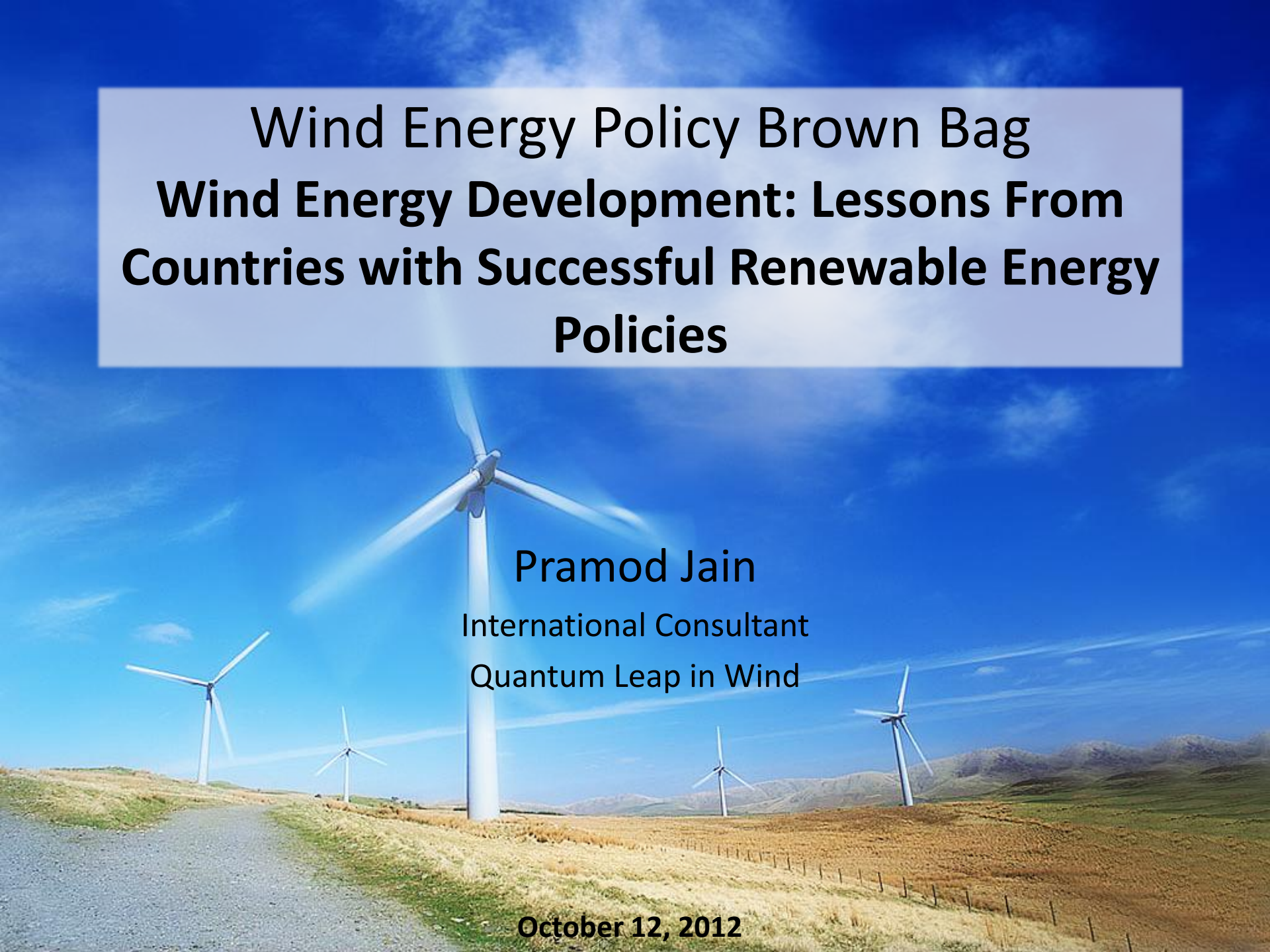
Wind Energy Policy Brown Bag

Wind Energy Development: Lessons From Countries with Successful Renewable Energy Policies



Pramod Jain

International Consultant

Quantum Leap in Wind

October 12, 2012

Agenda

- Overview of Policies
- Experiences in various countries
- Lessons learned
- Key Success Factors

Need for Policies

- Promote renewable energy:
  - Energy security: Indigenous and inexhaustible
  - Clean air
  - Zero use of water
  - Climate change
- Take out the “new technology” risk
- Allow RE to compete in marketplace that does not price the above benefits properly

