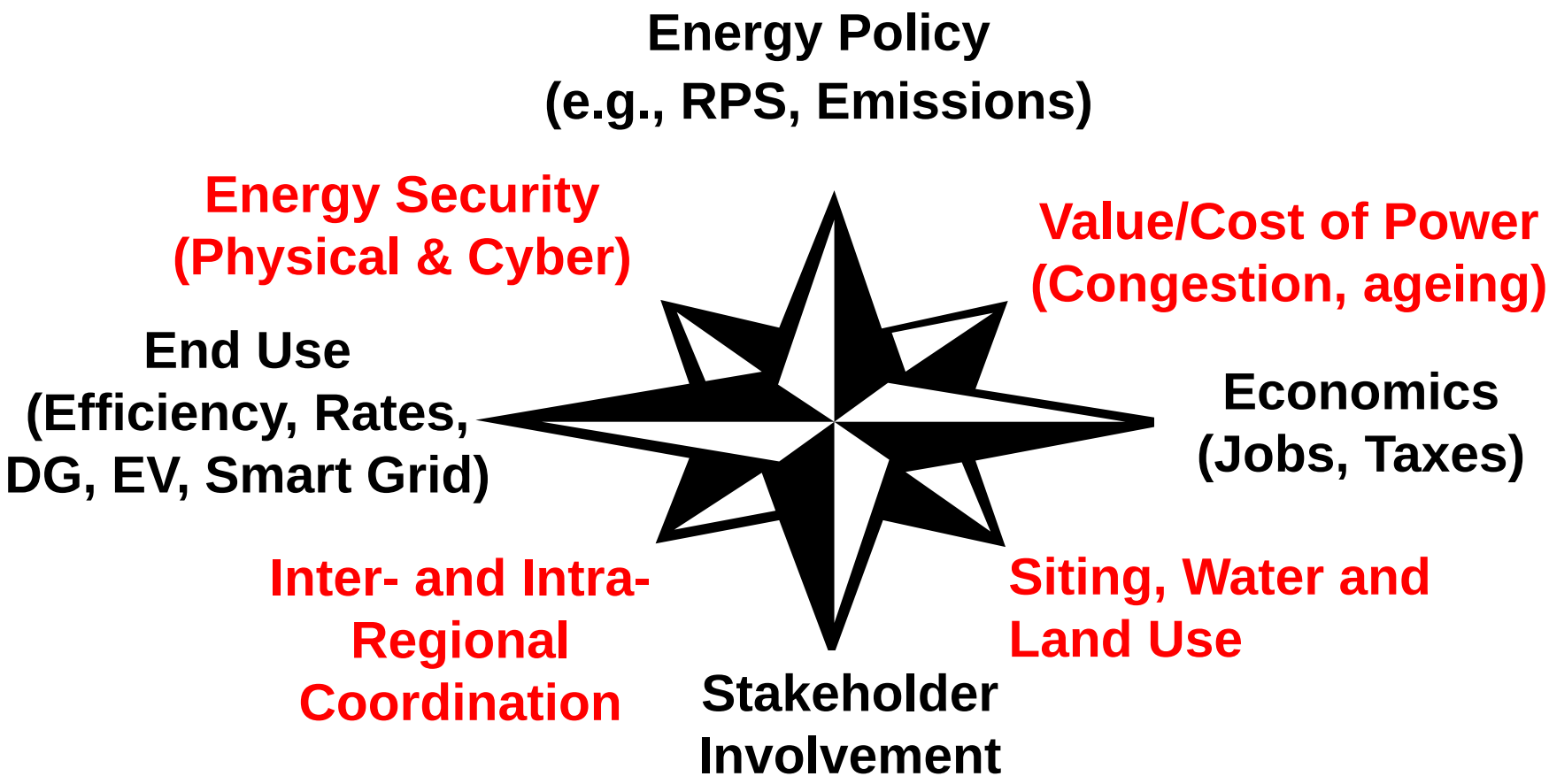
Cost Allocation Based on "Beneficiary Pays" and other Principles

ORDER 1000 HAS IMPLICATIONS FOR ALL RESOURCES

Overview of Compliance Process Requirements

- Requires a regional transmission plan for all markets, whether organized or not
- Applies to all new projects in the plan for purposes of cost allocation
- Requires the region to develop a transparent approach to determining which projects and alternatives are included in the plan
- If projects have inter-regional impacts, there must be a process for agreeing with the neighboring regions
- Requires all plans to include methods for including "public policy" projects – how defined? That's up to each region.
- Identifies three types of transmission projects – reliability, economic/ congestion and public policy, but they are not mutually exclusive.

