Abatement Cost Curves for China, Japan, Korea and Mongolia

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Background

- ADB's project
  - which is named, "Economics of Climate Change and Low Carbon Growth Strategies in Northeast Asia".
  - ADB's website says "one of the objectives of the project is to contribute to the regional and national debate on the economic costs and benefits of the actions on climate change mitigation".

- Mission
  - Projecting abatement cost curves for China, Japan, Korea, and Mongolia.
  - Projecting GHG emissions and mitigations for these four countries.
    - The following results are the preliminary findings for the ADB study.

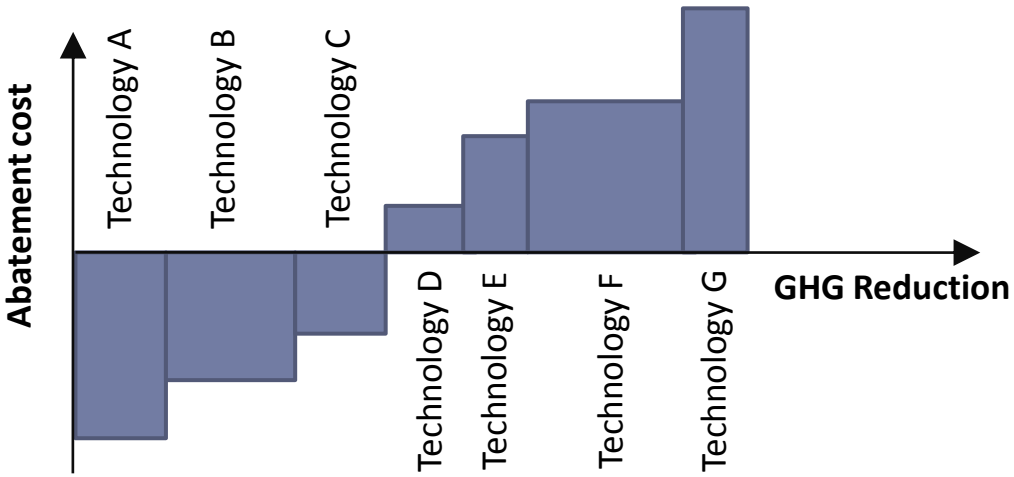
Background

- Outcomes
  - GHG emissions and mitigations in 2020/30
  - Abatement cost curves in 2020/30

- Calculation tool
  - AIM/Enduse ACC tool
    - Bottom-up modeling tool
      - Detail technology selection framework
    - Static analysis
      - Mitigation options under a certain carbon price are selected

Methodology

- Key factor of the abatement cost curve analysis



GHG abatement cost
=Additional annual cost of technology/ Reduction of GHG

Annual cost of technology
=Investment cost ×Capital recovery factor + O&M cost −Reduction of annual energy cost*

**Capital recovery factor*
$= a(1+a)^t/((1+a)^t-1) = 1/\text{Payback period}$
a : discount rate t : lifetime

- Abatement cost curves provide technological mitigation potentials and technological implementation costs in each region.
- Be careful that abatement cost curves vary depending on the setting of:
  - future energy price
  - technology data (technology costs, discount rate, payback periods, etc)
  - baseline scenario (socio-economic settings and energy service demand)

Methodology

- Data collection
  - Activity amount (= driving force)
    - Driving forces collected by consultants and researchers from four countries are used for our projection.
  - Mitigation option (= technology)
    - 200 or more options are prepared.

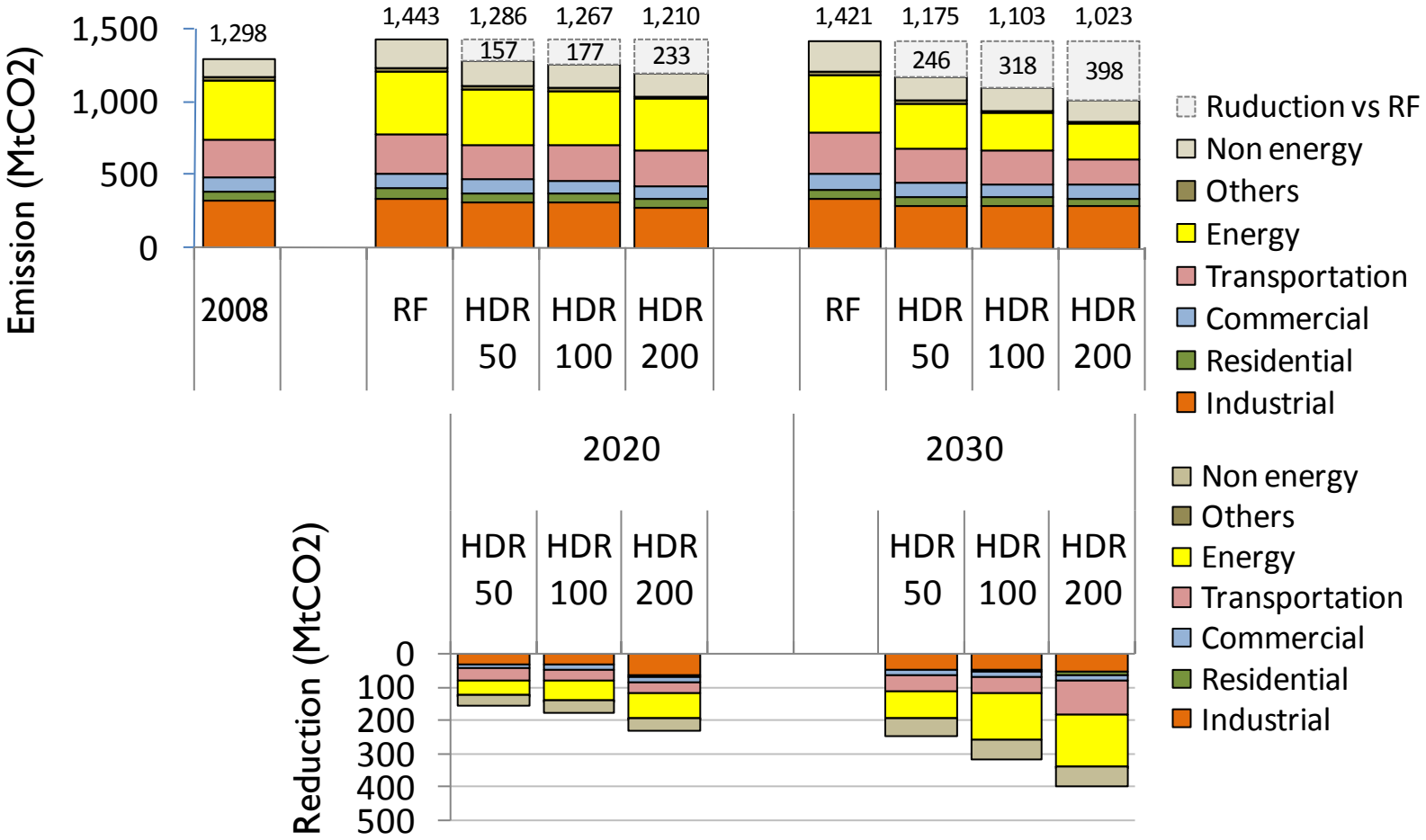
- Simulation cases
  - Baseline case:
    - Technology frozen case
  - Scenarios:
    - Carbon price: 50, 100, 200 USD/tCO2
    - Payback period: Short, Long

