DESIGN AND PERFORMANCE OF ECONOMIC INCENTIVES TO SUPPORT RENEWABLE ENERGY DEVELOPMENT

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IFC ESMAP RENEWABLE ENERGY TRAINING PROGRAM; June 17th, 2014

The World Bank Group

Agenda

PART I RATIONALE FOR RE POLICY

- Global targets and trends in RE
- Trends in RE policy
- WB Directions in Renewable Energy

PART II DESIGN

- Typology and description of policy instruments
- Importance of the business environment
- Policy Attributes

PART III IMPLEMENTATION AND PERFORMANCE

- Feed-in Tariffs
- Auctions
- Renewable Portfolio Standard
- Policy for RE in Distributed Generation

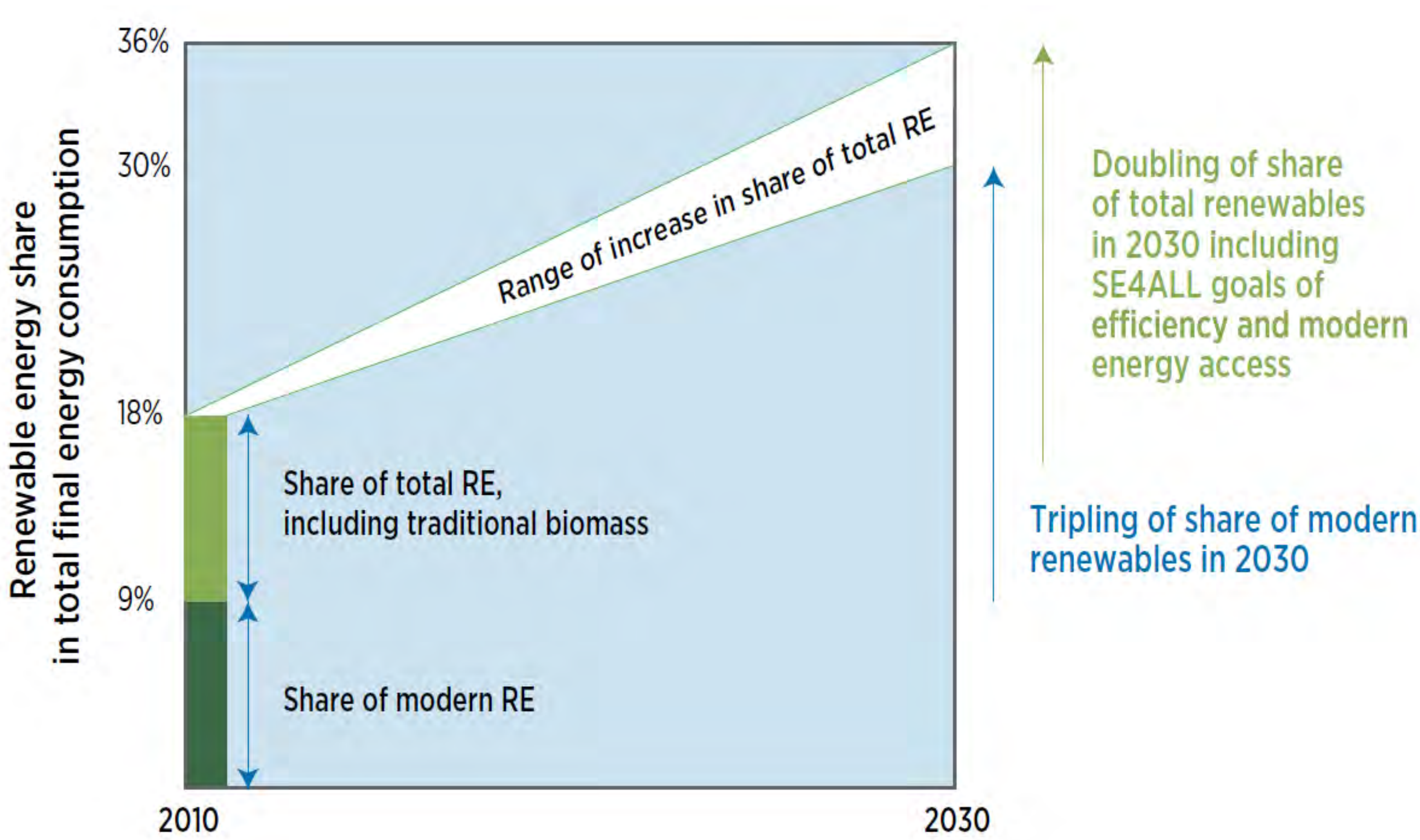
PART IV GENERAL LESSONS OF EXPERIENCE

PART I

RATIONALE FOR RE POLICY

SE4ALL Global Target on Renewable Energy

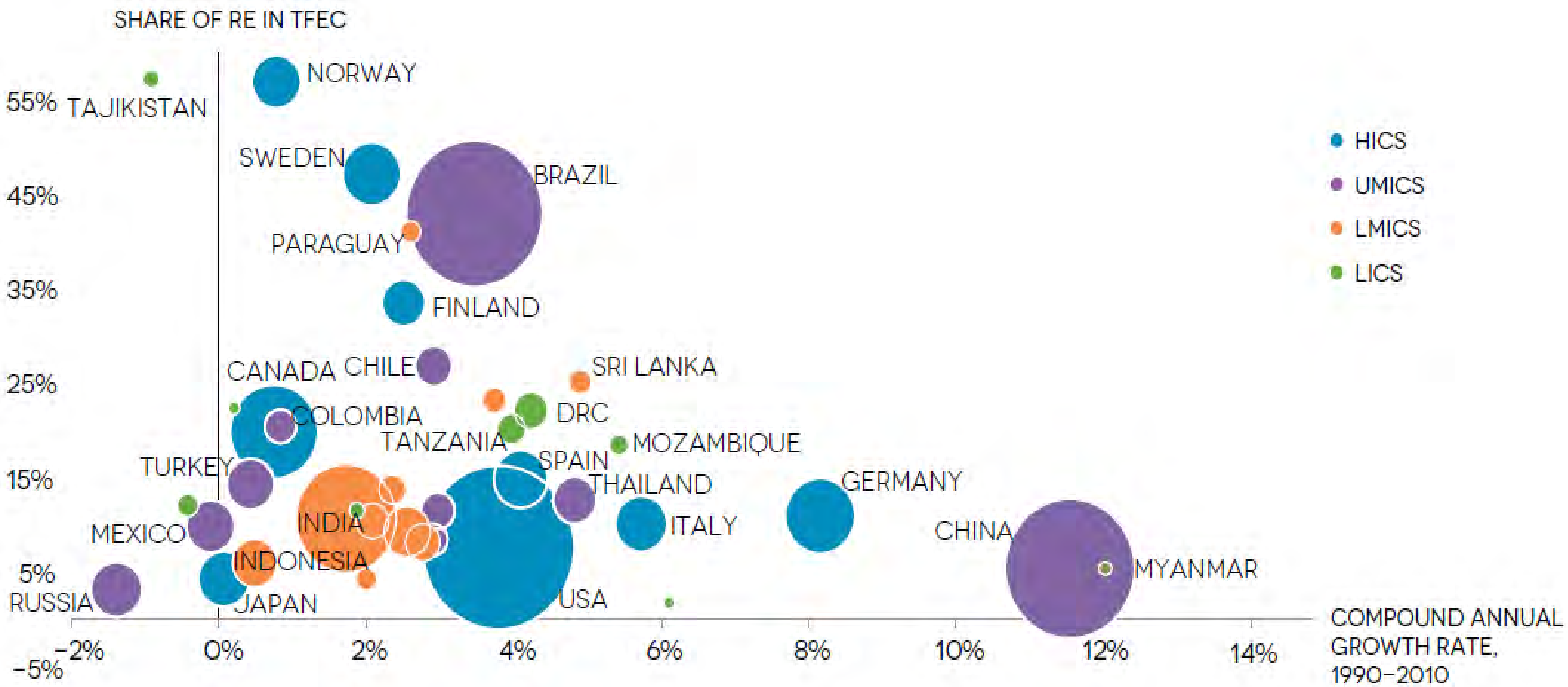
Doubling of the share of RE in Total Final Energy Consumption



Source: IRENA REMAP

Fast-Moving Countries

Almost 80 percent of modern RE produced and consumed by high income and emerging economies