RE Policies

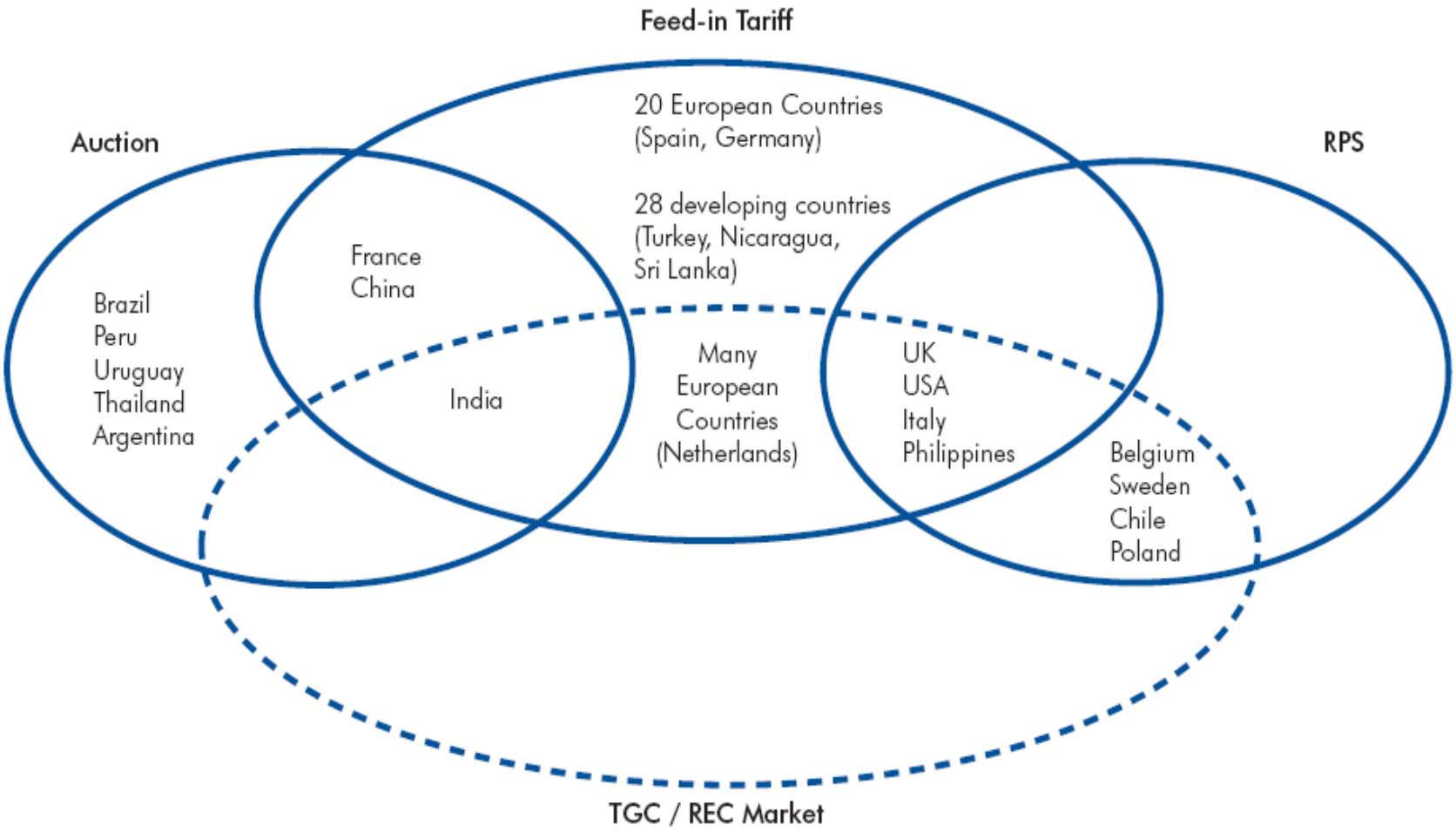
- Feed-in Tariff
- Market-based
  - Renewable Portfolio Obligations
  - Renewable Energy Credits
  - Reverse Auctions
- Tax-based Incentives
  - Accelerated depreciation
  - Production Tax Credit
  - Investment Tax Credit

Feed-in Tariff

- Published tariff
- Computed based on cost--Non-competitive, fixed-price, technology specific, resource density specific
- Standard contract for the life of the energy generating facility
- Widely used mechanism to promote renewable energy, in particular wind energy
- In countries with successful wind policies, FiT has been adjusted multiple times

RE Policies

Figure 1: Use of RE Policy Instruments



Note: Almost all countries apply some type of fiscal or financial incentive in parallel to price or quota based mechanisms.