Expanding Factors that Transmission Planning Needs to Take Into Account



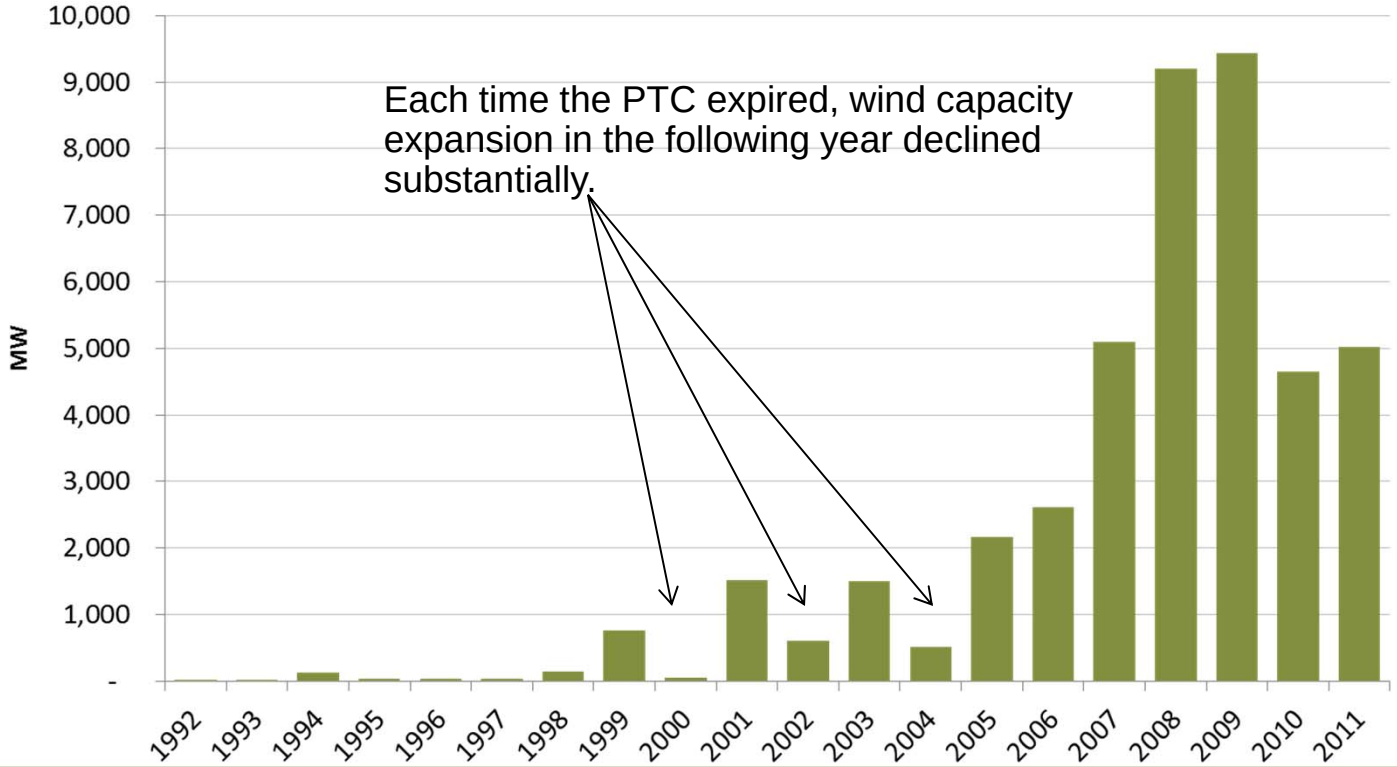
Being a planner/regulator is getting more complicated in the U.S.

U.S. wind capacity additions affected by Production Tax Credits

Investment Tax Credit (ITC) is a 30 percent credit available to solar units, distributed wind systems, and geothermal heat pumps

Production Tax Credit (PTC) of 2.2¢/kWh is available for wind, closed loop biomass, and geothermal units. The PTC is 1.1¢/kWh for landfill gas and open loop biomass.