Source: SE4ALL GTF, 2013
Note: excludes traditional biomass

Today, 138 countries have a target in RE

Competitive mechanisms increasingly popular

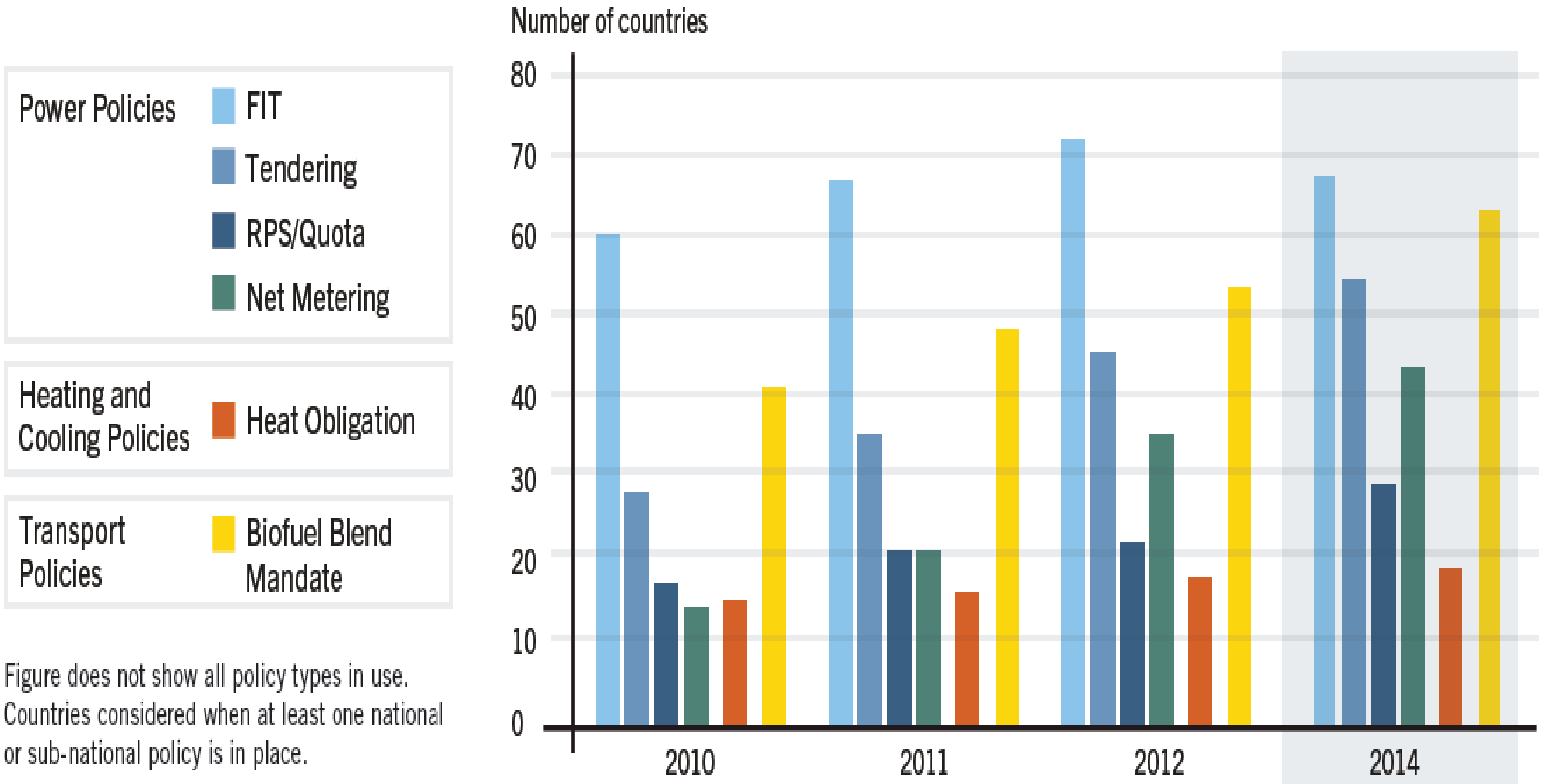
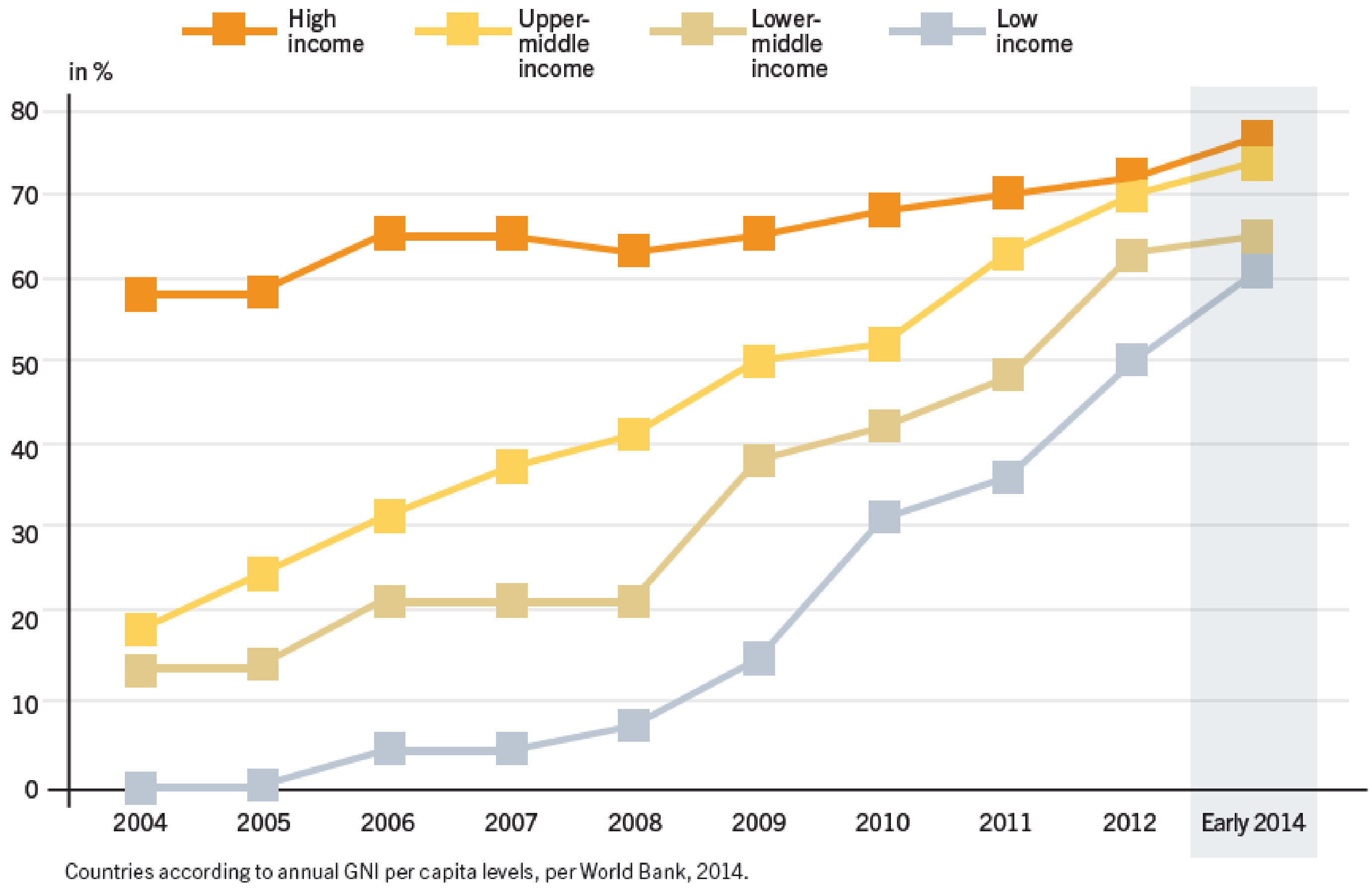


Figure does not show all policy types in use. Countries considered when at least one national or sub-national policy is in place.

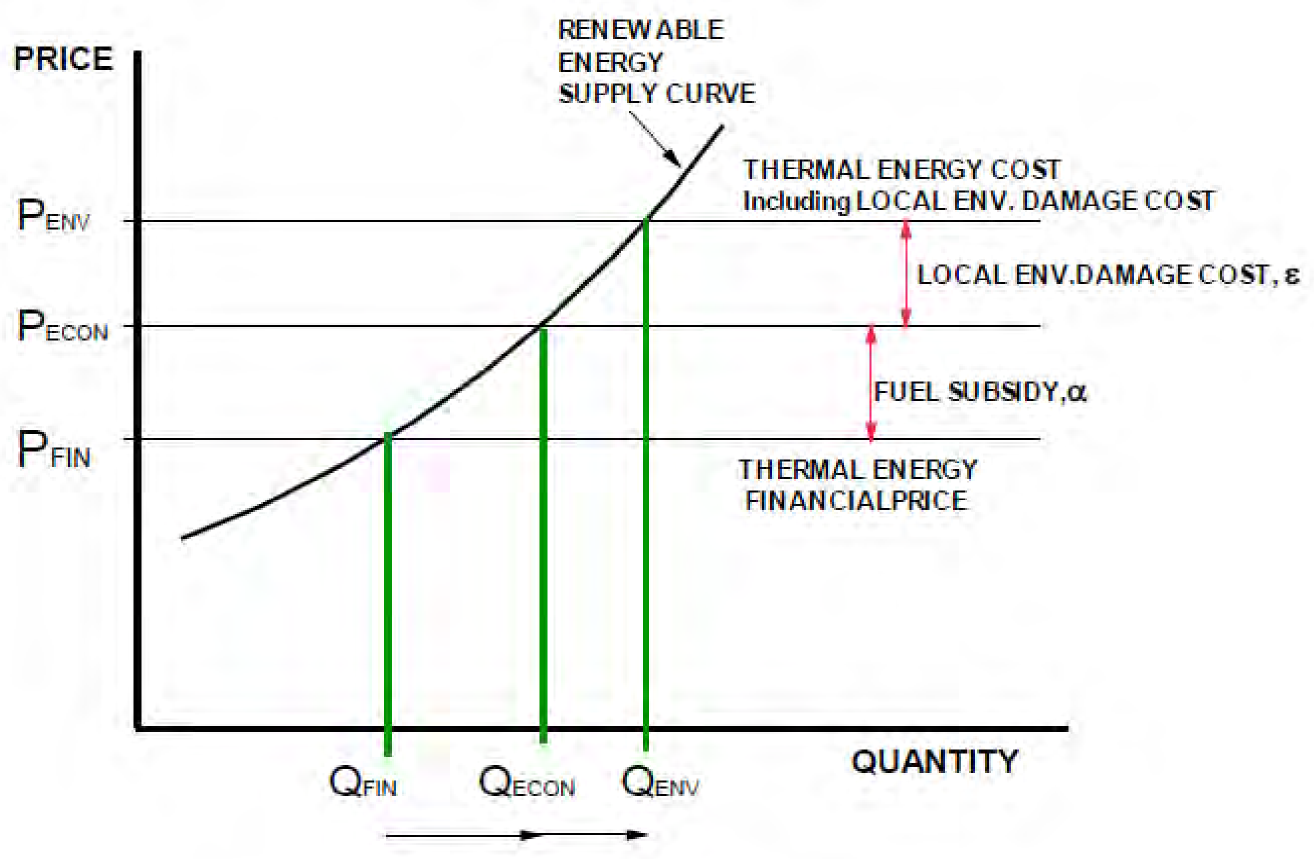
Source: REN21, 2014

Share of Countries with RE Policies
By Income Group



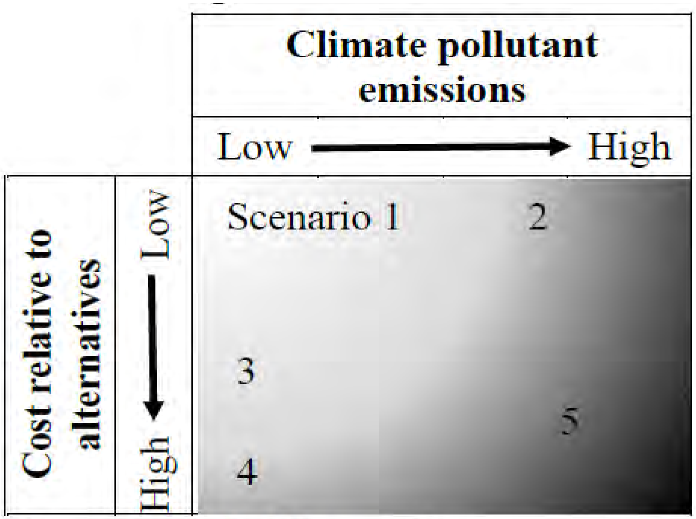
Source: REN21, 2014

Economic rationality is a sine qua non for successful RE incentive programs



❖ Transparent recovery of incremental costs is critical

World Bank Group: Energy Sector Directions Paper



Source: World Bank Group staff.