Types of Market-Based Policies

- Renewable Portfolio Obligations (RPO) and Renewable Energy Credits (REC)
- Auction
- Renewable energy sale to wholesale electricity market
- Bilateral contracts with large consumers of electrical energy

Renewable Portfolio Obligations & Renewable Energy Credits

- RPO is a policy that mandates the electric utility companies to purchase certain percentage of electrical energy from renewable energy sources.
- RPO takes the form of goals like: 15% of renewable energy by 2015 and 20% by 2020.
- Why is this approach market-based?
  - The reason is it forces the electric utility companies to purchase the “most efficient” renewable energy from the market. Most efficient means a combination of high reliability, low variability and low cost.

Renewable Portfolio Obligations & Renewable Energy Credits

- RPO is also called Renewable Portfolio Standard (RPS)
- A utility may choose to purchase Renewable energy credits (REC) if it cannot meet the RPS obligation
- RECs are tradable certificates earned by renewable energy generators for electricity production

Auction

- Reverse auction is a mechanism for bidding
- Government or Utility company announces its intent to buy certain amount of wind energy from a region
- It is a competitive method to seek the most cost effective project from a pool of developers in a region
- Two types of reverse auction:
  - Lowest delivered price for energy
  - Lowest total install cost
- An electricity auction increases the competition and transparency
- Developed power markets with a large number of buyers and sellers in sound financial standing are more conducive to competition

Renewable energy sale to wholesale electricity market

- Allowing RE projects to sell into a wholesale electricity market
- This is applicable in countries with both conditions:
  - Established wholesale market
  - Average wholesale price that is higher than average cost of production of RE.

Bilateral contracts with large consumers of electrical energy

- Allowing RE projects to sign bilateral contracts with large electricity consumers
- Such a model requires:
  - Deregulated electricity market in which a large consumer of electricity can buy from any generation source
  - Transparent and predictable transmission and distribution tariff.

Tax-Based Policies

- Accelerated Depreciation
  - Reduction in taxable income
  - Tax-equity investors or offset tax liability of parent company
- Production Tax Credit
  - Credits accrue for each kWh of RE
- Investment Tax Credit
  - Credits accrue based on amount of investment

Experiences in UK

- Non-Fossil Fuel Obligations (NFFO) obligated utilities to purchase renewable energy at a premium
  - Introduced in 1990 and stayed in effect until 1998
  - **Auction based; no targets for renewable**
  - Premium was funded by a fossil fuel levy.
  - Four auctions for 600MW, 1000MW, 1500MW & 1177MW
- NFFO did not have penalties for companies that won bids, but did not start a wind project
  - Unutilized capacity
  - Companies were bidding low with impunity, sometimes to block competitors
  - There is general agreement that if NFFO had a penalty for non-performance, it would have been a good mechanism

Source for country experiences: History of Policy Development for Wind Energy, GWEC & IRENA, April 2012

Experiences in UK

- Since 2002, Renewable Obligations (RO) have taken the place of NFFO
- Target: 10% by 2010
- It mandates all distribution companies to supply set percentage of electricity to consumers from renewable sources
- RE projects generate Renewable Obligation Certificates (ROCs), which are tradable
- This quota-based market model has proved to be more successful, with growth to 7% of electricity from renewable energy versus 3% before the RO.