- Time horizon
  - Base year: 2008, Target year: 2020/30

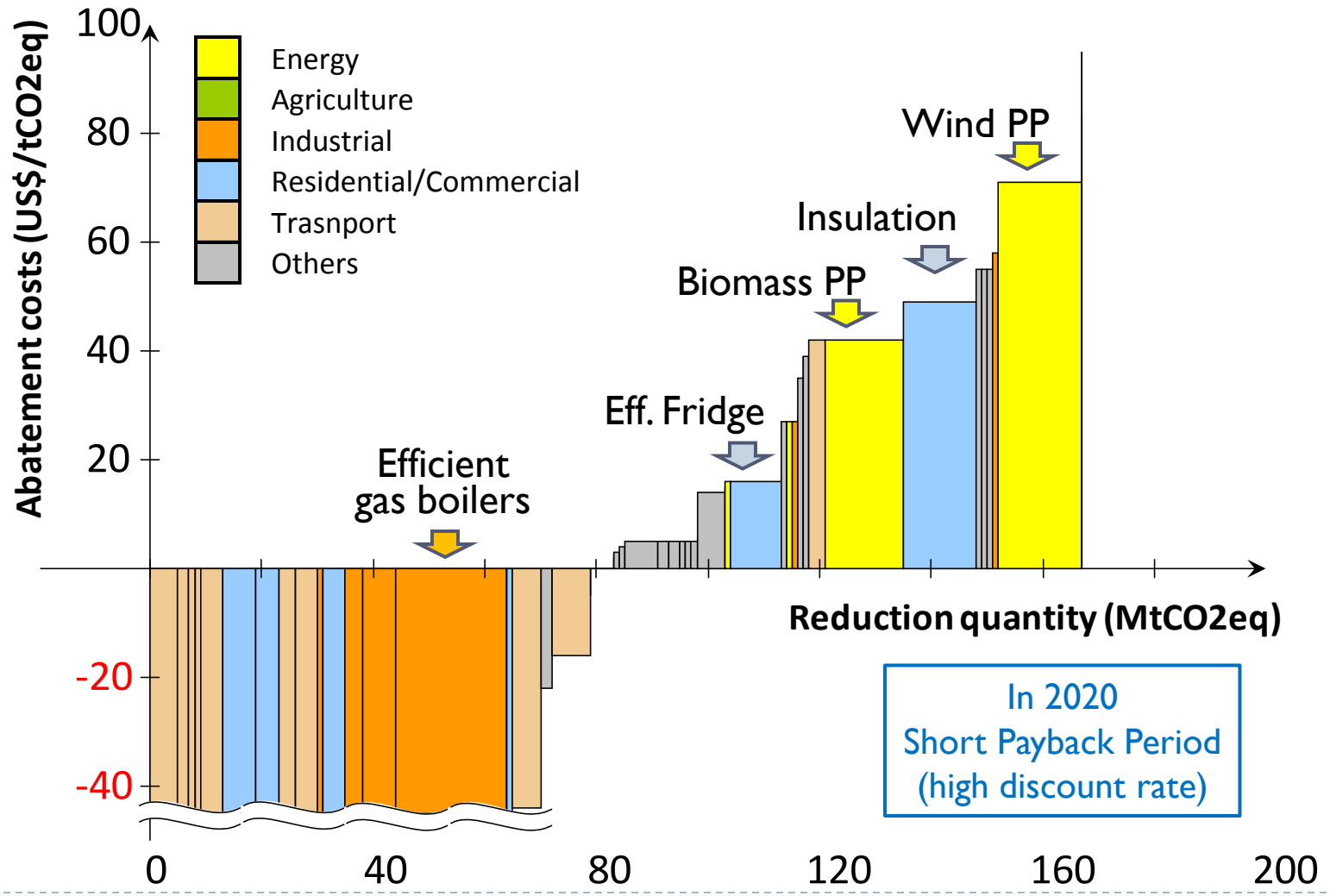
Japan
Activity amount

				Base year	Target year	
Sector		Indicator	Unit	2008	2020	2030
Industry						
	Iron & Steel	Production	Million tons	106	120	120
	Cement	Production	Million tons	66	67	66
	Others	Industrial Production Index	2008 = 100	100	100	101
Residential		No. of Households	Million HHs	52	54	52
Commercial		Floor Space	Million m2	1,817	1,932	1,920
Transportation						
	Passenger	Traffic Volume	Billion p-kms	1,292	1,307	1,304
	Freight	Change in Traffic Volume	2008 = 100	100	114	114
Agriculture						
	Livestock	Livestock	1000 heads	4,420	4,280	4,280
	Crops	Cultivation Area	1000 ha	4,270	4,950	4,950