Scenario 1. Projects that exhibit low cost and emit zero or low emissions which represents a strong case for WBG support

Scenario 2. Projects that exhibit low cost but release moderate to high emissions, which may be supported if critical energy demands need to be met, especially when the project aims at increasing energy access

Scenario 3: Those with higher cost, low emissions projects in which WBG support is **possible contingent on either availability of concessional finance to cover incremental costs**, or strong client demand and ownership

Scenario 4. Projects with very high cost low emissions projects mostly representing emerging innovative technologies, in which WBG support is **possible when the project offers strategic potential for the future and where there may be global externalities in demonstration and replication effects**

Scenario 5. High cost high emission projects, which will not be supported by the WBG if there are other feasible alternatives

PART II

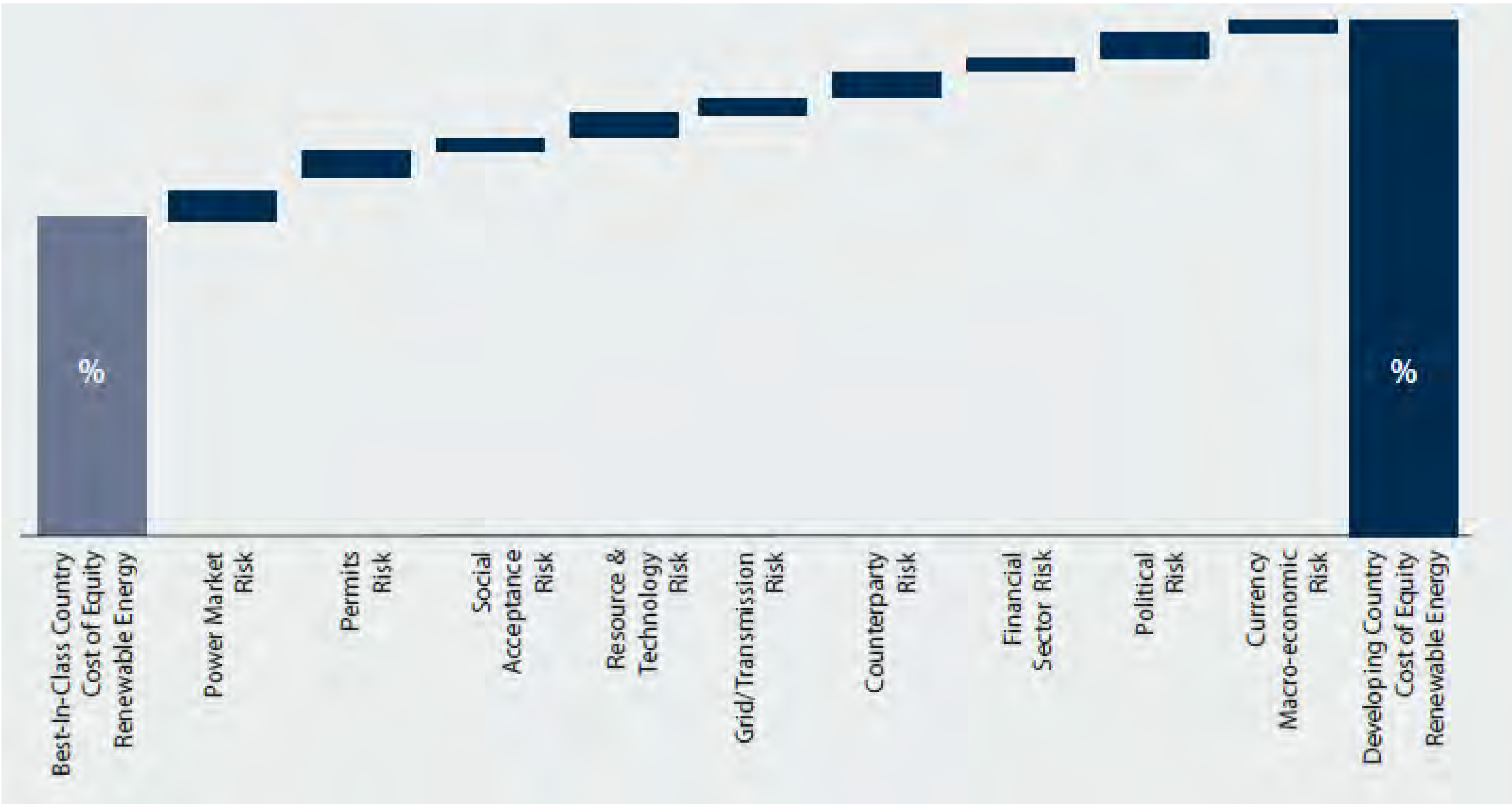
POLICY CHOICE AND DESIGN

Complex Policy Packages: Use and Overlapping of Many Instruments

Country	FITP	RPS	Tradable RECs TGC	Public Competitive Bidding	Capital Subsidies, Grants, Rebates	Investment or other Tax Credits	Tax reductions, exemptions	Energy production Payments , Tax Credits	Public Investment Loans, Financing
India	X	X	X	X (auction)*	X	X	X	X	X
China	X	X		X (auction)	X	X	X	X	X
Brazil				X (auction)		X	X		X
South A.		X		X (auction)	X		X		X
Turkey	X				X				
Argentina	X			X (auction)*	X	X	X	X	X
Chile		X		X	X		X		X
Poland		X	X	X	X		X		X
Romania		X	X						X
Philippines	X	X		X	X	X	X	X	X
Kenya	X			X			X	X	X
Tanzania	X				X		X		
Uganda	X				X		X		X

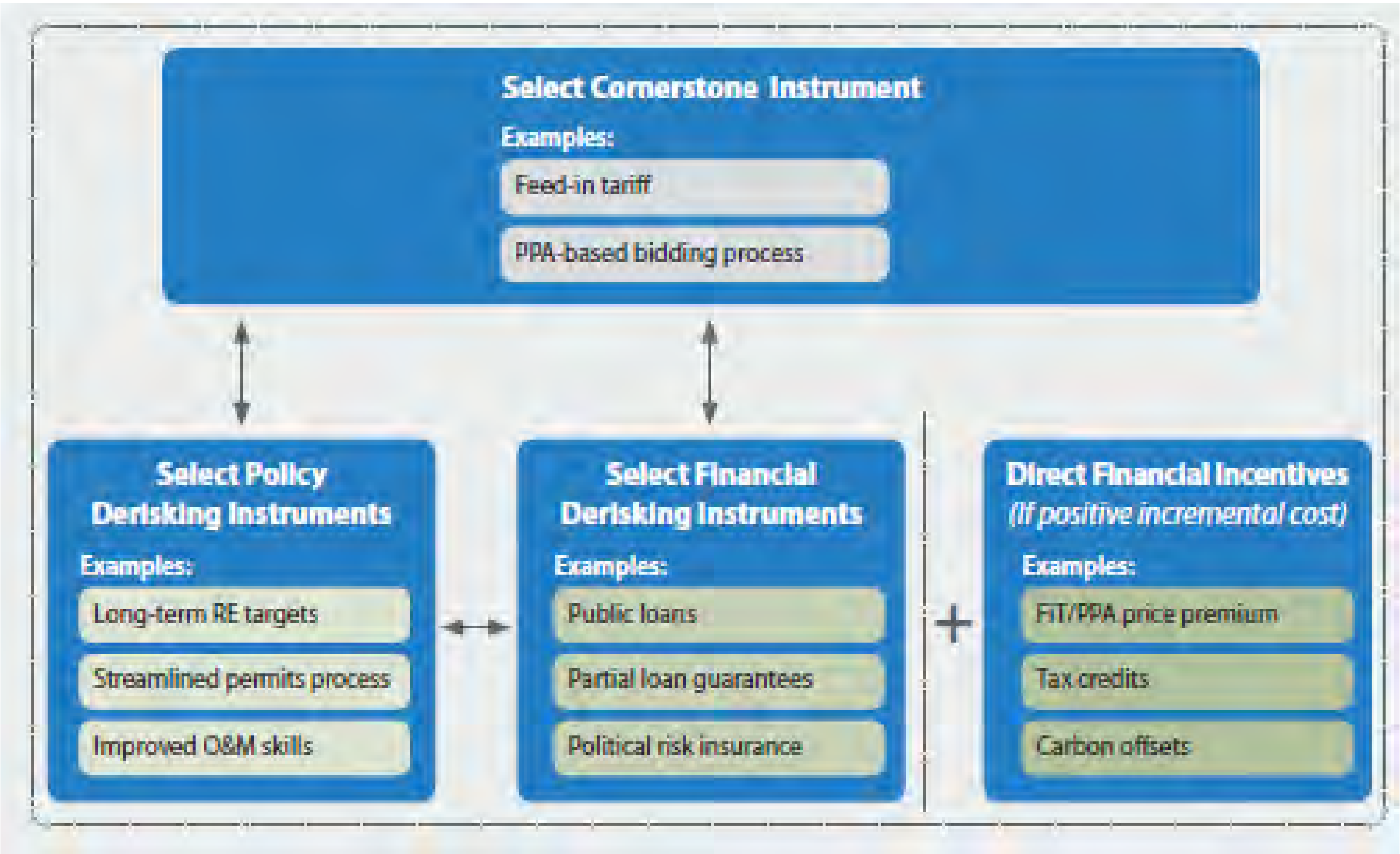
Importance of the Business Environment

Financing Cost Waterfall: Impact of Risk in Financing Cost



Source: UNEP, 2013

Necessary to blend economic (performance based) instruments with de-risking instruments