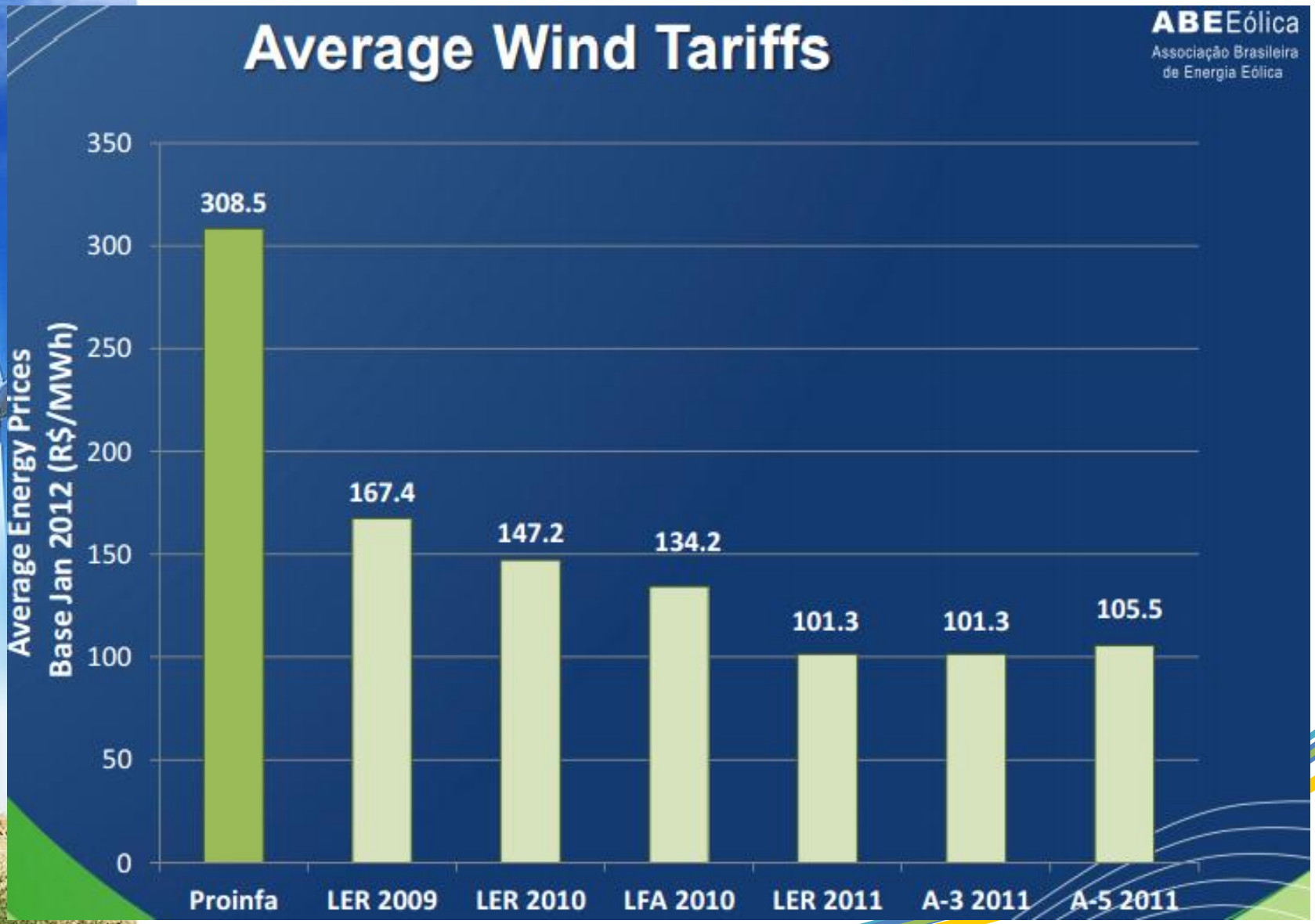
Experiences in Brazil

- Started with The Programme of Incentives for Alternative Electricity Sources (PROINFA) in April 2002
  - 1,100MW was assigned under this Feed-in Tariff scheme with a deadline of 2008
  - Not successful because of:
    - Complex and highly bureaucratic permitting process and procedures to obtain or renew environmental licenses
    - Problems and delays in obtaining the Declaration of Public Utility (DUP) for projects
    - Difficulty in connecting to the grid, particularly in the Central-West region
    - High local content requirement for turbines & BOP
  - Deadlines were repeatedly postponed
  - Lack of a clear long-term policy signal strongly undermined investments

Experiences in Brazil

- In 2009 PROINFA was replaced with auction
- New policy signals spurred the development of the projects
- Under reverse price auction (competitive bidding system) aim was to efficiently and cost effectively increase the country's energy supply security
- Structure of the auction system set the bar for entry sufficiently high such that only serious players were able to compete for the tenders
- Rigorousness of this system has given the industry confidence to move ahead even with the very low prices of the winning bids in auctions
- 7,000 MW of wind energy pipeline has developed under the auction scheme

Experiences in Brazil



UK vs. Brazil

- UK started with auctions with little success
- Renewable portfolio obligations with renewable energy credits has proved to be successful

- Brazil started with Feed-in tariff with luke warm uptake
- Auctions have resulted in sharp rise in wind projects

Long-term targets for renewable accelerated development

Experiences in Italy

- Italy's national policy for renewable operates through complex set of incentives:
  - Indirect regulatory support measures such as feed-in tariffs and fiscal incentives
  - Market based mechanism such as quota obligations and tradable green certificates
- According to the EU RE-Shaping study, Italy has the highest average expenditure for supporting wind power
- Result: Sustained investments despite long administrative procedures and grid constraints

