The current policy issues for Renewable Portfolio Standard in South Korea

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Contents

FIT (Feed-in Tariff) vs. RPS (Renewable Portfolio Standard)

	FIT	RPS
Key elements	- Price-based regulation - To guarantee a specific price or a specific premium over market price for RES-E [1)]	- Quantity-based regulation - To establish obligatory quota for power suppliers to ensure that a portion of their electricity come from RES-E
Countries	Germany etc.	USA etc.

1) RES-E: Electricity from Renewable Energy Sources

RES-E policy in South Korea

- **FIT (2002-2011)**
  - Guaranteeing fixed tariffs for hydropower(small scale), biomass, waste, fuel cells, wind, and solar PV
  - Over a period of 15-20 years
  - Choice of fixed tariffs or variable tariffs (α+market price) for hydropower and biomass

- **RPS (2012-)**
  - Obligatory targets of RES-E given to power suppliers
  - The target can be fulfilled by producing by itself or by buying RECs
  - RECs(Renewable Energy Certificate) are issued for every unit of RES-E

FIT rates in South Korea (2011)

		Capacity limit for application	Classification		Feed-in tariffs (KRW/kWh)		Note
					Fixed Price	Variable price	
Wind Power		Over 10kW	-		107.29	-	Decremental rate : 2%
Hydro power		Under 5MW	Typical	Over 1MW	86.04	SMP*+15	
				Under 1MW	94.64	SMP+20	
			Non-typical	Over 1MW	66.18	SMP+5	
				Under 1MW	72.80	SMP+10	
Waste energy (including RDF)		Under 20MW	-		-	SMP+ 5	Fossil fuel use : Under 30%
Bio energy	LFG	Under 50MW	Over 20MW		68.07	SMP+ 5	
			Under 20MW		74.99	SMP+10	
	Biogas	Under 50MW	Over 150kW		72.73	SMP+10	
			Under 150kW		85.71	SMP+15	
	Biomass	Under 50MW	Ligneous bio		68.99	SMP+ 5	
Ocean Energy	Tidal Power	Over 50MW	Tidal range is over 8.5m	With embankment	62.81	-	
				Without embankment	76.63	-	
			Tidal range is under 8.5m	With embankment	75.59	-	
				Without embankment	90.50	-	
Fuel Cell		Over 200kW	Using Biogas		234.53	-	Decremental rate : 3%
			Using other fuels		282.54	-	

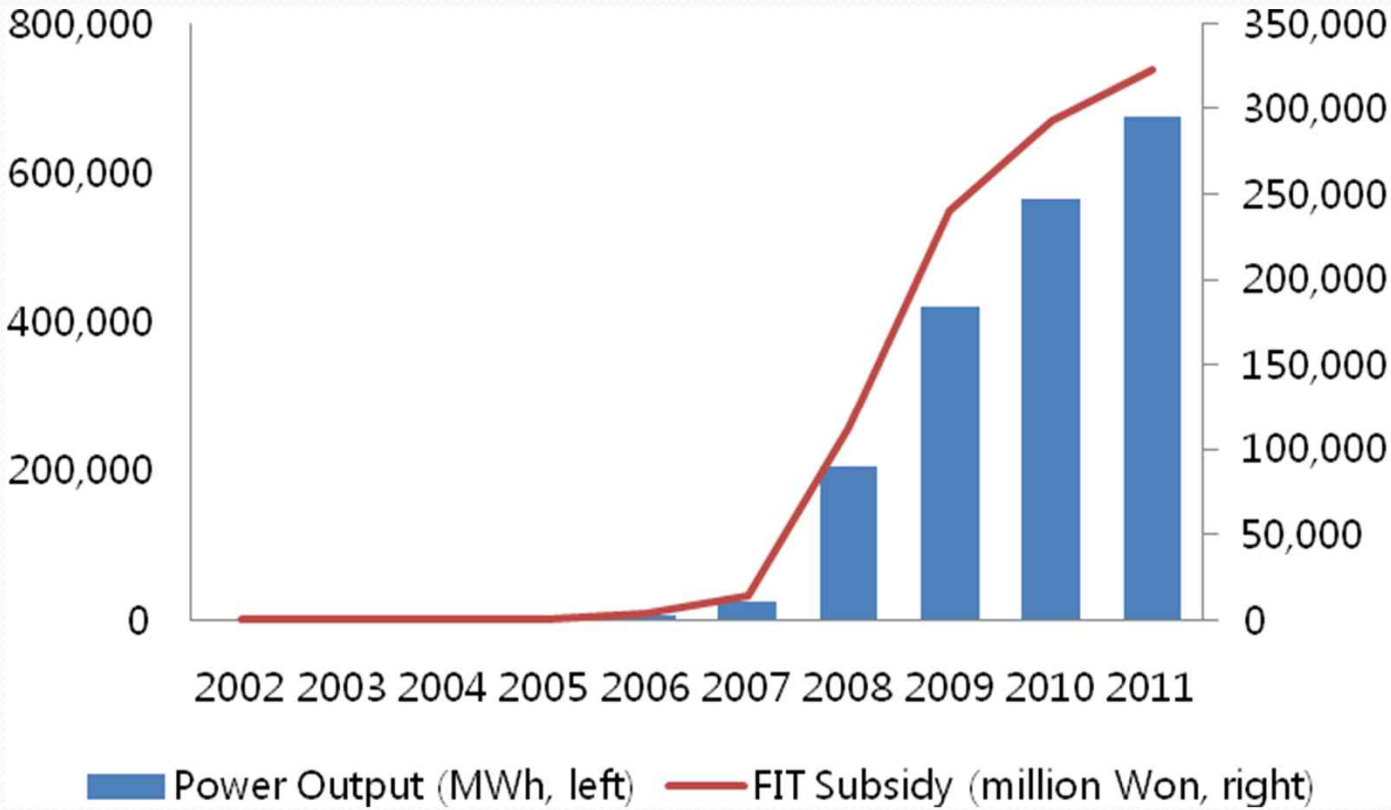
* SMP : System Marginal Price

FIT rates for solar PV (2011)