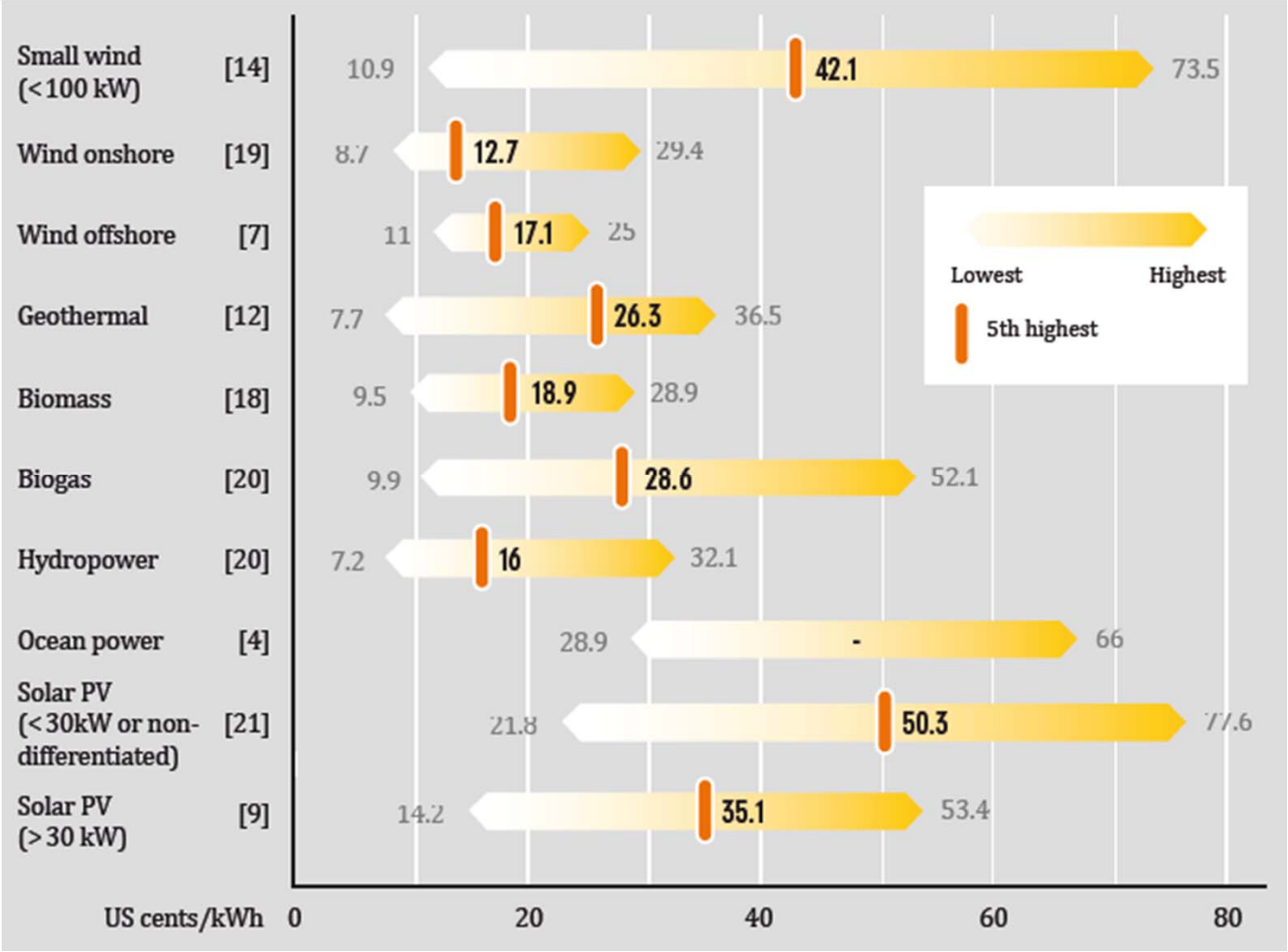
Modified Accelerated Cost-Recovery System (MACRS) allows for full depreciation for wind, combined heat and power (CHP), geothermal, fuel cells, and solar units over a five-year period.