Japan
GHG Emission/Mitigation Potential



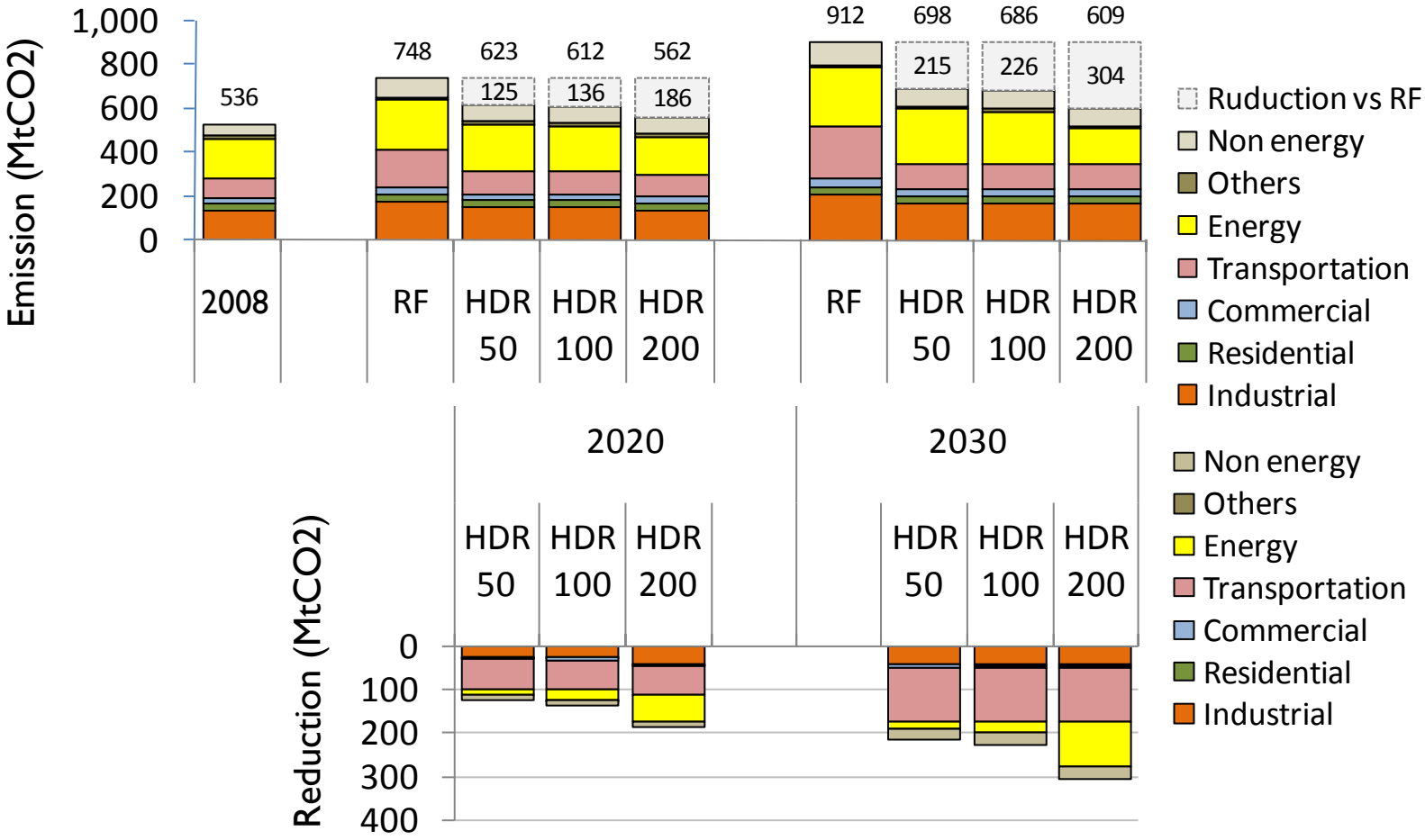
Japan
Abatement Cost Curve



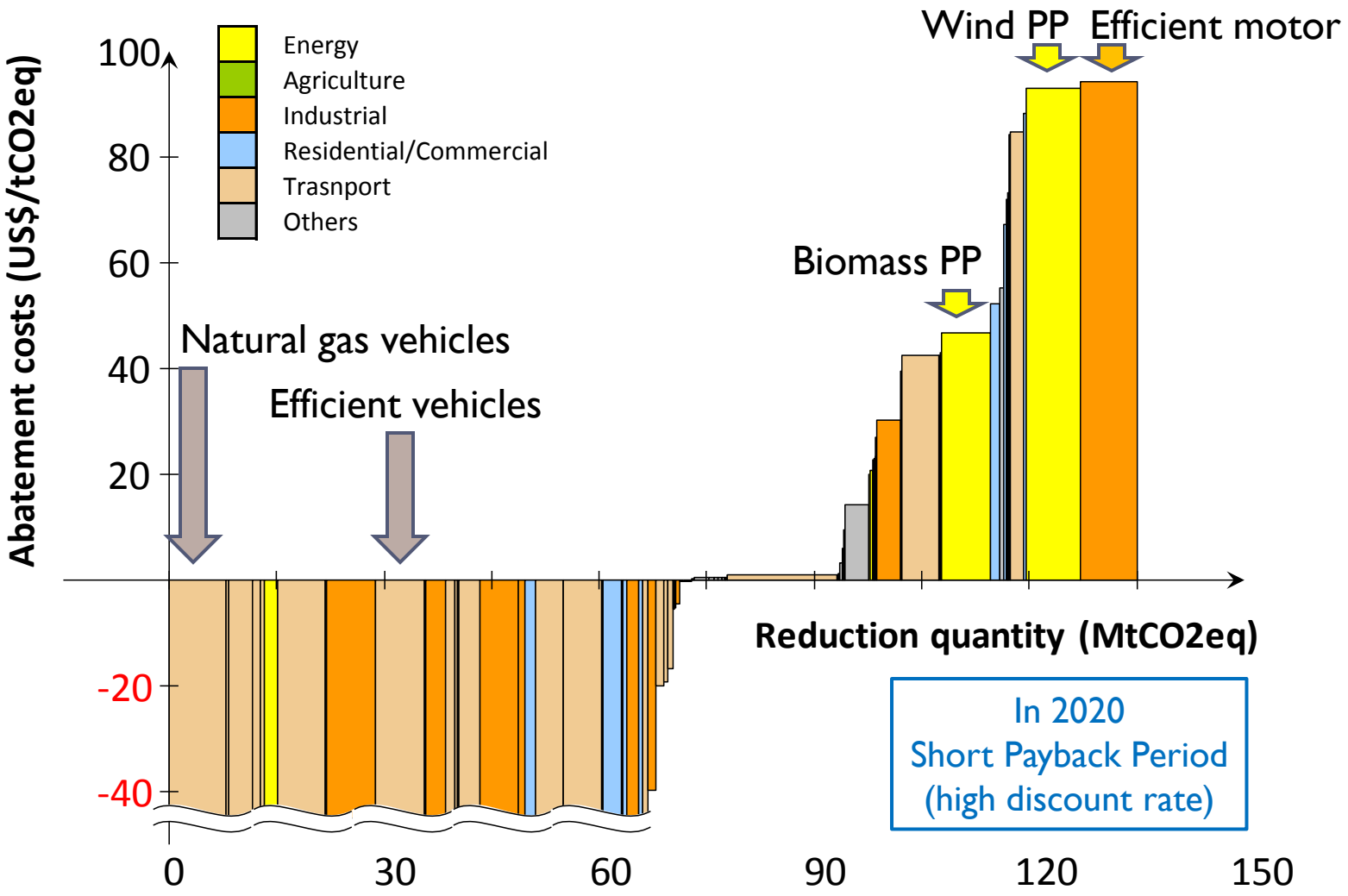
Korea
Activity amount

				Base year	Target year	
Sector		Indicator	Unit	2008	2020	2030
Industry						
	Iron & Steel	Production	Million tons	56	74	88
	Cement	Production	Million tons	53	70	83
	Others	Change in GDP	2008 = 100	100	131	155
Residential		Population	2008 = 100	48	50	50
Commercial		Change in GDP	2008 = 100	100	131	156
Transportation						
	Passenger	Traffic Volume	Billion p-km	332	393	445
	Freight	Traffic Volume	Billion t-km	171	426	639
Agriculture						
	Livestock	Number of Livestock	Million heads	615	593	595
	Crops	Cultivation Area	1000 ha	1,210	1,248	1,267