Location	Period	Capacity				
		Under 30kW	Over 30kW Under 200kW	Over 200kW Under 1MW	Over 1MW Under 3MW	Over 3MW
Ground	15 year	484.52	432.69	436.50	414.68	349.20
	20 year	439.56	419.76	396.00	376.20	316.80
Building	15 year	532.97	508.96	480.15	-	-
	20 year	483.52	461.74	435.60	-	-

(Korean Won/kWh)

Total FIT subsidy and power outputs for solar PV



Kwon, 2015, "Is the renewable portfolio standard and effective energy policy?: Early evidence from South Korea", *Utilities Policy*, Vol 36, p.47

RPS (2012-)

Background

- Fast rising FIT budget (especially for solar PV)
- Market-friendly policy : introducing competition in RES-E markets
- Market (not government) picks a winner

Process

- Obligatory targets of RES-E given to power suppliers providing more than 500MW
  (18 companies: 8 Public-owned utilities, 10 private utilities)
- The share of RES-E is scheduled to rise from 2% in 2012 to 10% in 2023
- The target can be fulfilled by producing by itself or by buying RECs (Renewable Energy Certificate)

RPS target (%)

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Target (%)	2.0	2.5	3.0	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0

RPS (2012-)

REC market

– Spot market: REC auction at the Korea Power Exchange (KPX) every week
– Contract market: private transaction
– Long-term contract (12 years) for solar PV: auctioning twice a year

Other RPS design rules

- Penalty: 150% of the average REC price
- Banking: RECs are valid up to 3 years
- Borrowing: Up to 20% of targets can be transferred to next year

Current issues of the RPS

- Regulating technology competition
- Regulating market risk (in particular) for small RES-E suppliers

Current issue of RPS:
1. Reglating technology competition

- FIT
  - Differentiated support according to technologies
- RPS
  - Technology neutral RPS:
    - Potential technologies in the early period of development may by forced out from the market
    - Excess profits given for non-marginal technologies
  - Regulating technology competition : Banding or Carve-out (Set-aside)

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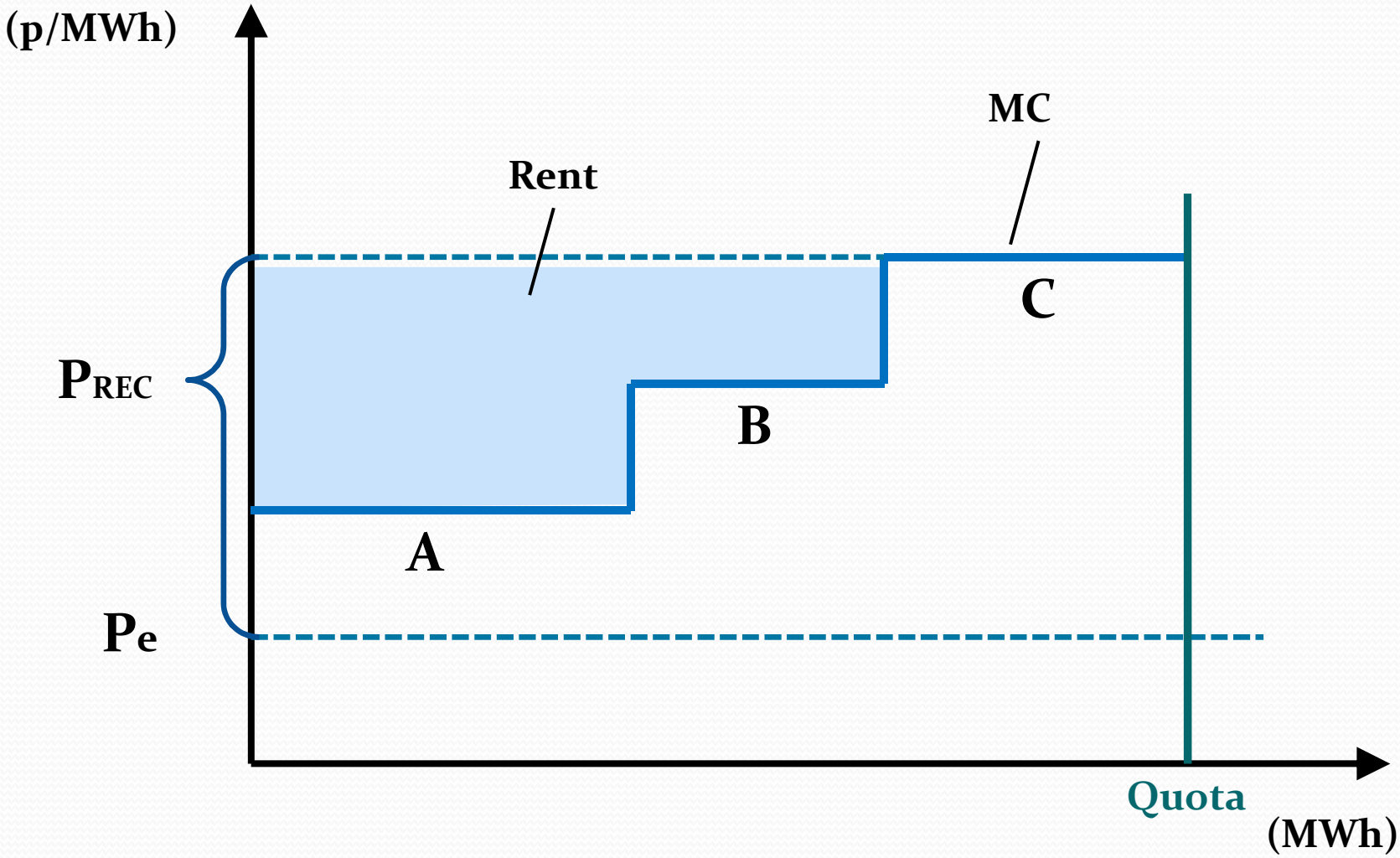
RPS: Excess profits for non-marginal technologies