Source: Ventyx

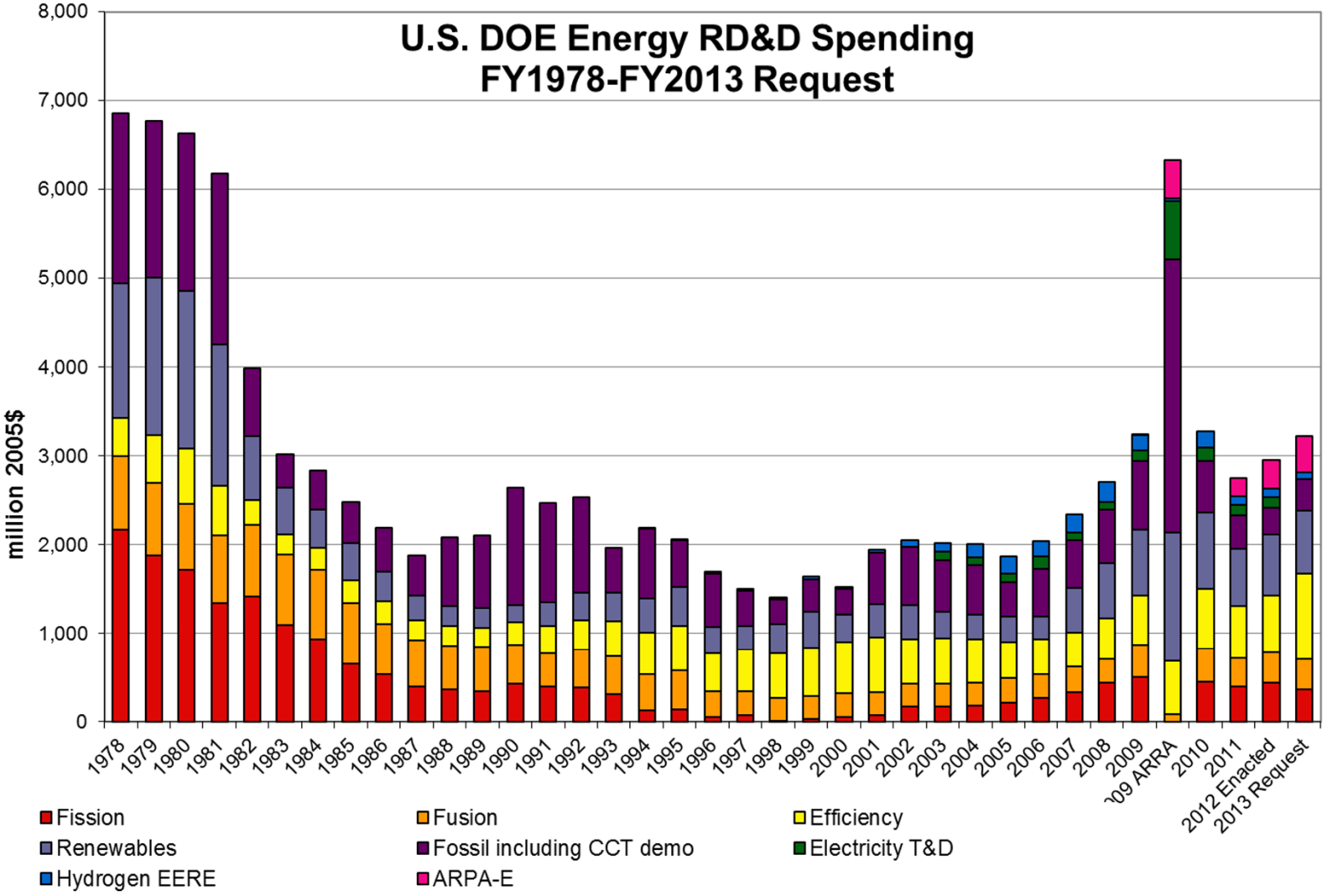
Feed-in Tariffs low for wind and recent reductions in solar PV

Levels of support vary widely and are affected by technology cost, resource availability, and installation size and type