Korea
GHG Emission/Mitigation Potential



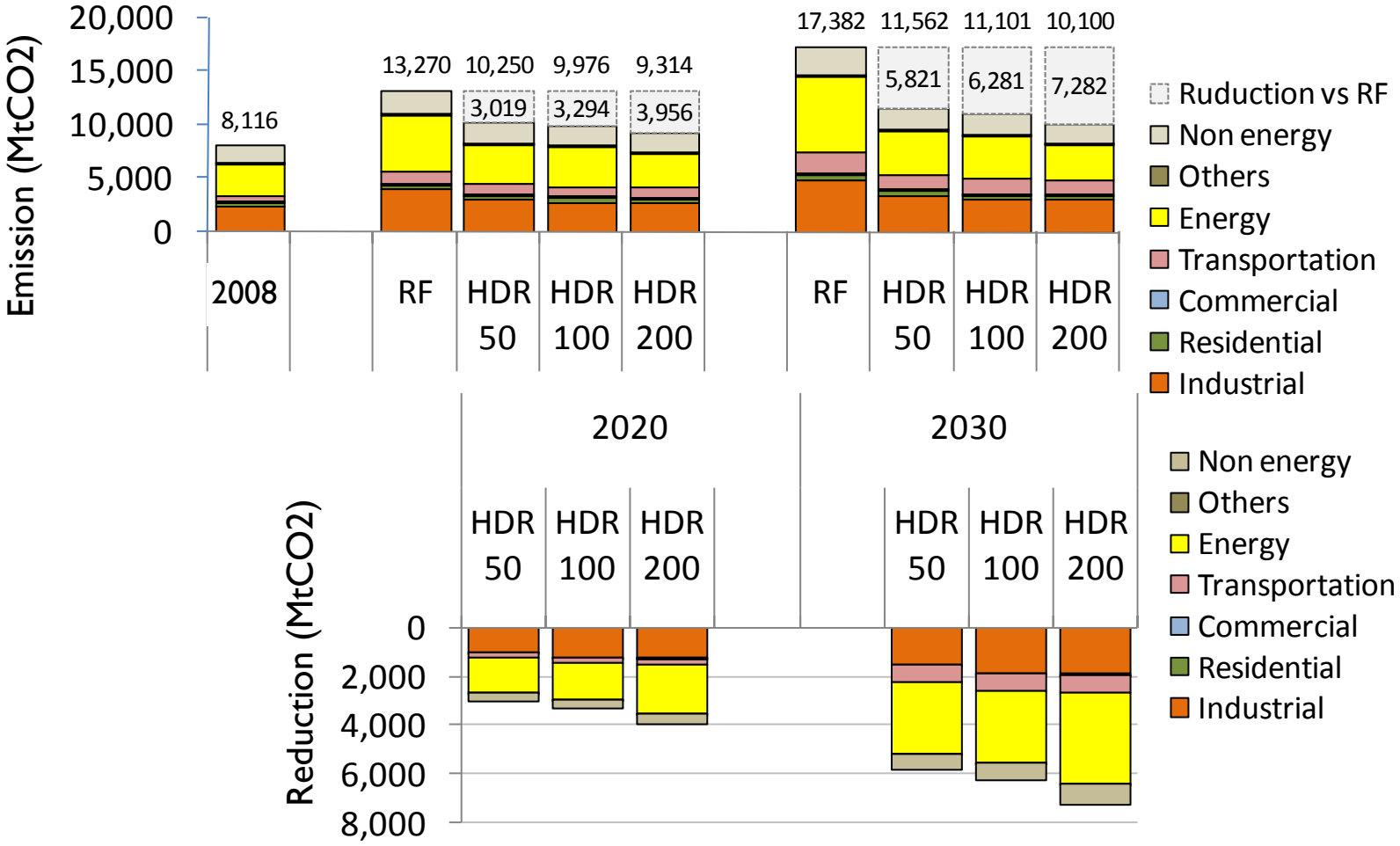
Korea
Abatement Cost Curve



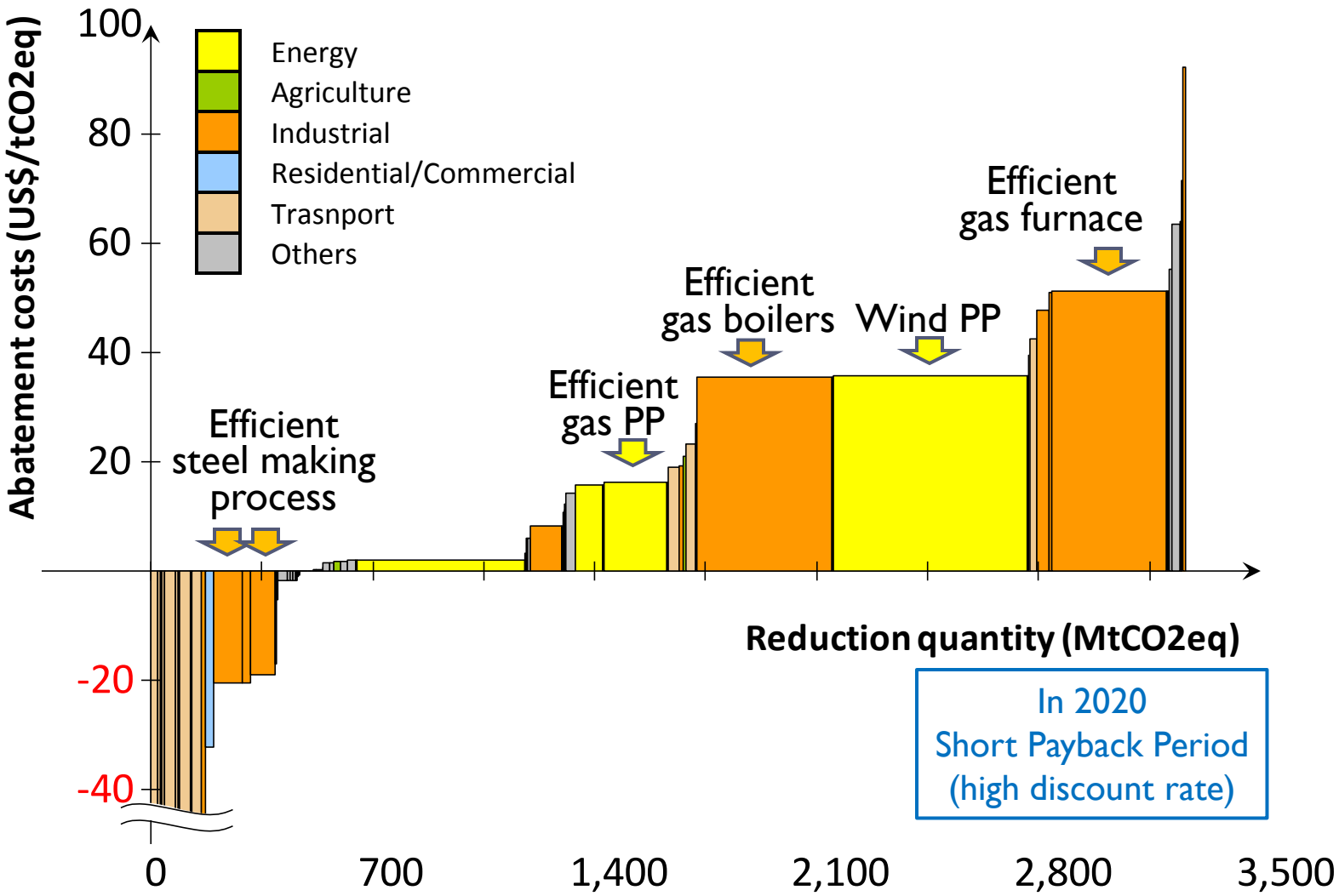
China
Activity amount

				Base year	Target year	
Sector		Indicator	Unit	2008	2020	2030
Industry						
	Iron & Steel	Production	Million tons	406	610	570
	Cement	Production	Million tons	1,168	1,600	1,600
	Others	Change in Secondary Industry GDP	2008 = 100	100	213	340
Residential		Population	Million ps	1,329	1,388	1,394
Commercial		Change in energy service demand	2008 = 100	100	122	141
Transportation						
	Passenger	Traffic volume	Billion p-km	2,571	4,999	8,033
	Freight	Traffic volume	Billion t-km	3,224	6,188	9,357
Agriculture						
	Livestock	Number of Livestock	Million head	10,544	12,884	14,520
	Crops	Cultivation Area	Million ha	123	151	170