Kwon, 2015, "Rent and rent-seeking in renewable energy support policies: Feed-in tariff vs. renewable portfolio standard", *Renewable and Sustainable Energy Reviews*, Vol 44, p.678

Regulating Excess profits from RPS

- **Banding**
  - Different multiples of tradable certificates are issued for each unit of generation depending on the type of RES-E

- **Carve-out (Set-aside)**
  - REC markets for particular RES-E types are separated from other RES-Es

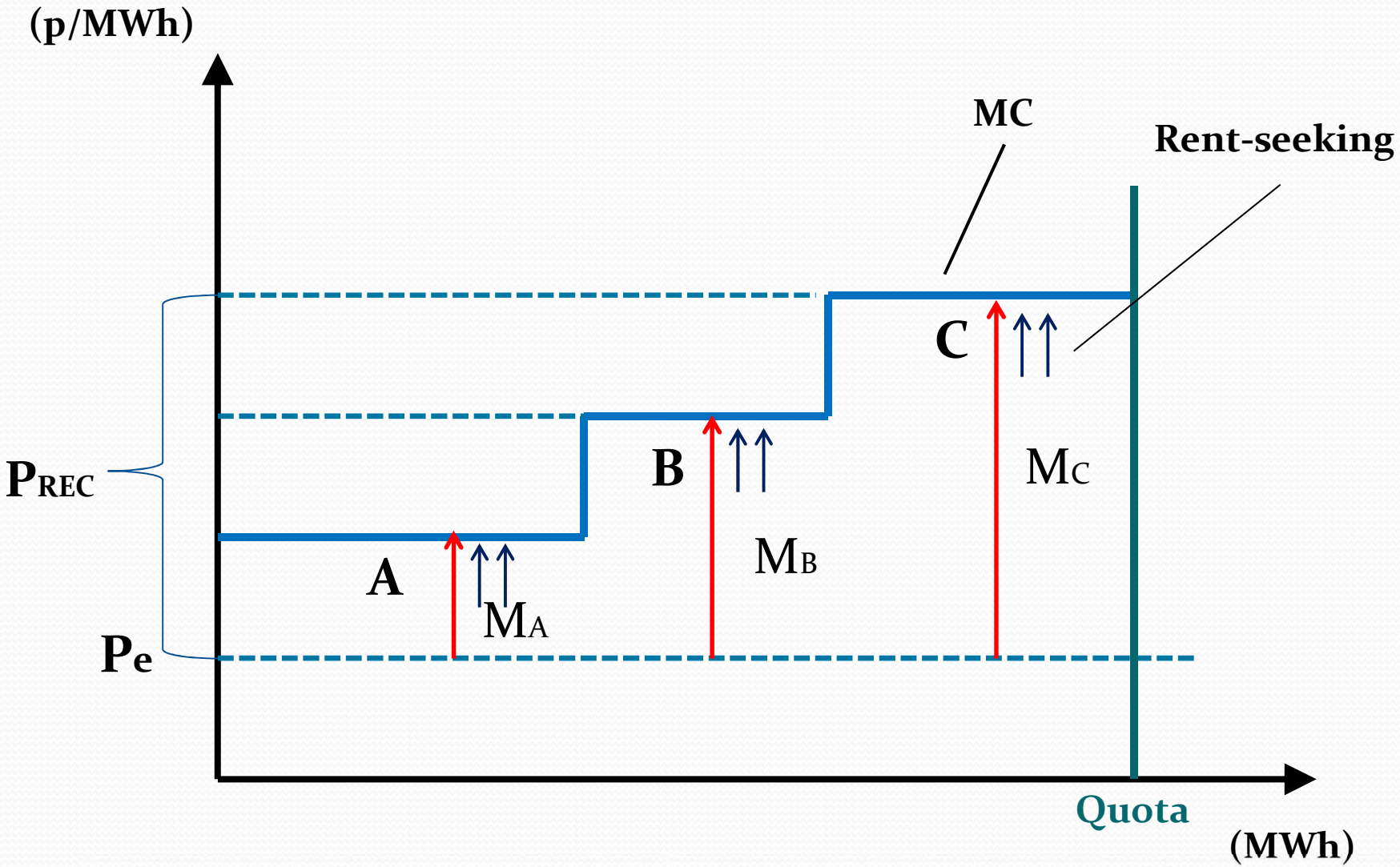
REC Weighting for Solar PV

Category	REC weighting	Energy source and criteria	
		Facility type	Criteria
Solar PV	1.2	Facility installed on land areas	Less than 100kW
	1.0		More than 100kW
	0.7		More than 3,000kW
	1.5	Facility installed on existing buildings	Less than 3,000kW
	1.0		More than 3,000kW
	1.5	Facilities floating on the water	