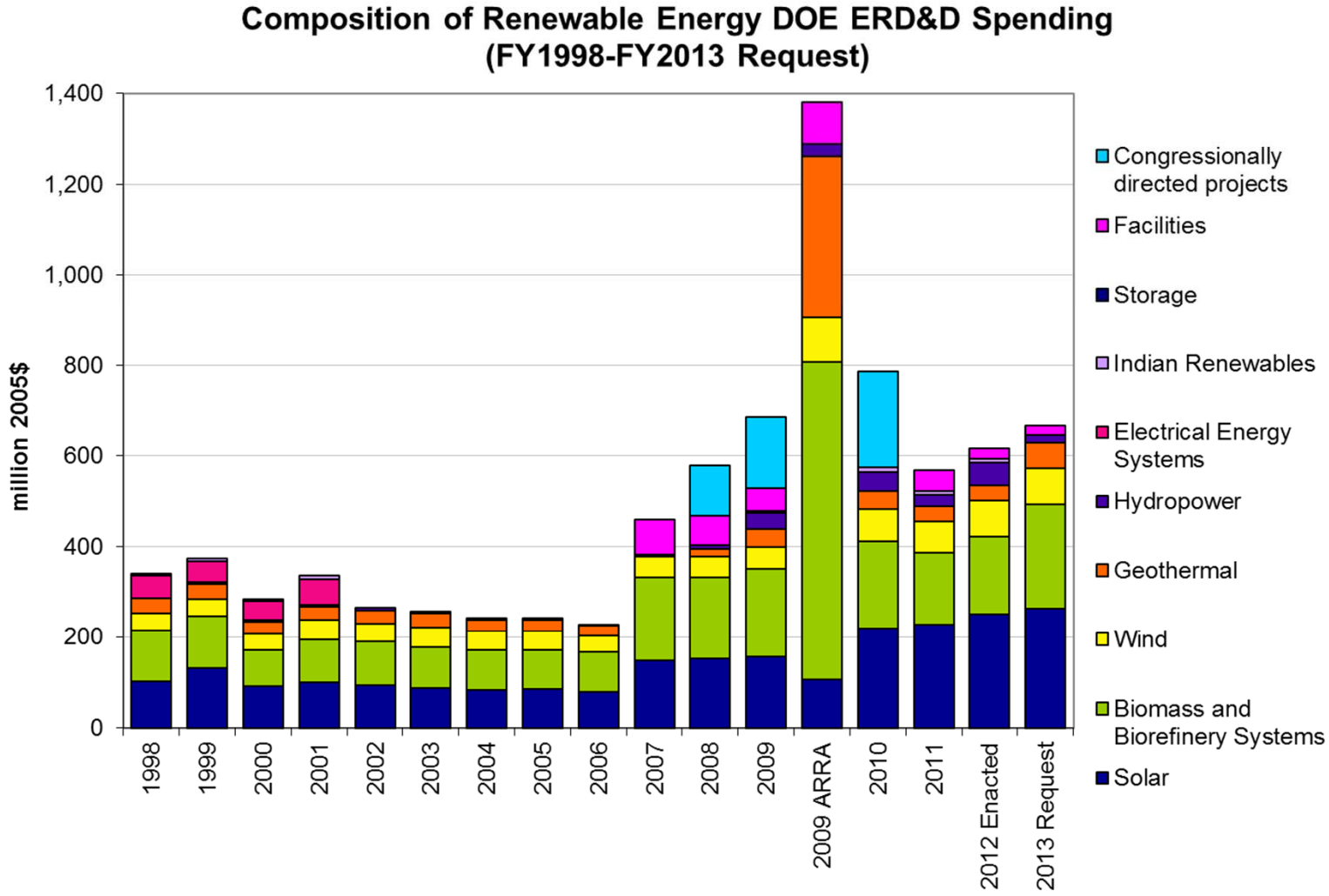
Renewables 2012
REN21

U.S. has invested heavily in Clean Energy R&D in 2009 with ARRA support



Gallagher, K.S. and L.D. Anadon, "DOE Budget Authority for Energy Research, Development, and Demonstration Database," Energy Technology Innovation Policy, John F. Kennedy School of Government, Harvard University, February 29, 2012.