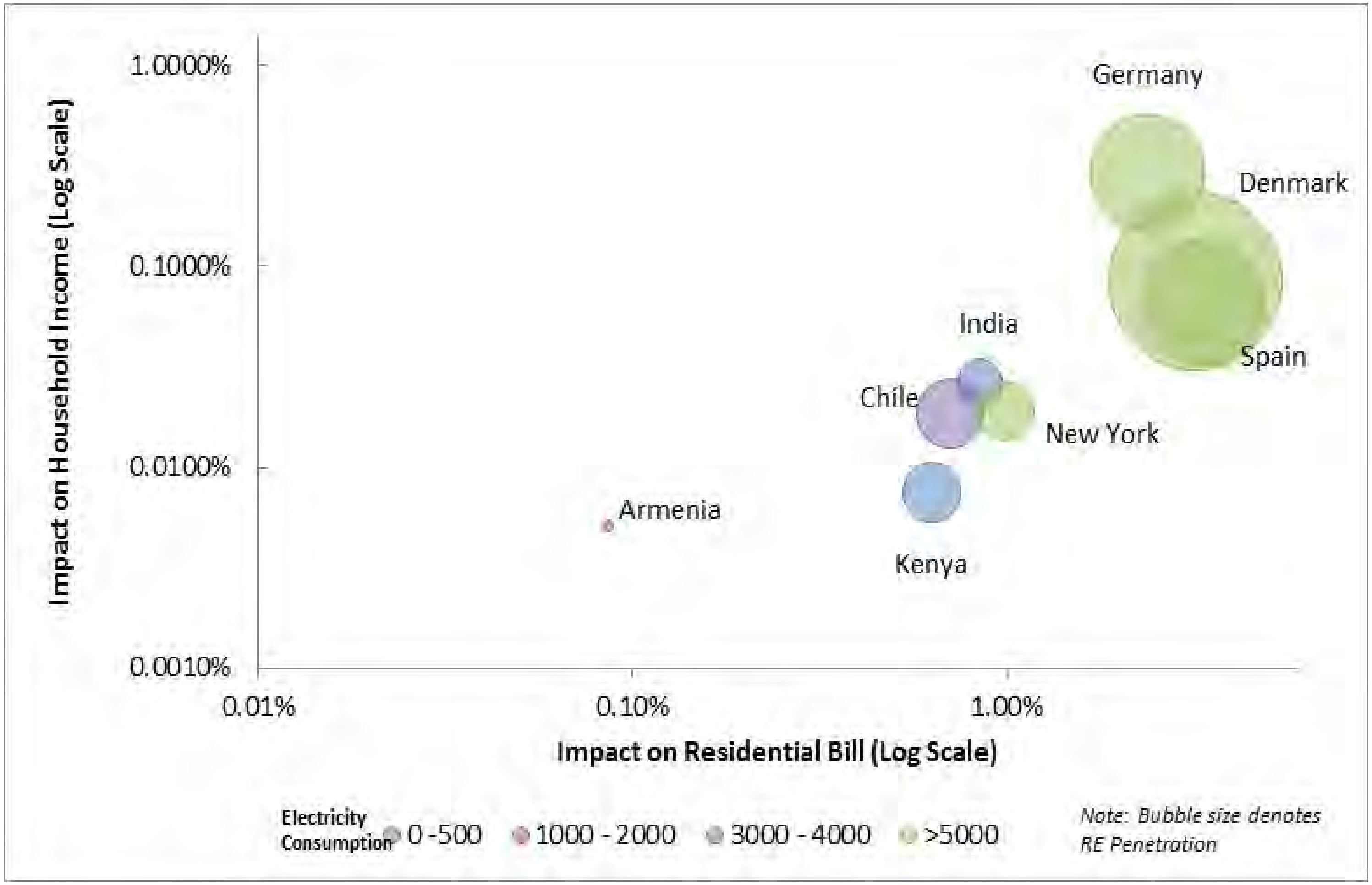


Source: UNEP, 2013

Policy Attributes

Predictability	**Associated with the long term certainty of RE production purchase and price** ❖ purchase obligation imposed on utilities, discos or other service providers ❖ explicit rules for price level modifications and their frequency ❖ inclusion of mechanisms in tenders that promote realistic price bids
Efficiency	**Refers to the efficiency of the remuneration level (price, period of support)** ❖ Policy makers need to ensure that the price incentive is closely aligned to costs to avoid over compensation or infra-marginal rents
Sustainability	**Incremental cost is covered through a sustainable mechanism** ❖ Pass-through to the consumer tariff (surcharge) ❖ Consumer affordability
Accessibility	**Associated with access to the grid** ❖ Prioritized access to the grid (or priority dispatch) ❖ Existence of a grid code that includes measures or standards for managing variable renewable energy ❖ Transparency in cost allocation of curtailment

Importance of Affordability



Source: RISE Index, World Bank

PART III

IMPLEMENTATION AND PERFORMANCE

The merits of Feed in Tariffs

- No other mechanism has promoted such an explosive growth in renewable energy in the world
- Most countries leading the deployment of renewables have adopted FiT
- Massive deployment has created economies of scale and contributed to technology development, learning curve, and price decline
- Developed countries like Germany and Spain deserve a lot of credit for this quantum leap
- Countries expect that by providing very generous FiTs they will accelerate renewables (e.g. Japan)

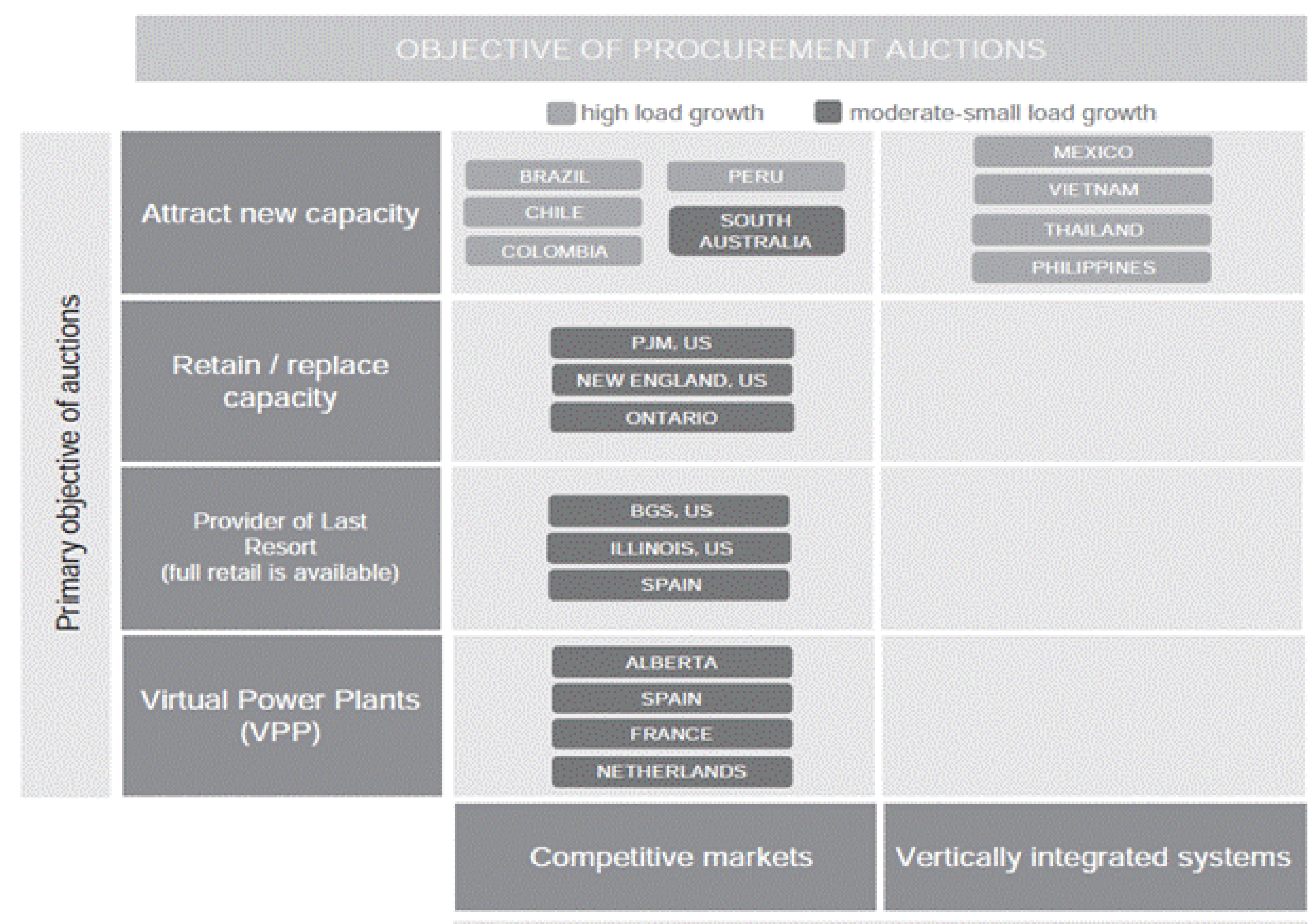
The drawbacks of Feed-in Tariffs

- No competition - Excessive rent in the system
- Huge costs – who is going to pay? (e.g. the bubble in Spain)
- Allegedly mechanism to reinforce industrial policy on local content (e.g. WTO organization dispute in Canada)
- Critics claimed that huge state incentives created excessive profits for companies
- Lack of sustainability and government's sudden shifts have challenged the own essence of FiT – "stability, predictability" (Germany, Bulgaria, Greece)
- If the goal is really to deploy renewables, should an expensive mechanism continue to be pursued?
- Can poor countries afford not having lowest cost options for their generation?