REC Weighting for other RES-Es

Category	REC weighting	Energy source and criteria	
		Facility type	Criteria
Other RES-E	0.25	IGCC, Byproduct gas	
	0.5	Waste, landfill gas	
	1.0	Hydro, onshore wind, bioenergy, RDF, waste gasification, tidal power (with embankment)	
	1.5	Wood biomass, offshore wind (grid connection less than 5km)	
	2.0	Fuel cell, tidal power	
	2.0	Offshore wind (grid connection longer than 5km), geothermal, tidal power (no embankment)	Fixed
	1.0~2.5		Variable
	5.5	ESS (connected to wind power)	'15
	5.0		'16
	4.5		'17

RPS Banding and rent-seeking



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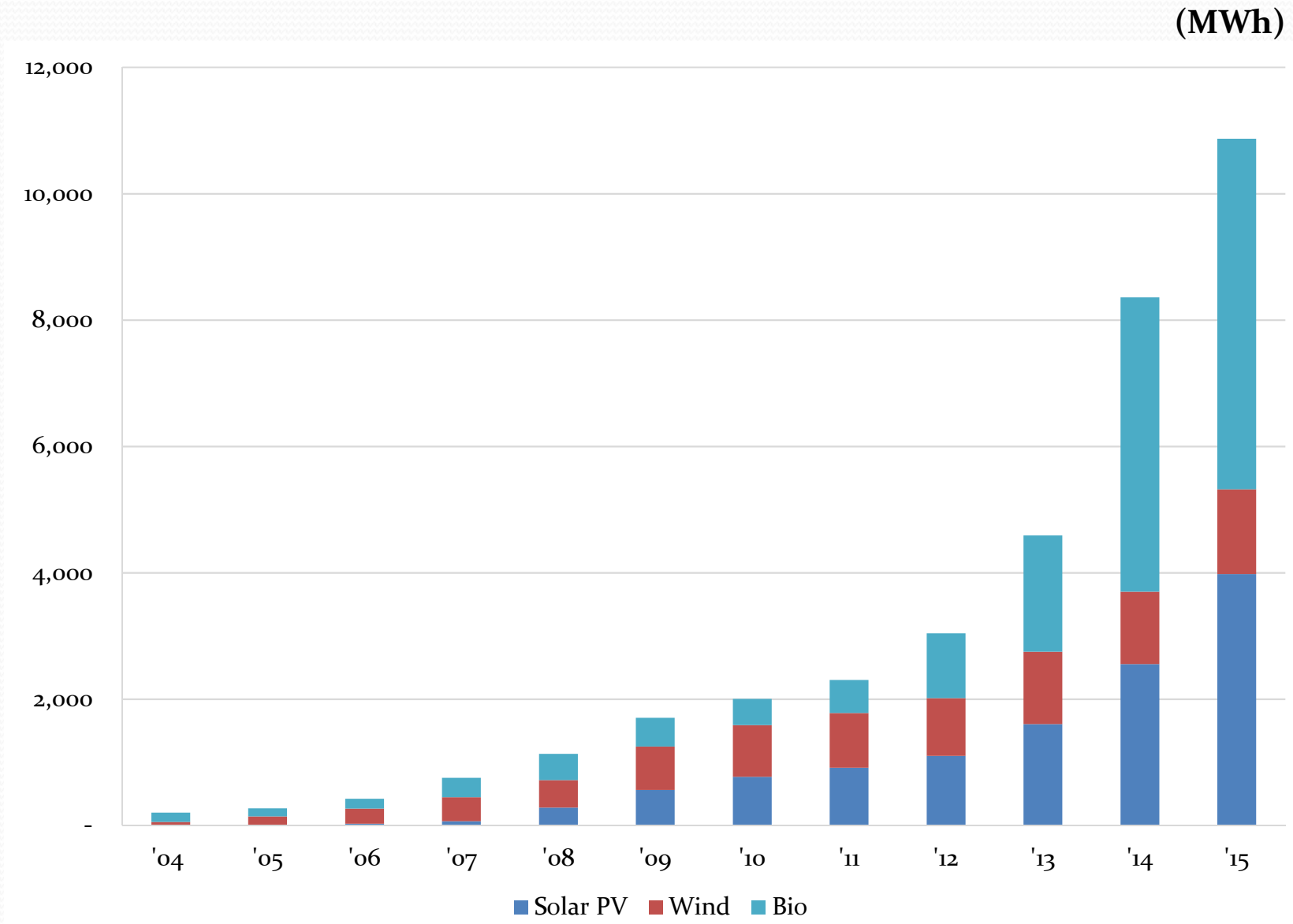
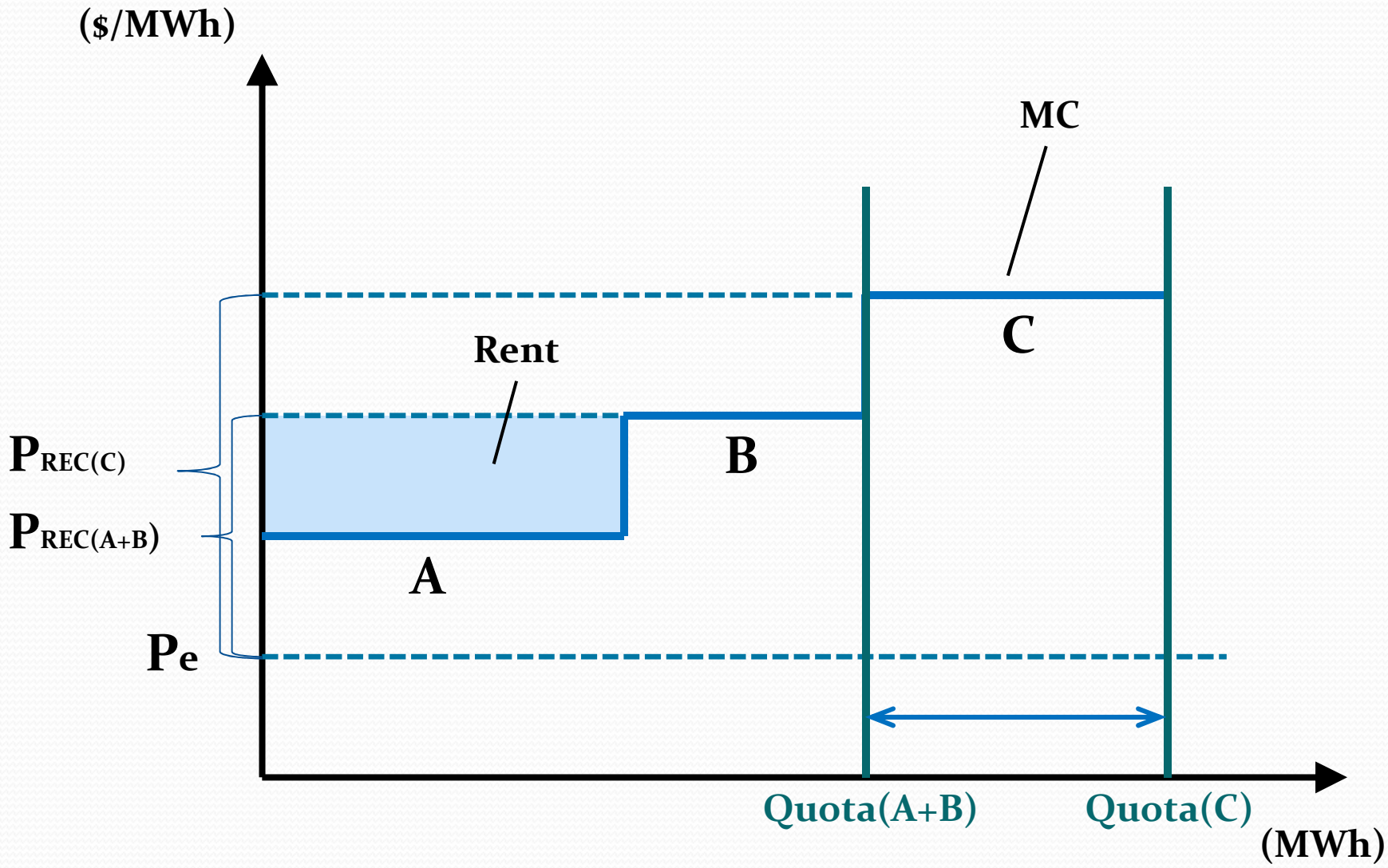
Interviews of shareholders on the current REC weighting