Experiences in Italy

- As examples of favorable incentives:
  - Price of Green Certificates was 109 EUR/MWh in 2005 and 130 EUR/MWh in 2007
- The current level of favorable incentives and support are not sustainable and a reduction is likely
- Starting 2013, the Green Certificates will be replaced with Feed-in tariff for small projects and tendering system for larger projects

Experiences in India

- Tried a wide variety of and combinations of incentives and market-based mechanisms:
  - In the formative years, the most successful incentive was 100% depreciation in year 1, which was reduced to 80% and now has been phased out. It has been replaced by a generation-based incentive.
  - Most states in India have Renewable Portfolio Standard, which are met by renewable energy purchases or tradable Renewable Energy Certificates (REC)
  - Most states have state-specific feed-in tariff, computed based on a cost-plus methodology
  - Few wind rich states allow for third party sale of electricity generated from wind projects within the state, in addition to banking and wheeling facility. These states have enjoyed large number of wind installations.

Experiences in India

- India's early success was also from manufacturer driven vertically integrated model :
  - Wind turbine manufacturer provides complete start to end services--Land acquisition, installation, commissioning, operations and maintenance
- New model is Independent Power Producer based system with the following collection of incentives:
  - Feed-in Tariff
  - Generation-based incentives
  - Market oriented incentives in the form of RPS & RECs.

Lessons from Italy & India

- Collection of incentives that combine feed-in tariff and market-based incentives that are continuously fine-tuned is a recipe for success
- Policies that result in successful growth of renewable energy are not necessarily efficient

Experiences in Denmark and Germany

- Denmark is the pioneer of wind industry, while Germany has the largest amount of wind installations in Europe
- Both countries have benefited from long-term renewable energy targets
- Primary incentive mechanism is feed-in tariff, specified as a premium over the market price
  - Denmark: Premium in 2009-2012 is 33.5EUR/MWh
  - Germany, the Feed-in tariff mechanism is extremely detailed and designed to respond to market developments. Since 2009, the total feed-in tariff is 92 EUR/MWh, with an annual degression.

Experiences in Denmark and Germany

- Both countries started with a very community-focused approach to wind development, which resulted in cooperative owned wind farms
- There were no auctions, so no competition from outside
- Market-oriented policies like auctions have been adopted recently, but only for off-shore wind

Experiences in China

- China's wind industry has experienced extremely high growth. Primary reasons are:
  - Sustained government support
  - Clear long-term goals
  - Stable tariff
- Until 2008, there was low to moderate growth, and then experienced sharp growth
- Prior to 2008, the feed-in tariffs were determined by competitive bidding, which resulted in low and uncertain tariffs
- After 2008, the feed-in tariffs are fixed for different regions of the country

Lessons from Denmark, Germany and China

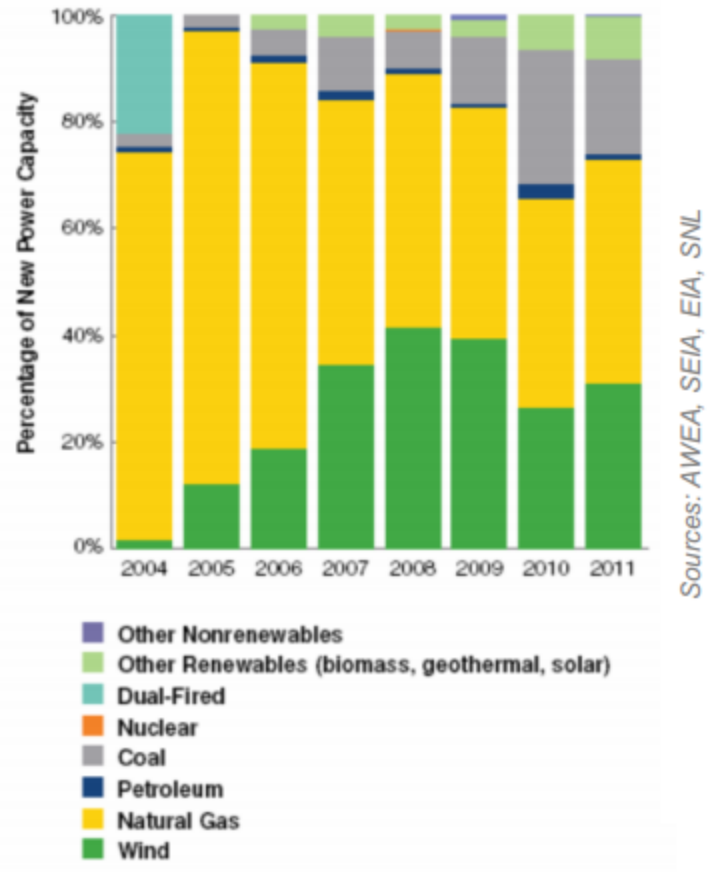
- Primary mechanism that has resulted in high growth is Feed-in tariff
- Stimulating growth requires constant fine tuning and adjustment based on market conditions
- Key ingredient in addition to feed-in tariff is long-term commitment reflected in long-term goals/targets for renewable energy