Competitive Procurement and Auctions

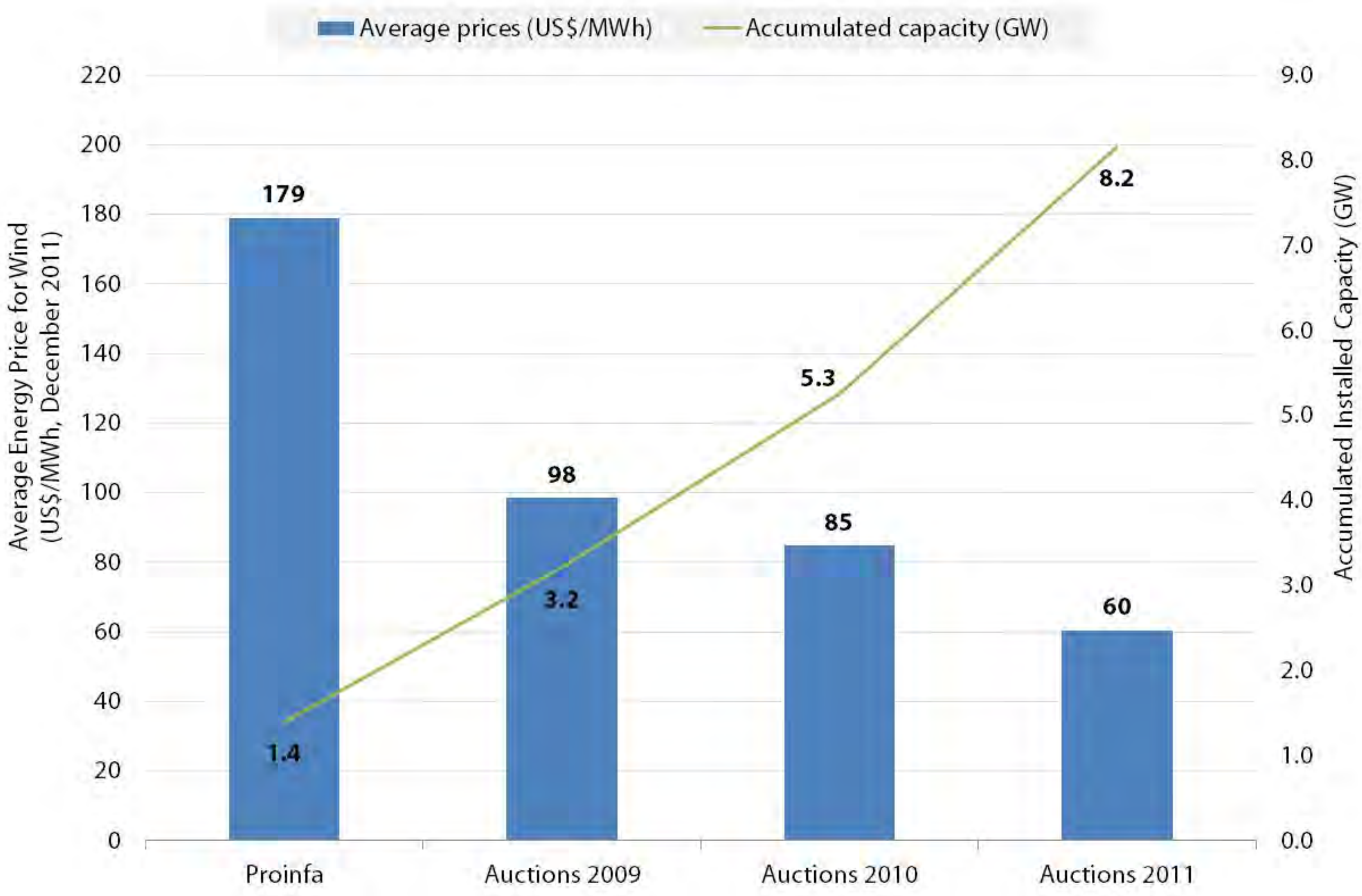
- **Competitive Procurement to acquire resources – prices are not-predetermined, but the result of a competitive process and bids presented by multiple participants**
- **It can be applicable to supply (electricity contracts) or demand - buyer is typically a utility company**
- **Award (winning bid) depends on a weighting of price and non-price factors**
  - **Off-shore wind in France**
  - **South Africa wind and solar (RE-BID)**
  - **PURPA in some states**
- **While "auctions" per se are awarded solely on the basis of lowest price among qualified bidders (including a wide menu of auction designs)**
  - **Many recent auctions for renewables and non-renewables in Latin America**
  - **EE procured in Missouri**
  - **Capacity market in several jurisdiction in the US**
  - **Demand Response in the US**
  - **BGS in New Jersey**

Competitive Schemes have served multiple purposes in many countries



The merits of auctions on prices and volumes

Barroso, Luiz (2012) renewable Energy Auctions: The Brazilian Experience



Several other recent success stories in auction performance

- <u>Peru</u> - Prices ranged from $69 a megawatt-hour for a wind farm to **$119.90 for a photovoltaic solar park**. Wind farms get 77 Euros a megawatt-hour in <u>Spain</u> and 82 Euros in <u>France</u>, both through feed-in tariff programs.
- **<u>India</u> - Between early 2010 and March 2012, the price of solar energy in India dropped to as little as INR 7.49 per kilowatt hour or <u>USD 0.15 USD/kWh.</u> Much of this price decrease is due to the National Solar Mission's reverse auction bidding process, which awarded solar projects to companies with the lowest asking price. This price drop in Indian solar power means that solar could achieve price parity with coal or natural gas by 2016.**
- <u>Uruguay</u> – Wind auction $63 a megawatt-hour
- <u>Turkey</u> – "Merchant" wind generator – not an auction for long term contract, but price resulting form an auction taking place every [15] minutes in the power pool
- **<u>Morocco</u> – CSP – remarkable price decreases compared to expectation and to other countries (US 18 cents)**
- **<u>South Africa</u> – US 9.5 cents/kWh competitive PV - Nov 2013**
- **Chile – Private merchant PV about US 10-12 per kWh – Oct 2013**

The South Africa RE-BID Case

Anton Eberhard, 2012 IFC Viewpoint

- RE target: 18,8GW of wind and solar, out of total system capacity of 90GW, by 2030 (*IRP2010*)
- 2009: FiT policy announced by NERSA; 2011: shift in policy and announcement of competitive bidding for RE (REBID)
- First request for proposals: 3,625MW in total, mix of technologies
- 2-step process:
  1. Satisfaction of minimum threshold requirements in six areas: environment, land, commercial legal, economic development, financial and technical
     - Plus: bid bond (US$12,500/MW)
  2. Price bid 70%; 30% composite score on job creation, local content, preferential procurement, enterprise development and socio-economic development
- Evaluation of bids: 28 qualifying bids, total 1,416MW
- **Lesson learned for Round 2: less capacity bid (1,284MW) to increase competition: bid prices 20% lower for wind and 40% lower for solar**

Drawbacks of Auctions (alleged)

- "Indeed, auction-based mechanisms are not without their flaws either. Under an auction-based system, an incentive is created for bidders to bid as low as possible in order to increase their chances of securing a contract. Recent experience from jurisdictions such as China and Brazil suggests that underbidding is widespread, and contract failure rates remain high, leading to slower growth.

- If repeated over several auction cycles, this process can be timely, costly and highly inefficient, both for regulators and investors, and can effectively undermine investor confidence, as well as a jurisdiction's ability to meet renewable energy targets on time.

- On a different level, auctions significantly increase the overall risk of renewable energy investments, as there is a relatively low likelihood that any individual project will receive a contract. Bidders must therefore put up significant sums in order to mount a bid at all, adding layers of transaction costs with little assurance that this risk will be rewarded with an actual contract to build. This risk must then be reflected in the cost of capital, as both debt and equity providers will rightly identify increased contract and completion risks, and demand higher returns. These higher returns may well wipe out any gains derived from greater price efficiency.

- A further challenge with an auction-based mechanism is that it will prove exceedingly difficult under such frameworks to develop robust and dynamic manufacturing and supplier markets, partly because the latter will have to rely largely on periodic auction calls."

How to respond / address those concerns?

- **Bidding as low as possible (build, not built - DB) – penalties, performance bonuses, governance; FiT delays are also usual**
- **Multiple auction cycles may be timely and costly – on the contrary, systems and expertise already in place. Reasonable to exclude DG and very small plants (e.g. net metering)**
- **Increase transaction cost for bidders. Government has to prepare large projects, benefits in terms of cost of capital will not be trivial, compensate early development costs**
- **Difficult to establish a manufacturing base. Ask manufacturers. True that government should not be the only player in town.**

Is competition feasible (or desirable)?

- **Feasible?** – Not always. It depends on several factors
  - Can the product (contract) be defined precisely?
  - Chances of attracting competition
  - Size of the project – e.g. utility scale versus distributed generation
  - Stage of technology development
  - Institutional arrangements
  - Rule of Law - a must for both FiT or Auction
- **Desirable?** It depends to whom. Customers? Taxpayers, Local Manufacturers?
- **Is this an energy issue or industrial policy issue**, aiming at industry protectionism and local content?
  - If the former, the more transparent and efficient the better.
  - Otherwise FiT is better – government has more control on the economic rent allocation

The real drawbacks of ongoing electricity auctions

- Most auctions in the developing world “mute” the demand side
  - One sided
  - Demand is assumed to be a vertical, inelastic line

- With a few cases (e.g. Colombia) where a hypothetical elasticity of demand is embedded

- Demand resources are not considered “resources” – not part of the equation

- No competition among demand resources

DISTRIBUTED GENERATION

- Two goals - Economic efficiency, balancing the interests of the utility and those of the consumers
- Does it make sense to have policies and regulations to foster DG? Definitely yes
  - Continued cost decreases expected
  - Most of our clients have abundant sun and high tariffs
  - Hedge against oil price volatility
- What are the primary regulatory mechanisms? There are more than ten. The main ones are net metering and net billing or combinations thereof.
- Most assume synchronization with grid and in rare cases storage (therefore do not work as back-up power)

NET METERING vs. NET BILLING – OR VARIATIONS?