Biomass and Geothermal investments dominant in ARRA support

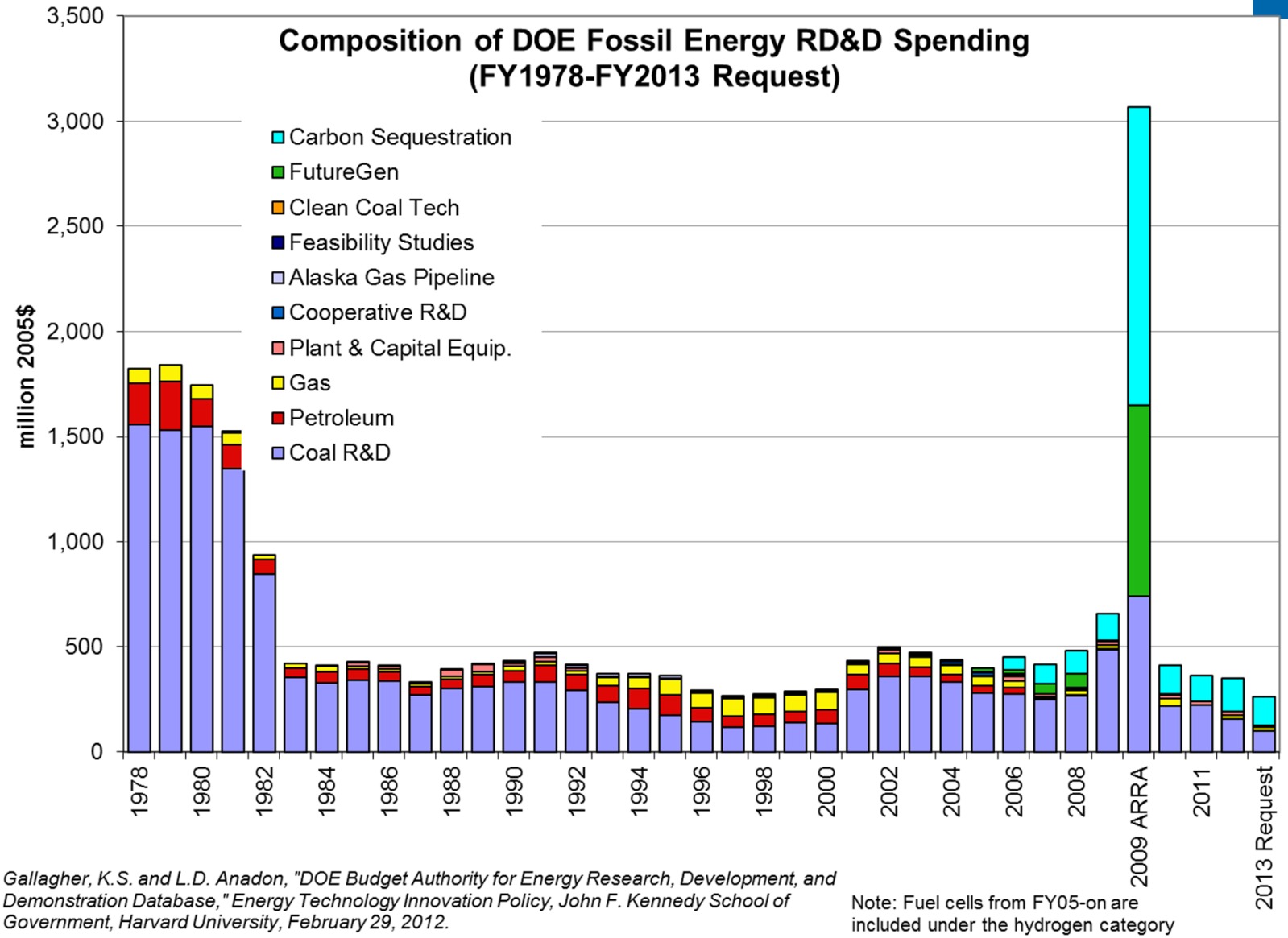


ARRA Funding
$7 billion for RD&D
$22 billion for Deployment

- $5 Billion for Smart Grid
- $400 million for ARPA-E
- $4 billion in loan guarantees
- $15 billion for efficiency
- $1.6 billion for CCS

Gallagher, K.S. and L.D. Anadon, "DOE Budget Authority for Energy Research, Development, and Demonstration Database," Energy Technology Innovation Policy, John F. Kennedy School of Government, Harvard University, February 29, 2012.

Significant support for CCS and Clean Fossil Fuels in the U.S.



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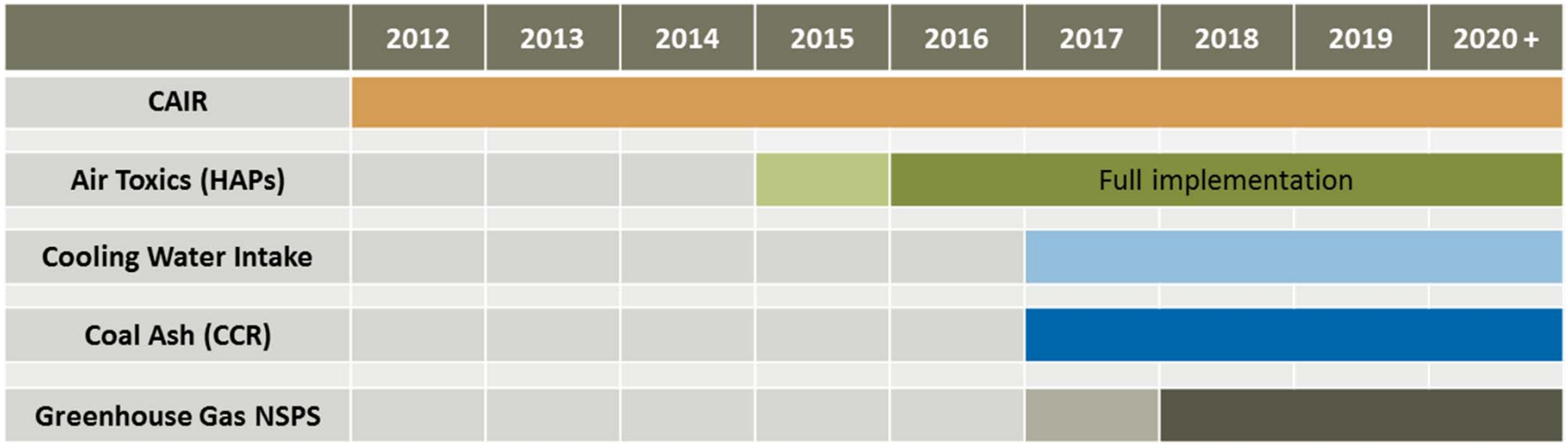
Note: Fuel cells from FY05-on are included under the hydrogen category