Stakeholders	Propriety of Weighting	Reasons
Official in charge of RPS (MOTIE)	○	
Official in charge of RPS (KEA)	○	
Official in charge of RPS (KPX)	○	- Generally appropriate, but new technologies such as Ocean wind power needs higher ratio
Wind power (parts suppliers)	×	- Wind power needs a higher ratio
Solar PV (parts suppliers)	×	- Solar PV (more than 3000kW) needs a higher ratio
Solar PV (small power suppliers)	×	- Solar PV needs a higher ratio
Landfill gas (Power suppliers)	×	- Landfill gas needs a higher ratio
Utilities with RPS targets (Public-owned)	×	- Ocean wind power needs a higher ratio
Utilities with RPS targets (Private-owned)	×	- Higher weighting is needed generally to increase volume of REC supply

Growth of Bio, Wind power and Solar PV



RPS Carve-out

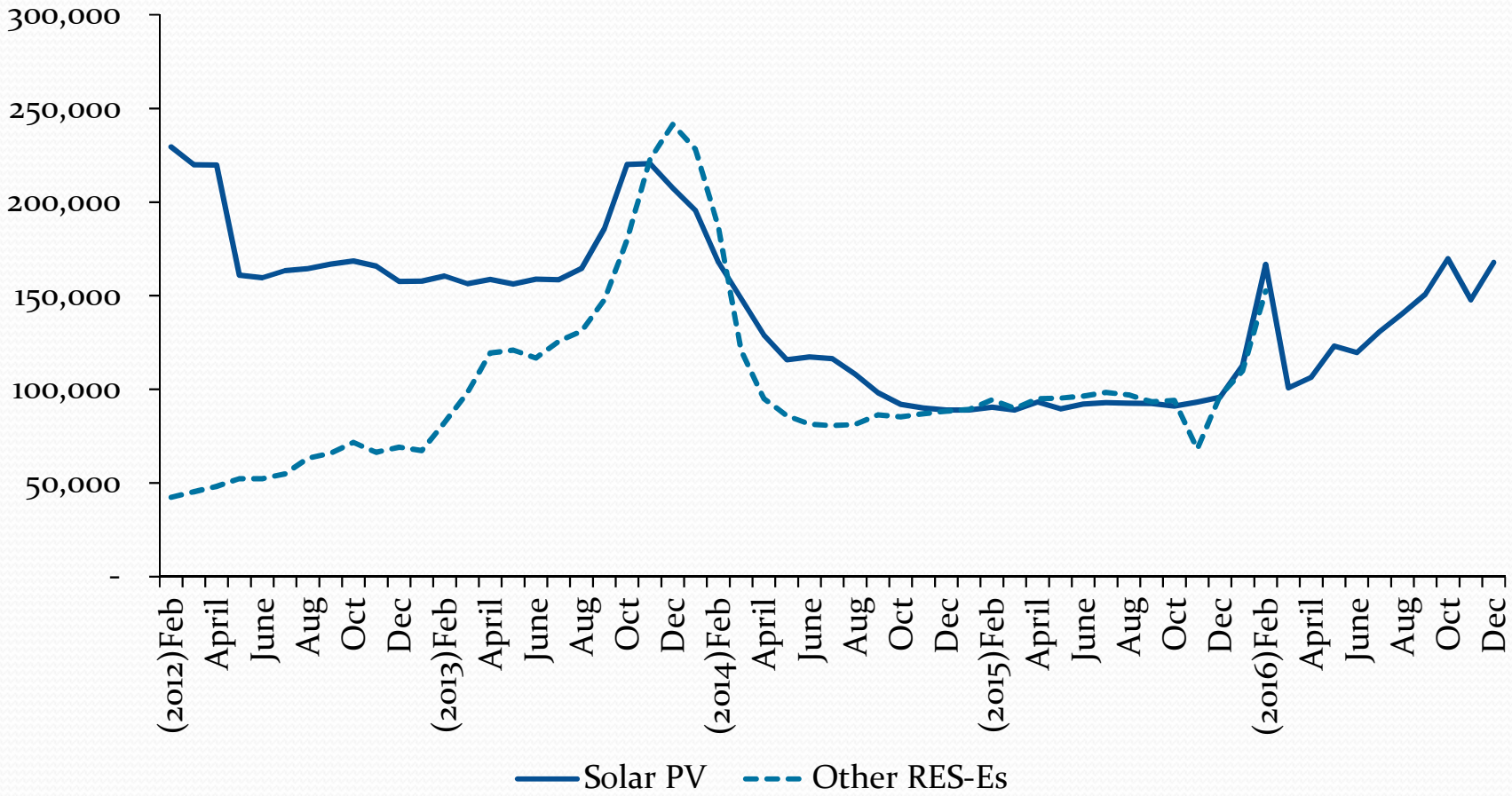


Carve-outs (targets for solar PV)

Year	'12	'13	'14	'15	'16
Target (GWh)	276	723	1,156	1,577	1,577

- **Termination of carve-out for solar PV**
  - Decrease of cost gap
  - Decrease of disparity of REC prices
  - Termination of carve-out for solar PV in 2016
  - Showing stability of REC market after the merge of two REC markets

Trends of REC price (Won, 1REC=1MWh)