China
GHG Emission/Mitigation Potential



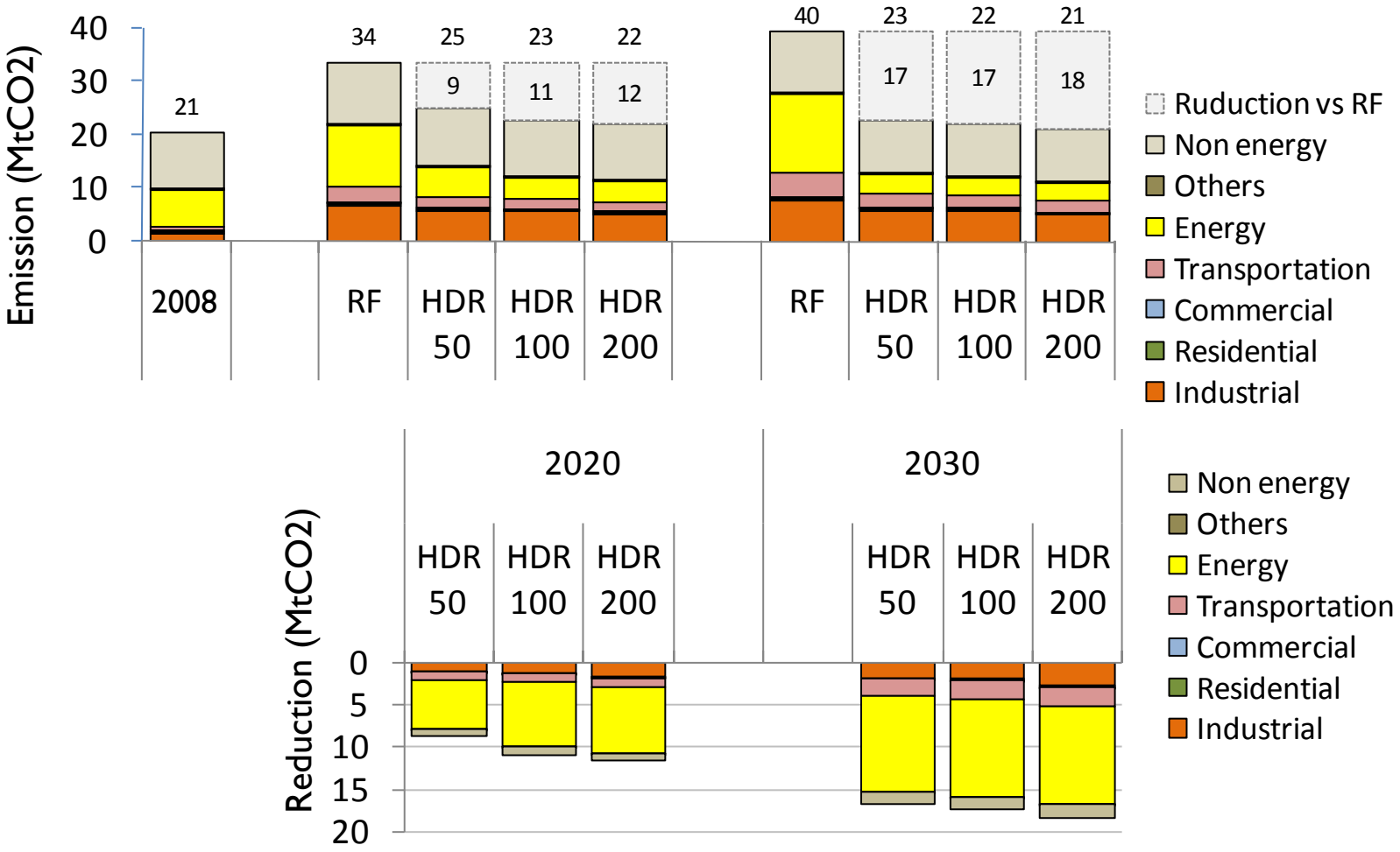
China
Abatement Cost Curve



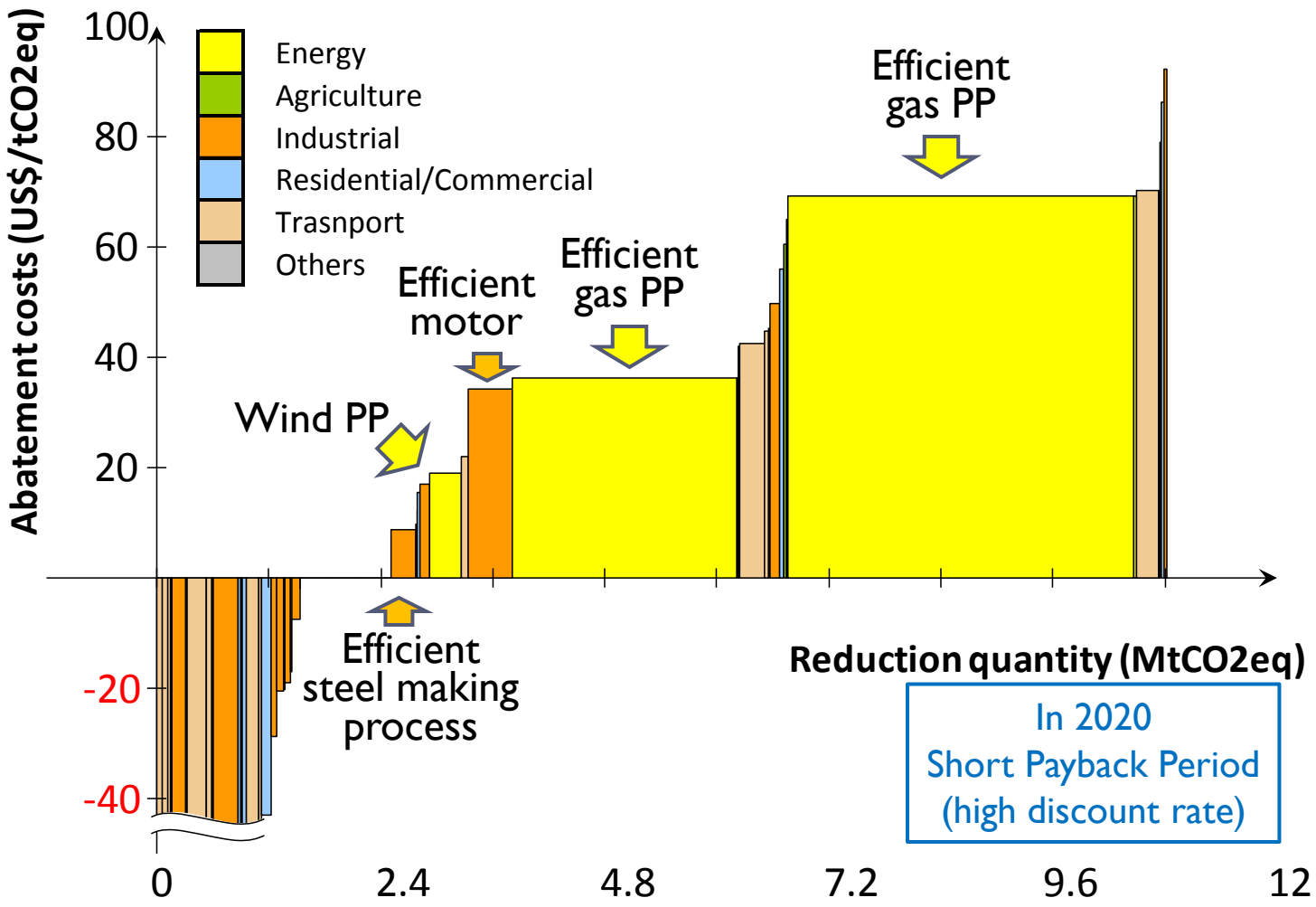
Mongolia
Activity amount

				Base year	Target year	
Sector		Indicator	Unit	2008	2020	2030
Industry						
	Iron & Steel	Production	1000 tons	157	2,100	2,100
	Cement	Production	1000 tons	169	1,250	1,250
	Others	Change in Secondary Industry GDP	2008 = 100	100	166	239
Residential		Number of Household	1000 HHs	678	759	847
Commercial		Number of Employee	1000 persons	282	335	375
Transportation						