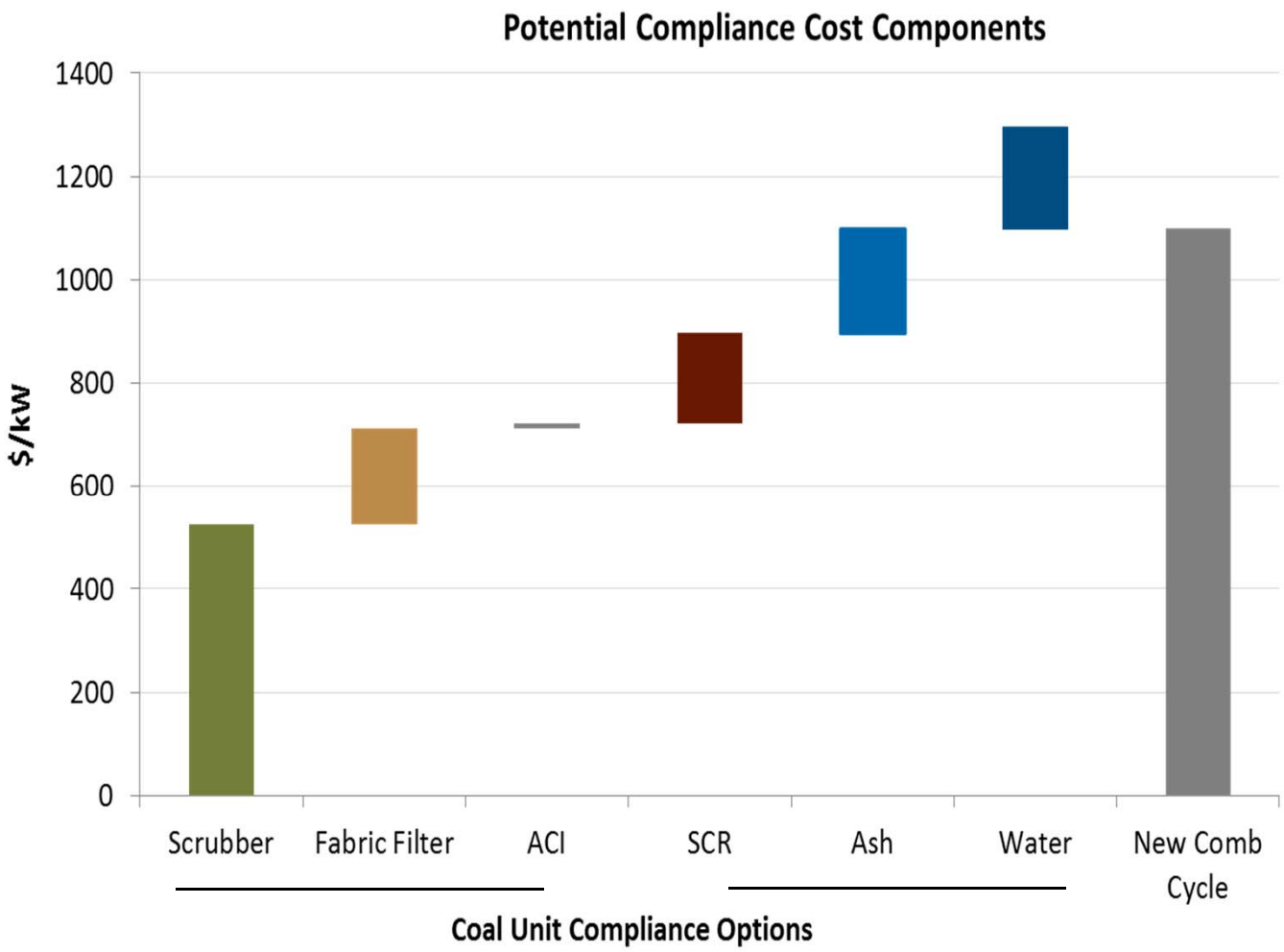
Major New Regulations for Emissions Control in U.S. – yet significant uncertainty remains