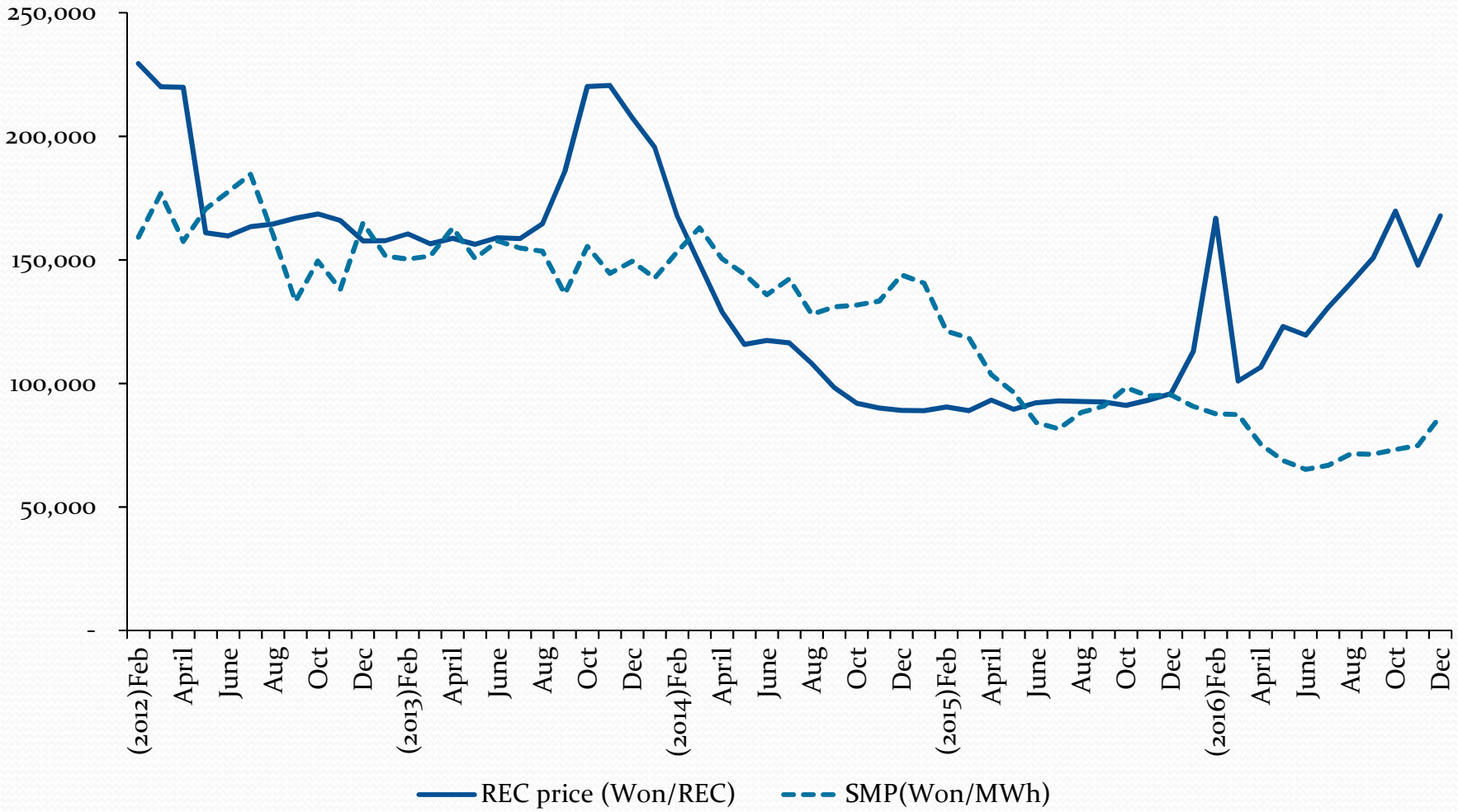


Current Issue of RPS:
2. Regulating market risk for small RES-E suppliers

- FIT
  - Guaranteeing tariffs over a longer period (15-20 years)

- RPS
  - Increase of market risk especially for small RES-E suppliers
    - Up and down of REC prices and electricity prices (SMP: System Marginal Price)
    - Difficulty in getting a financial loan due to market risk
    - Utilities with RPS targets prefer contracts with large RES-E suppliers.

Changes of REC prices and SMP



Options for governing market risk

- Long-term contract by Fixed price (Sliding premium)
  - Long-term contract by fixed price of (REC+SMP) (20 years)
  - Obligatory to public-owned utilities with RPS targets for wind and solar PV
  - Allocation by auction for solar PV and Wind energy twice a year from 2017
- Re-introduction of FIT for small capacity (?)
  - Strong requests from small RES-E suppliers (especially Solar PV)
  - Negative responses from policy makers

Interviews of shareholders on reintroducing FIT

Stakeholders	FIT for small capacity	Reasons
Official in charge of RPS (MOTIE)	×	Too early to change RES-E policy only few years after RPS replaced FIT
Official in charge of RPS (KEA)	×	- Small RES-E suppliers can be supported by other policy instruments such as compulsory ratio of REC for small RES-E suppliers - Long-term contract by SMP+REC price can reduce market risk of small and medium suppliers
Official in charge of RPS (KPX)	×	- Really difficult to determine FIT rates appropriately - Long-term risk is rather higher under FIT (Under RPS spot market and contract market function complementally)
Wind power (parts suppliers)	○	
Solar PV (parts suppliers)	×	- Against current global trends - Spending too much government budget - Long-term contract by SMP+REC price can reduce market risk of small and medium suppliers (In addition long-term contract by SMP+ REC price can support domestic part suppliers)
Solar PV (small power suppliers)	○	
Landfill gas (Power suppliers)	○	- RES-E suppliers should be allowed an RPS scheme after FIT expiration
Utilities with RPS targets (Public-owned)	×	- Small RES-E suppliers can be supported by other policy instruments such as compulsory ratio of REC for small RES-E suppliers - FIT will reduce supply of REC
Utilities with RPS targets (Private-owned)	○	- Under the current system, Utilities with RPS targets prefer a contract with Large RES-E suppliers

Market risk under different RES-E policies

REVENUE	FIT	FIT (Feed-in Premium)	RPS (Spot Market)	RPS (Long-term contract)	RPS (Long-term contract: Sliding premium)
Subsidy	Fixed (guaranteed)	Fixed (guaranteed)	Variable (market)	Fixed (market)	Fixed (market)
Electricity price		Variable (market)	Variable (market)	Variable (market)	

Country comparison of long-term contract auction(1)

	Korea	UK (CfD)	Germany	California
Auction outcome	20 year contract by sliding premium (fixed sum of REC and SMP)	(up to) 15 year contract by sliding Feed-in Premium (CfD)	20 year contract by sliding Feed-in Premium	10 15 20 year contract by FIT Contract price is a basis for FIT
Technology specification	Wind / Solar PV (single or combined auction)	Two pots (established/less established) min/max volume	Solar PV /Wind /Bio Separate auction for each technology	3 product types (Peaking/Non-peaking/ Baseload)
Buyer (Contracting Authority)	Public-owned utilities with RPS targets	Low-Carbon Contract Company	Federal Network Agency	3 largest utilities with RPS targets
Setting volume	Sum of demand by buyers (government set min. targets)	Government-set budget caps	Government-set volume cap	Government-set target and allocate among 3 utilities

Source: Legal source on Renewable Energy (http://www.res-legal.eu/), EU AURES project (Auctions for Renewable Energy Support) (http://auresproject.eu/publications/)

Country comparison of long-term contract auction (2)

	Korea	UK (CfD)	Germany	California
Price ceiling	Yes	Technology-specific ceiling prices	The value of winning bid of previous round	No
Qualification (Capacity)	group1: < 100kW Group2: < 3MW, > 100kW Group3: > 3MW	> 5MW	> 100kW, < 10MW	> 3MW, < 20MW
Frequency	Twice per year	1 round per year	3 times a year	1 or 2 round per year
Main support scheme	RPS	CfD FIT (< 5MW)	Feed-in Premium FIT (< 100kW)	RPS FIT (< 3MW)

Source: Legal source on Renewable Energy (http://www.res-legal.eu/), EU AURES project (Auctions for Renewable Energy Support) (http://auresproject.eu/publications/)