Experiences in USA

- Production Tax Credits (2.2c/kWh)
  - High uncertainty
- Accelerated depreciation (5 year)
- Several temporary schemes (ITC, grant, etc.)
- State specific Renewable Portfolio Standard & RECs
  - Steady

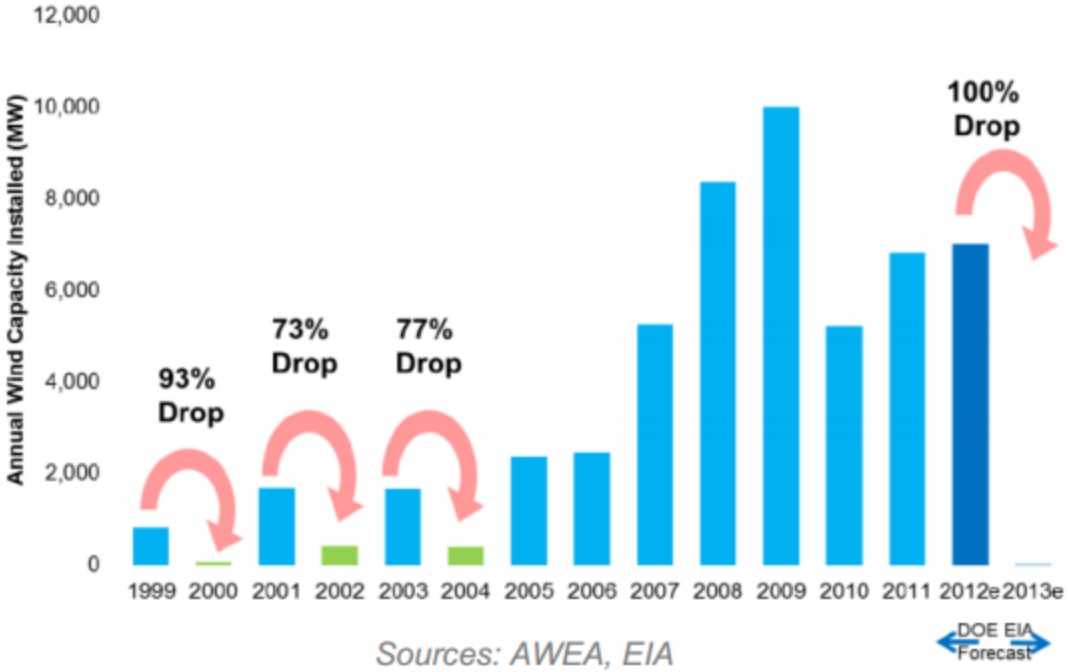
Experiences in US

Wind provided 35% of all new U.S. power capacity in the last five years



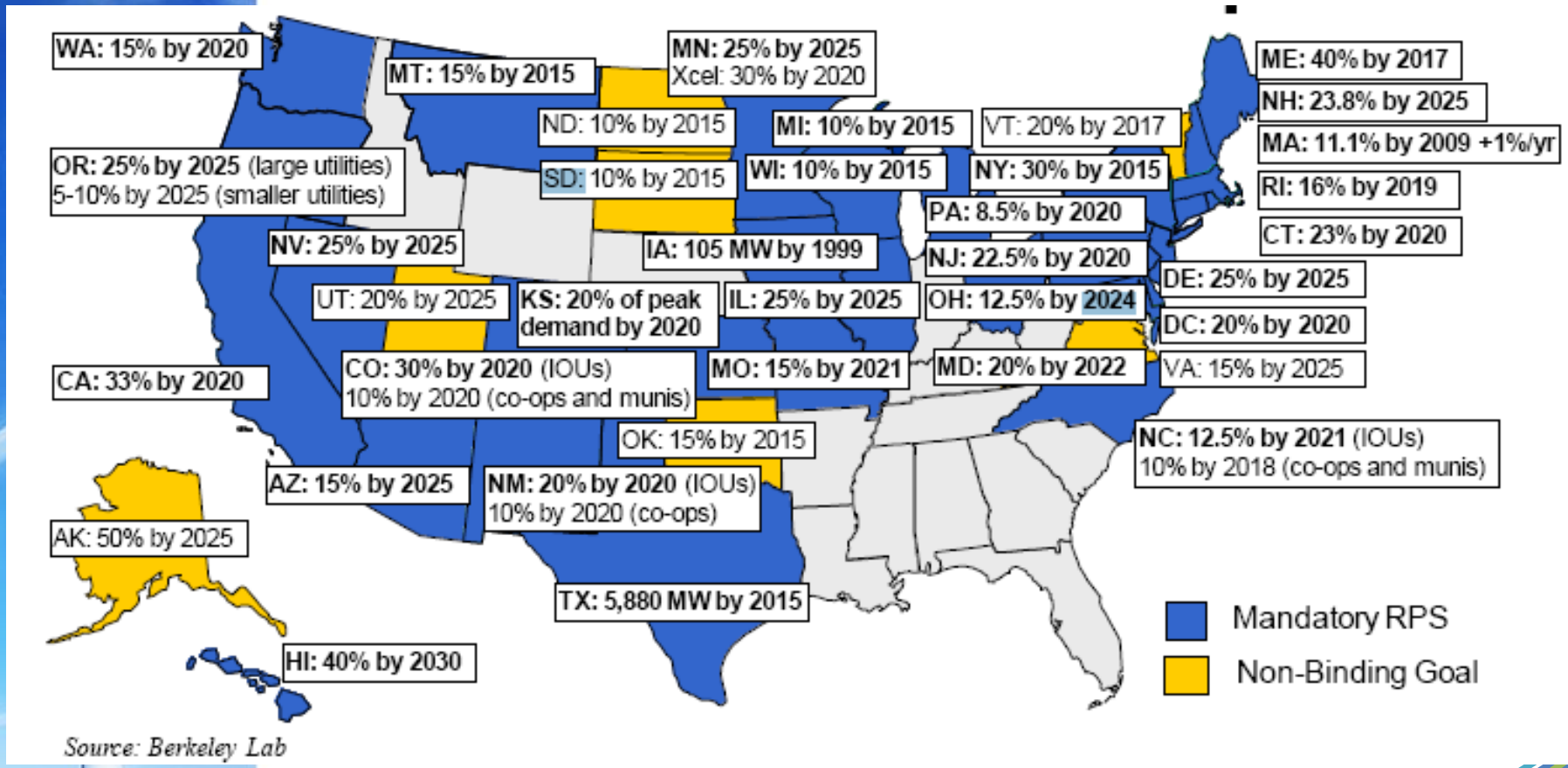
Sources: AWEA, SEIA, EIA, SNL