- **Net Metering – energy sold to the utility at same price as energy bought from the utility – one "net" meter**
- **Net Billing – energy sold to the utility at marginal cost of fuel – two meters**
- **Which is better? Which is ideal?**
  - Better – Net Metering – prices same product at same amount in the same electric node
  - Ideal – none
- **What would be ideal?**
  - A net-metering system that remunerates the utility for the grid services and back-up power
  - And compensates the utility adequately for the cost of back-up when wind is not blowing or sun not shining (which may be peak-hours) – therefore time of use (TOU) pricing advisable
  - In the absence of TOU tariffs – start with net metering with a fixed payment for distribution use of system

A case study – built on a full "do-it-yourself" basis

- 7.25 kW (26 x 250 W + 3 as back-up)
- Micro-inverters and Data Concentrator
- Sunny Summer day > 40 kWh
- Sunny Winter day = 20 kWh
- Cost = US$ 2.2/Watt peak
- Expected Production= 12 MWh/yr.
- Expected Consumption = 9 MWh/yr.
- Net metering, but monthly surplus settled at PJM price
- Owner holds RECs
- Expected Payback – 5-6 years
- Tax benefit – 30% tax bracket
- Other subsidies = none in VA, but …
- As an option - Utility offers 5-year PPA at US 15 cents (FiT) – Utility holds RECs

UTILITIES HAVE THREE APPROACHES TO DEAL WITH THIS NEW CHALLENGE OF DISTRIBUTED GENERATION

- Deny it – it is not going to happen here, cost of capital is higher, too small systems to deal with volatility
- Fight against it – lobby for import tariffs, limit DG, object to regulations to foster RE - But it may backfire, leading to a proliferation of informal systems, increased tension with governments and customers
- Seize the opportunity (see examples in the next page)
  - Understand your strengths – utilities are possibly the best vehicle to deliver RE and EE – know the customer, have resources
  - Work with government to put win-win regulations in place
  - Engage the customer as an ally
  - Engage with potential IPPs and technology suppliers
  - Explore new financing options – e.g. On Bill Repayment
  - Leverage existing assets –diesel gensets sell ancillary services

SEIZING OPPORTUNITIES – EXAMPLES OF SOLAR DG

OWNING INSIDE THE FENCE	Utility owns facilities, sells output to retail customers
	Leverages brand, investment grade, customer loyalty
	Customer prefers relatioship with utilities - often acquring solar companies with sales force
	Cross-sell of other products, such as EE, Demand Response, Storage, Back-up, community solar
PROVIDING O&M INSIDE THE FENCE	Proper O&M crucial to sustainability of assets (25 years)
	Utilities have experience, fleets, crews, etc.
	Customer knows utility will be in the market to stay?
	Will solar companies be in the business for 25 years?
AGGREGATION OF SOLAR BUSINESSES	A Bank owns rooftop assets - leased to individuals, with PPA sold to utility
	Utility is well suited to assess credit risk, based on energy savings
	Utility may sign sub-PPAs with retail customers, and provide O&M
	Utiliy leveraging its skills as credit intermediary, solar marketer and service provider
OWNING OUTSIDE THE FENCE	Basically same as "Owning Inside the Fence" outside of utility service territory
	Organized as a non-regulated utility entity
	Rooftop owners pay monthly under leased or PPA agreements

Source: Adapted from Hanelt, K. *Making Friends with Solar DG*. Public Utilities Fortnighly, September 2013.

In a nutshell

- Competition in generation is one of the pillars of market reform
- However, expansion of renewables have relied heavily on FiT
- In spite of its undeniable merits, time is ripe for introducing competition, reducing prices, expanding renewable base, and reducing GHG emissions
- Auctions (or competitive procurement) are gaining momentum among developing countries – Brazil led the effort
- Several success cases, appetite for more, but still a lot of inertia and appetite to include the demand side
- Distributed generation (DG) – a simplified business model is recommendable, such as net-metering (in its multiple variations)
- There may be opportunities for APINE members to explore new opportunities in the DG business

Renewable Portfolio Standards

A quota based policy that mandates that electricity suppliers (utilities) source a given proportion or share of their electricity from renewable energy

- RE sources compete to supply the electricity necessary to meet the target or quota
- Typically, generators of eligible electricity receive a REC, a certificate of proof that one unit of electricity was generated and delivered
- RECs can be traded in power exchange trading platforms
- Includes penalties for non-compliance

Pros	Cons
If successful in inducing competition between suppliers, the RPS-REC scheme can drive the cost down A tradable certificate scheme can further reduce the costs of achieving the target	Policy makers / regulators need to balance the target level with the overall expected cost of RE scale-up Competition can be difficult to establish when the market is not sufficiently large or electricity suppliers have the scale or means to exercise market power
	Presence of a large number of competitive RE generators to maintain liquidity of REC market
A level-playing field of competitive generators favors least cost mature technologies	Special arrangements have to be made to support RE that are not least cost, for example through technology differentiated RECs or quotas (solar set-asides or RECs)
	The certificates scheme and trading platform are complex to design and administer
Successful in systems where RE developers can secure long-term contracts with creditworthy counterparties	RE developers find it more difficult to secure long term financing due to inherent price uncertainty RPS requires credit-worthy long term power purchasers

RPS in Poland: System Characteristics

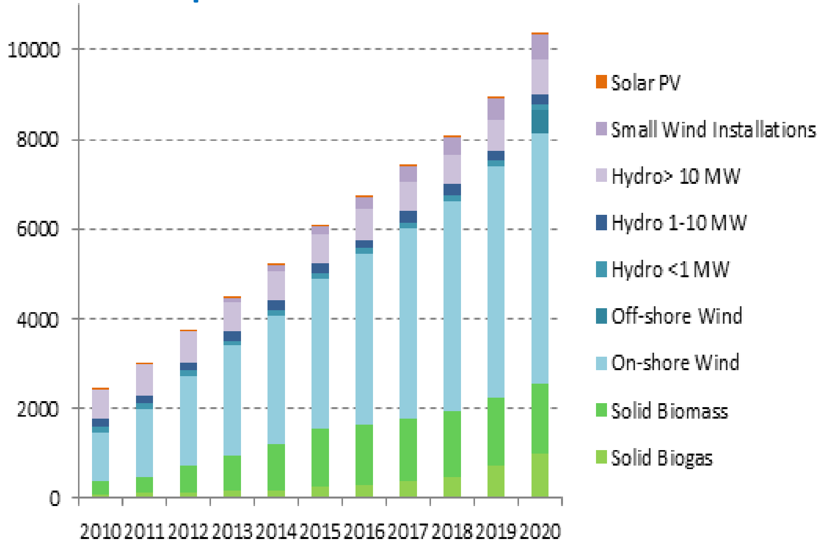
Market structure: liberalized wholesale market (spot and contracts), electricity trading conducted by the Polish Power Exchange (TGE)

In 2011, 37.8 GW of installed capacity: 88% coal-based, 3% biomass, 2 % hydro, 2% wind and geothermal, 2% oil and 3% natural gas

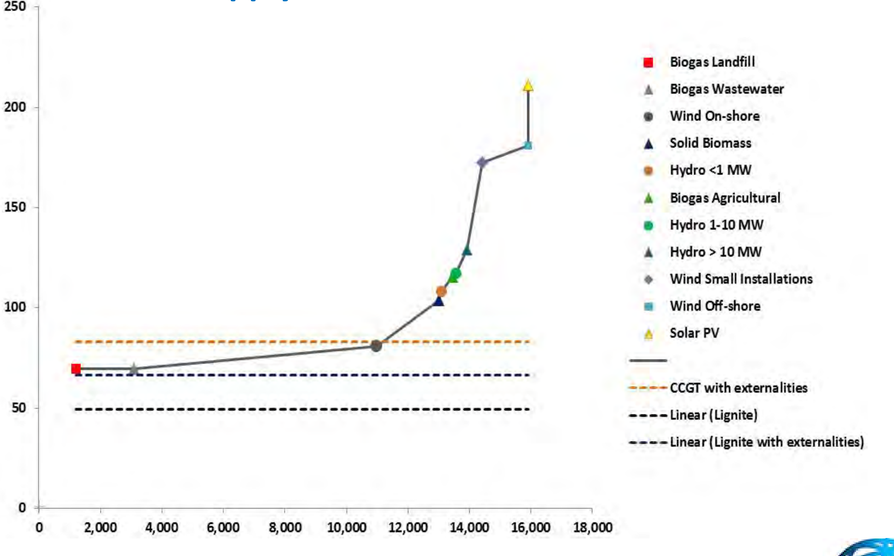
Ambitious targets in renewable energy: national RE binding target for Poland is 15 percent of gross final energy consumption by 2020 (European Directive 2009/28/EC)

National Renewable Energy Action Plan: proposes a RE scale-up in electricity from 2.4 GW in 2010 to 10.33 in 2020, total subsidy volume expected in 583 Million Euros (unit subsidy around 45.5 Euro/MWh)

RE Expansion Plan



RE Supply Curve



Has the REC market been effective in closing incremental cost gaps between RE and conventional alternative?

The short answer is no

Risk Category	Business Environment
Electricity Market Risks arising from limitations and uncertainties in the energy and renewables markets	**Wholesale price gradually lowered** from 51 to 35 Euro/MWh in the period June 2011 to June 2013: lower electricity demand growth rate, general legal and regulatory uncertainties (implementation of Third Energy Package) **RECs price volatility:** plummeted from about 65 to 35 Euro/MWh in June 2013 (approval of co-firing with biomass as a RES increased certificates supply and contributed to lower certificates price, plus continuous discussion on potential changes to legal and regulatory frameworks)
Regulatory Suboptimal regulations and/or uncertainty regarding the design and implementation of future regulatory frameworks / rules	**High policy/ regulatory uncertainty** New RE law and regulatory framework still in design stage Proposed technology specific coefficients have been continuously discussed Cap on co-firing debated, but no resolution Non of the resolutions discussed so far ensure financial viability of RE
Grid Transmission Risk arising from inadequate or antiquated grid infrastructure, risks arising from limitations in grid code and grid management	Grid is old and **substantial investments are needed for RE integration** Lack of long term planning in transmission infrastructure Lack of legal and regulatory clarity regarding connection conditions and cost
Permits Risk arising from the public sector's inability to efficiently and transparently administer licensing and permitting processes and approvals	**Administrative procedures are burdensome and expensive** (generator must pay non-refundable deposit when applying for connection)