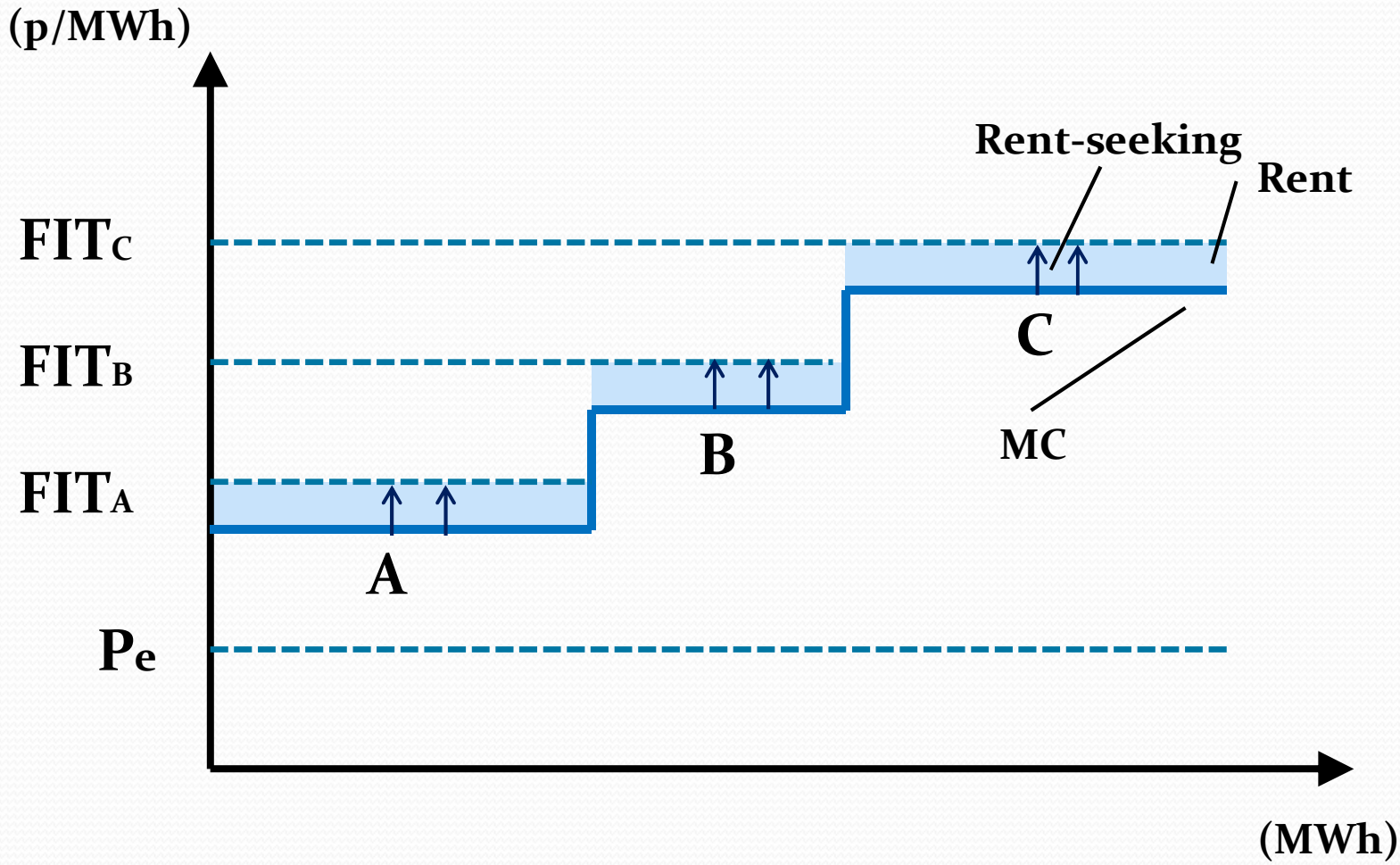
Trends of RES-E policy scheme and its implication for Korea

- FIT for small capacity (UK, Germany, California)
  - Utilities with RPS targets prefer trades or contracts with large RES-E suppliers
  - Vulnerable to market risks under RPS

➢ Re-introduction of FIT for small capacity ?

- Negative responses from policy makers
  - It may change after the political power change (to pro-Renewable / anti-Nuclear/Coal party) this year
- Need to design an FIT scheme to be able to prevent rent-seeking (blocking price down of FIT)
  - e.g.) linking to RPS auction outcomes / flexible degression rules (Germany)

FIT Under Asymmetric Information



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Trends of RES-E policy scheme and its implication for Korea

- Technology pots and minimum/ maximum volume rule (UK)

➢ Redesign of banding scheme :

- The current banding scheme is too complicated: encouraging rent seeking behaviours
- Pots for established technologies and less established technologies
  - Environmental factors may be considered for classification
- Setting minimum volume in long-term contracts auction for less established technologies

Country comparison of long-term contract auction(1)

	Korea	UK (CfD)	Germany	California
Auction outcome	20 year contract by sliding premium (fixed sum of REC and SMP)	(up to) 15 year contract by sliding Feed-in Premium (CfD)	20 year contract by sliding Feed-in Premium	10 15 20 year contract by FIT Contract price is a basis for FIT
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Trends of RES-E policy scheme and its implication for Korea

- Wide uses of auction for long term contracts (UK, Germany, California)
  - With a linkage to FIT or RPS :
    - Link to RPS: auction outcomes as REC price or sum of REC and SMP (Sliding Premium)
    - Link to FIT: auction outcome as FIT or Sliding FIP or base of FIT

➢ Active role of auctions for long-term contracts

- Complementally role for RPS target
- Sliding premium: reducing market risk
- Achieving policy goals through auction allocations : auction for specific technologies (minimum rule etc.)