Historic impact of PTC expiration on annual wind installation



Sources: AWEA, EIA

Experiences in US



Source: Berkeley Lab

Experience in New Zealand

Wind now supplies just over 4% of New Zealand's electricity with no subsidy or special treatment whatsoever.

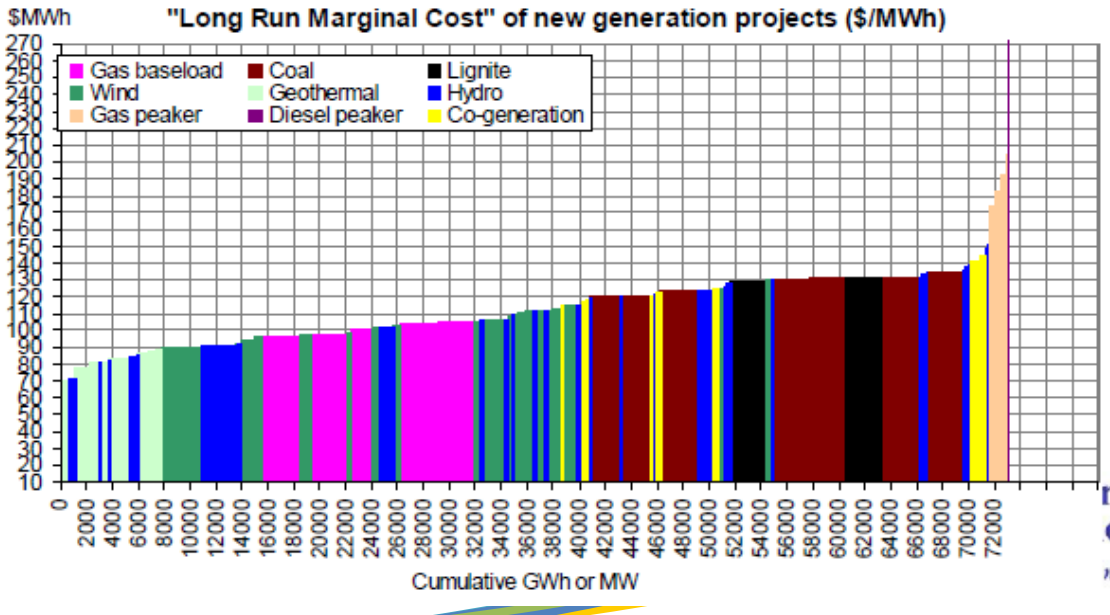
NZ Electricity Supply Growth

For the next 10 years at least, the majority of demand growth is expected to be met from wind, geothermal and hydro.