	Passenger	Traffic Volume	Million p-kms	3,607	6,800	8,700
	Freight	Traffic Volume	Million t-kms	9,051	23,010	46,515
Agriculture						
	Livestock	Number of Livestock	1000 heads	43,774	36,865	36,865
	Crops	Cultivation Area	1000 ha	178	181	182

Mongolia
GHG Emission/Mitigation Potential



Mongolia
Abatement Cost Curve



Policy implications

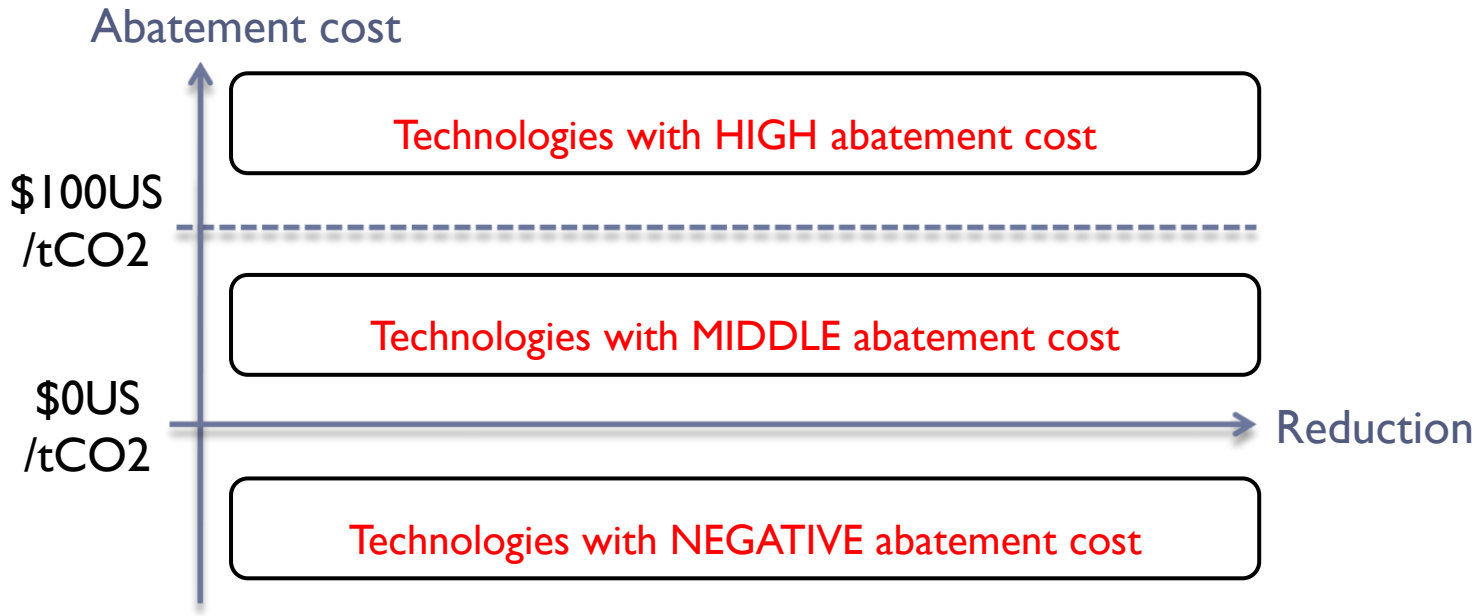
- (1) Effective policy varies for the type of technologies
  - Mitigation options are divided by abatement cost into some groups. The effective policy/action varies for each group.