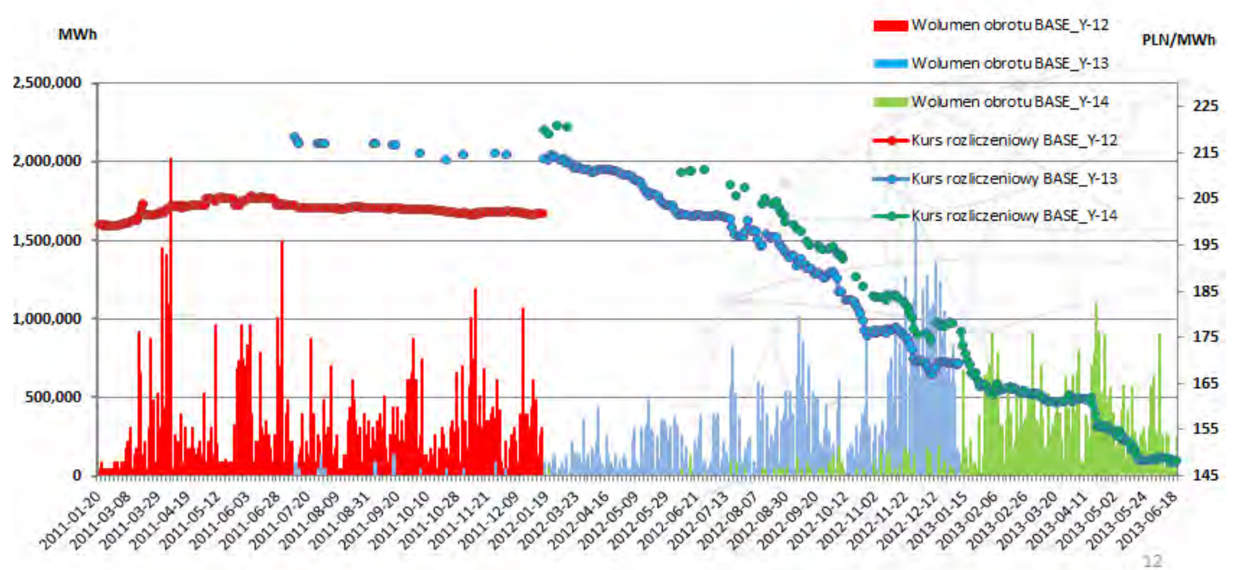
Evolution of electricity prices in Poland

- Economic Assessment: required unit subsidy necessary to achieve target is 45.5 Euro/MWh (lignite based capacity setting avoided cost of power generation)
- Renewables are paid electricity average wholesale price of previous calendar year and earn a premium through the REC market
- LCOE of on-shore wind in the order of 101 Euro/MWh
- Wholesale prices and RECs in the order of 35 Euro/MWh each (RE can only earn 70 Euro/MWh)

Day Ahead Market
(monthly volumes and average weighted price)

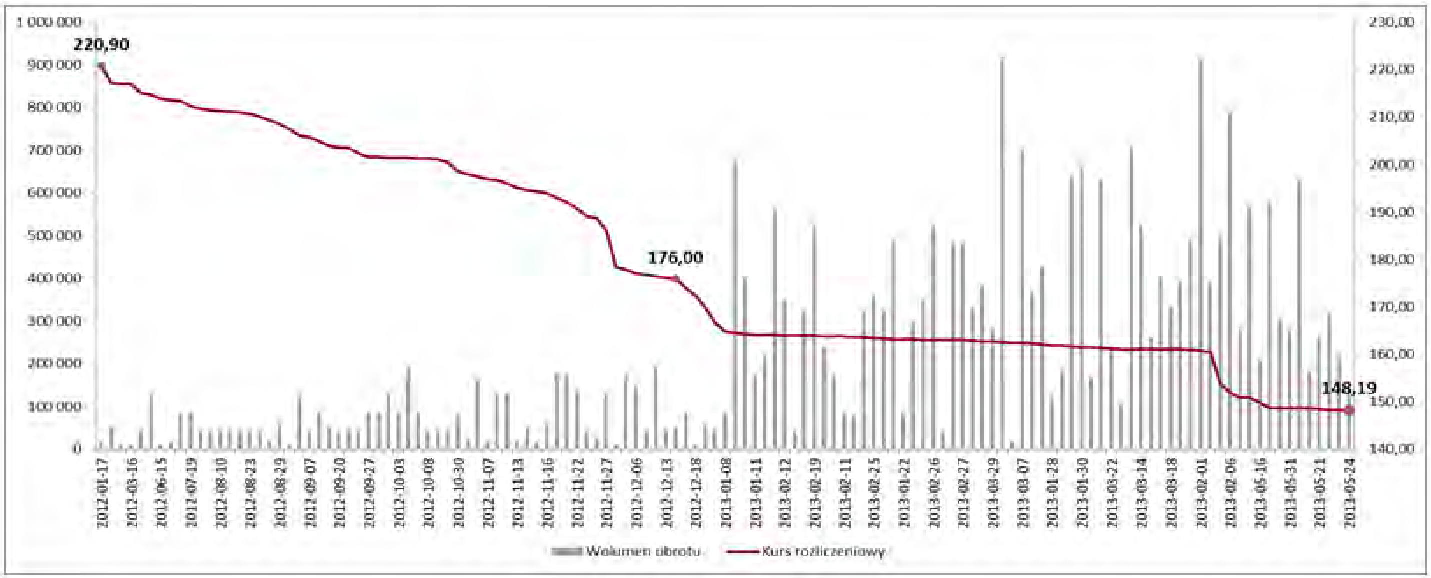
Contract Prices

Electricity Trading, Yearly Base-load Contracts 2012-2014



Declining REC Prices 2012-2013

Price (in PLN) and volume for yearly BASE_Y-14 contract since the beginning of quotation until the end of march 2013 with delivery in 2014 (MWh)



- **RE producers are loosing financial liquidity and their ability to service debt, commercial banks have stopped financing RE**
- **Private RE (wind) developers fleeing the market and selling to large utilities**

UGANDA: MAIN CHALLENGES OF THE POWER SECTOR

Significant supply shortages: UMEME implements load shedding in peak demand (improved temporarily with the addition of Bujagali, 250 MW hydro)

Contracts with expensive emergency thermal generation plants (diesel, HFO) in the order of 16-23 USDc per kWh: undermines efforts towards cost-reflective tariffs, puts additional stress on public finances

Distribution networks in very poor conditions due to under-investments: losses in the order of 30%, frequent voltage fluctuations and interruptions

Average retail tariff still below costs: despite recent ERA revisions (avg 46%)

Huge investment needs: estimated in the order of US$ 9 Billion between 2009-2030 (constant 2009 dollars)

Public funding in infrastructure: insufficient, stagnant (weak tax revenues, low –and costly- borrowing capacity)

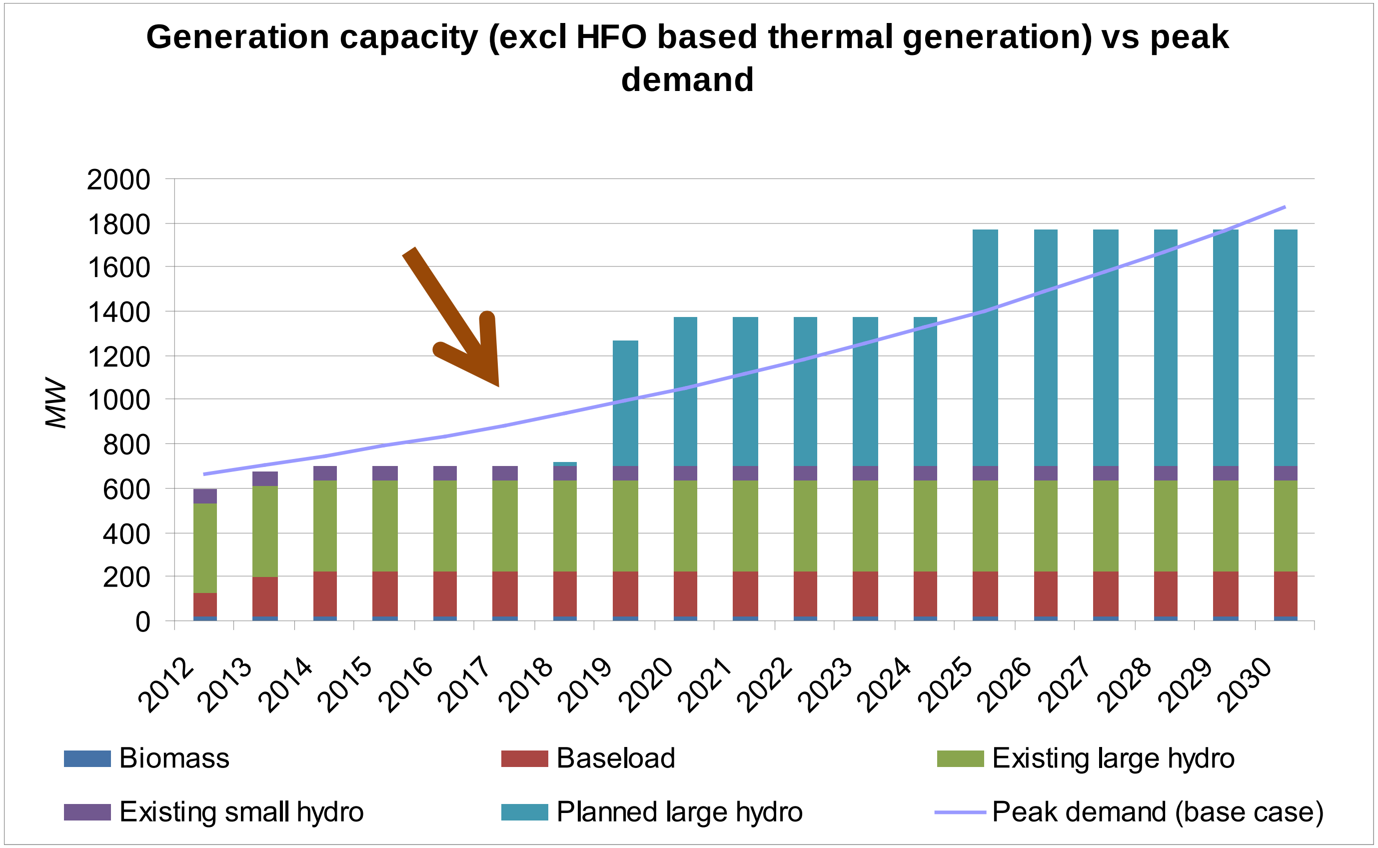
Private sector investment in infrastructure will have to take a central role, but:

- High perceived political risks
- Doubts regarding creditworthiness of off-takers
- Lack of bankable projects due to low FITs

GET FIT TOOLBOX: THREE KEY COMPONENTS

FiT Premium Payment Mechanism	Results-based subsidy designed to cover gap between current REFiT levels and the Levelized Cost of Electricity (LCOE), enhancing project's financial viability
World Bank / MIGA Guarantees	PRG Facility offered by the World Bank / MIGA to address political and off-taker risks
Private Debt/ Equity Facility	Facility (led by DB, open to other banks and investors) will offer debt and equity instruments to private developers