Major Regulations Facing U.S. Power Sector



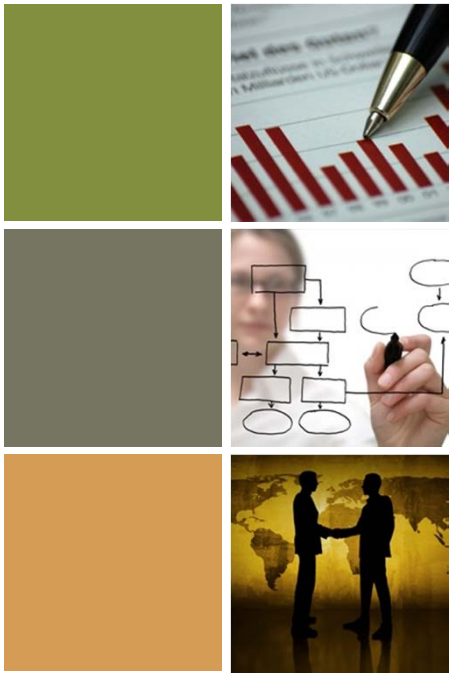
- Federal GHG regulatory regime (Cap & Trade/Taxes) are not realistic in the short term
- Cross-State Air Pollution Rule for SO2 and NOX (CSAPR) – vacated by court
- Mercury & Air Toxics Standards (MATS) – final rule, but legal challenges filed
- Coal Combustion Residuals (Ash) – final expected later this year
- Water Intake Structures (316b) – proposed with final rule delayed to 2013
- GHG New Source Performance Standards (NSPS) – proposed for new units, but challenged by industry; no schedule for existing units to be covered

Regulations may require large capital outlays on uncontrolled coal units and coal retirements



- ICF projects nearly 60 GW of coal retirements by 2016 due to air regulations
- Low natural gas is a key contributor
- Major deployment of FGD, fabric filters, ACI, and SCR
- 70% of retirements over 45 years old
- Strongly affects eastern states (PJM, MISO, SERC)
- Location-specific reliability issues

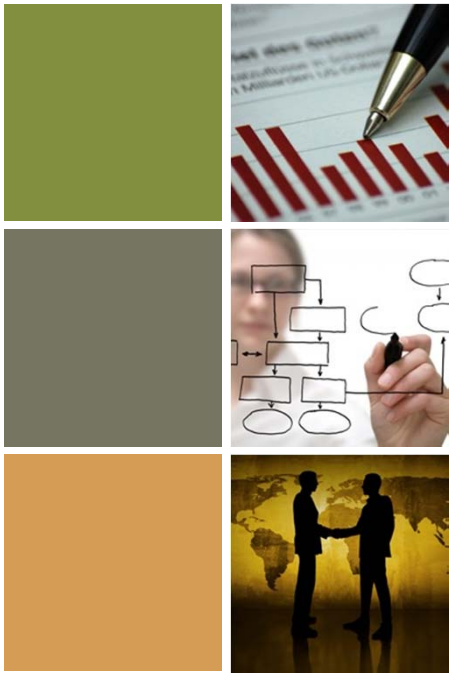
Source: ICF International.



Outlook

Outlook/Conclusions

- Drivers for Clean Development and Clean Technologies will only grow stronger over time, but transition away from fossil fuels will likely be a slow process
- Clean Development policies in the power sector are linked to broader sustainable development goals
- No silver bullet for technologies – need to focus on all options, but each country needs to decide its own path
- Similarly, no silver bullet for policies
  - Country-specific; pathway dependent; willingness to experiment
  - Can be linked to climate change mitigation, but this is not the only driver – many other reasons for clean technologies
  - Interaction of policies needs to carefully considered
  - Regulations and enforcement are critical for success
  - Government support, institutions, and human resources are key



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