No gas plants are expected except for peaking to mid-merit plant to support intermittent renewable generation.

Why?

Economics favour renewable investment.



Conclusions

There is no “one-size-fits-all” model

- None of the policies were effective in the first or second iteration.
- The most successful renewable energy markets have evolved over successive iterations
- Successive iterations not only align incentives with market/investor expectations, but also demonstrate a long-term commitment of government to tune policy parameters in response to market conditions
- Policies must be long-term with built in flexibility and mechanisms to adapt to lack of or excessive development of wind energy
- Built-in flexibility and mechanisms must be transparent and predictable to ensure steady progress of RE development.

Conclusions, Contd.

Several countries changed support regime over time in order to adapt to **the technology maturity and learning process**

- **China** 1/ demonstration phase, for a few projects 2/ tendering process and locally negotiated prices 3/ feed-in system taking into account the intensity of the wind resource, with clear national targets.

- **Brazil** 1/ dedicated programme, with a feed-in tariff 2/ launch a reverse auction system, with a large amount of projects.

- **Greece** : several changes in legislation. Latest are: clear targets, a one-stop-shop approach, clear administrative deadlines, a clear tariff structure, incentives for local communities, support to project investment, and land use planning.

Source: Efficient policies for wind power development Draft summary findings, **Dr. Nicolas Fichaux, IRENA**

Conclusions, Contd.

An efficient scheme provides security on investment and a decent return on investment.

- Germany - **feed-in tariff**, provides long-term guarantees and a fair return on investment to investors, taking into account the learning process of the technology.
- Portugal - a **feed in tariff** (15 years protected from inflation), and a boost provided by a **tender** in three phases, which led to the creation of an industrial cluster for wind energy.
- Spain - feed-in tariff as a **premium** paid over the **electricity market price**. Targets a stable return on investment of 7%. Recent cuts in the scheme.
- Italy - **certificate system**, with obligation for energy producers and importers to inject a quota of renewable energy, under the form of certificates bought from own renewable energy production or from third party. Further adapted to the technology by granting more value to less mature technologies and compensating for the learning process

Source: Efficient policies for wind power development Draft summary findings, **Dr. Nicolas Fichaux, IRENA**

Conclusions, Contd.

A tendering system does not seem to work as long as the technology is at the start of the learning curve – the supply chain is not in place and the costs are not well known. Risks are high to have too low bids, leading to non-completion of projects**:**

- **UK** – 1/ auctioning system – low completion rates, 2/ certificates system on pure market based, 3/ similarly to Italy got a bonus adapted to technology risk.
- **Ireland** – 1/ Tendering system large amount of projects, many not developed. 2/ market really took off when a feed in tariff scheme was created with clear targets.
- **Brazil** – 1/ programme based on feed-in tariffs, which created capacities in the country, and a learning experience. 2/ the auction system
  - Specific case study: Brazil has very important resource – hence potentially low LCOE, an important potential market, providing export opportunities. The auction price is protected from inflation, which mitigates part of the risks. In such specific configuration, the industry is taking the risk to invest in the market and create an industrial base

Conclusions, Contd.

Policy sequencing is critical for policy effectiveness

- Preconditions must be in place before RE policy is introduced, otherwise bottlenecks are created and there is chaos
- Preconditions:
  - Basic legal and regulatory mechanisms: Deregulation, IPP contracts
  - Institutional and administrative processes to conduct auctions, issue licenses, sign PPA
  - Legal and regulatory frameworks for grid connection and integration

Conclusions, Contd.

- Other preconditions for any model (Feed-in tariff with market-based models) to achieve sustained development
  - Grid interconnection standards
  - Planning for transmission capacity to evacuate power from wind rich areas
  - Sufficient spinning reserves to compensate for variability of wind energy
  - Clear guidelines for permitting: Environmental Impact Study, Interconnection study, Microwave & EM interference
  - Clear land ownership & land use rules
- Integrating Variable Sources
  - All market find a way to integrate, even at high levels of wind penetration