Generation shortfall in post-Bujagali / pre-Karuma environment

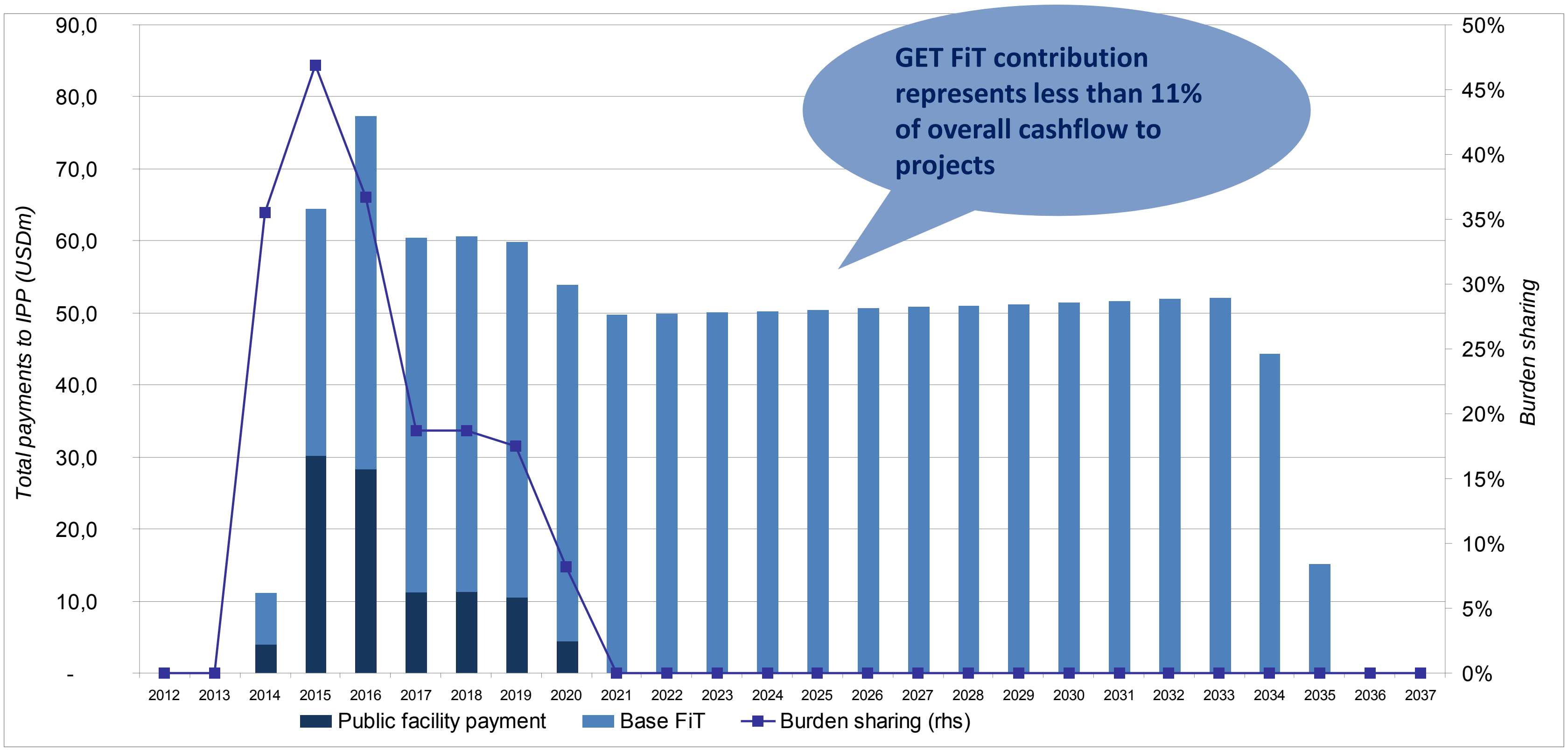


- **In order to avoid load-shedding or procurement of expensive emergency generation capacity between 2014 and 2019, Uganda will have to bring at least 150MW on-stream within next 3-5 years**

- **If HPP Isimba/ HPP Karuma are delayed, the demand to bring additional capacity online is even greater**

FIT PREMIUM PAYMENT MECHANISM

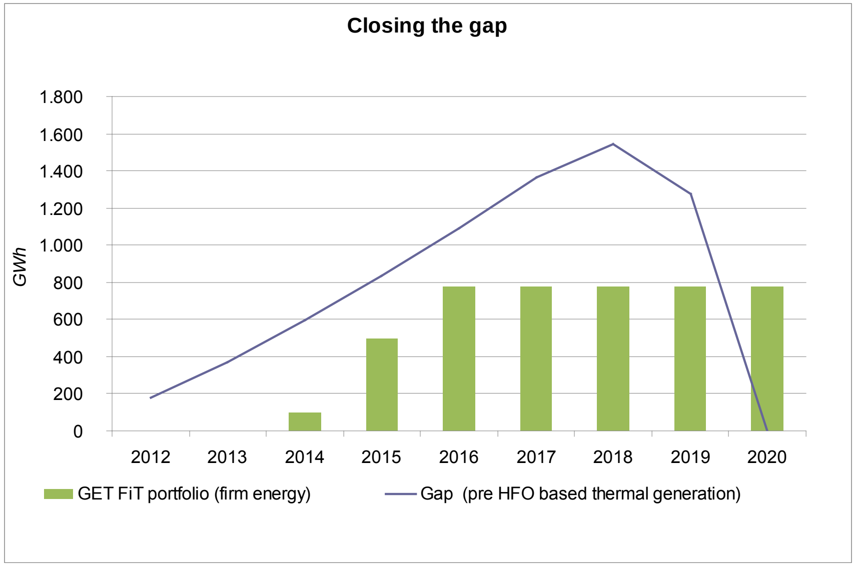
Relative Contribution (Burden Sharing)



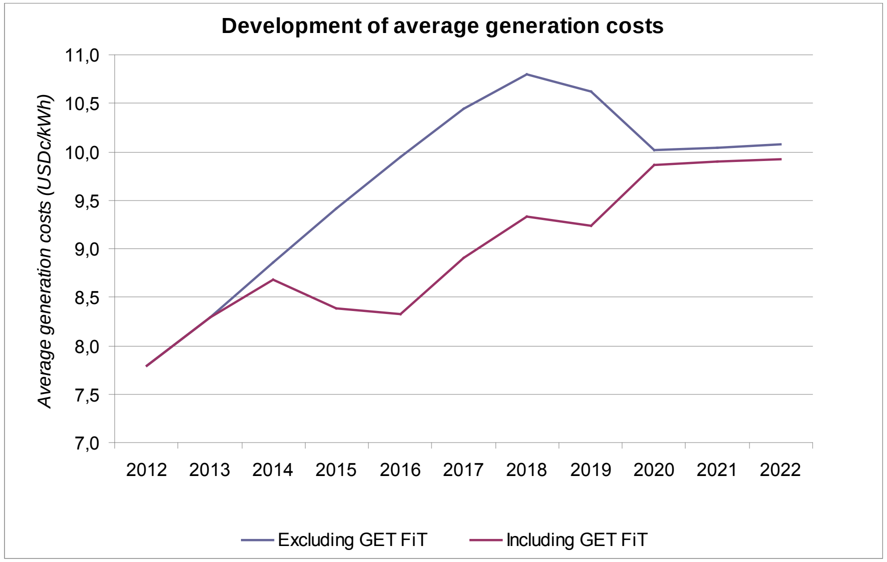
Note: Dark blue represents GET FiT contributions; light blue represents contributions from UETCL / Ugandan rate payers. Calculations based on 2% discount factor.

FIT PREMIUM PAYMENT MECHANISM

Effect of GET FiT Premium on Supply-Demand Gap



GET FIT lowers the production costs (avoid rationing and procurement of expensive thermal generation)



PART VI

GENERAL LESSONS OF EXPERIENCE

EMERGING EXPERIENCE

Policy choice: the choice of policy and regulatory instruments must be consistent with the characteristic of the system/market, institutional capacities, as well as overall investment climate.

Policy interactions and compatibility: the coexistence of policy and regulatory instruments has the potential to result in complex interactions and unintended effects which can occur with electricity sector's market rules and policies, but also with the wider set of polices introduced by other sectors (for example, interactions between developmental priorities and sustainable energy policies, carbon and green certificates markets, fiscal incentives and RE targets, or between innovation and market development policies).

Coordination of policies across sectors/sub-sectors: Policy objectives and incentives should be coordinated across sectors and sub-sectors to enhance synergies, avoid overlapping and excessive policy costs or subsidy volumes (for example, between RE and EE, or between climate change and energy security objectives). The design of policy instruments needs to be construed as interacting with national energy and non-energy policies in a dynamic context (UNEP, 2012).

EMERGING EXPERIENCE

Policy sequencing: Policies to support sustainable energy can be introduced in phases depending on the characteristics of the system such as resource endowments, market structure and size, conditions of the grid, tariff policies, demand growth, institutional capacity and other. For instance, many countries are now using competitive biddings or auctions as a benchmark mechanism to set feed-in tariff levels before a feed-in tariff policy is introduced; however auctions are sophisticated and require certain level of administrative and regulatory capacity as well as high market volumes or quotas. Another important example is the need to align transmission infrastructure strengthening with RE scale up, taking into consideration potential energy savings or negawatts.

Sustainability of incremental cost recovery mechanisms: fiscal transfers or surcharges to consumer tariffs need to be transparent, efficient, sustainable, and limited. Indeed, policies in support of RE and EE can only be effective when off-takers (state-owned utilities, Discos, energy traders) maintain a sustainable financial balance.

Efficiency of Economic Policy: Price and quota based instruments need to be designed based on solid economic analyses of the power system and market. Quantitative economic analysis (such as a supply curve) reveals the need and size of a potential subsidy (for a given target) and allows the evaluation of strategies to minimize infra-marginal rents.

Business Environment: The conditions of the business environment determine to a large extent the effectiveness of RE and EE policy and associated transaction costs.

Monitoring and Evaluation: which is needed to assess performance and create the feedback loop into the design of policies.

ANNEX

Additional Slides

Wind and solar PV technology costs
Gradual but dramatic reductions

FIGURE 4.8 LEARNING CURVES FOR WIND AND SOLAR PV MODULES