- (2) Payback period has a large impact
  - Only in Japan were there major changes in reduction potential depending on the payback period.

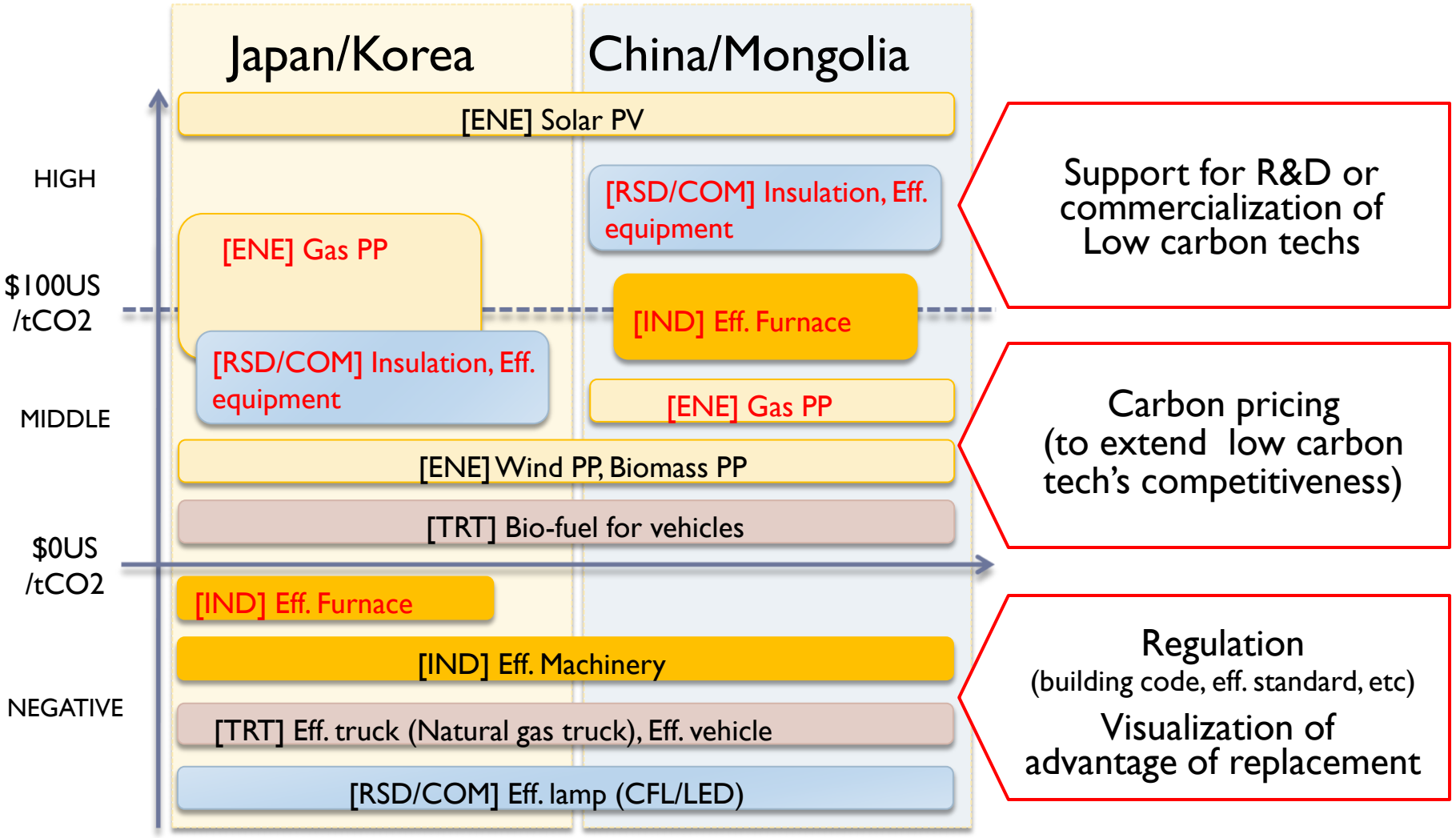
- (3) Measures for climate change enhance the stability of energy supply
  - Especially in China, coal consumption increases tremendously without actions for climate change. On the other hand, in the event that actions are taken, coal consumption increase could be held to a small amount.

Policy implications
(1) Effective policy varies for the type of technologies

- In following example, mitigation options are divided into three groups.
  - Technologies with very HIGH (100~) abatement cost
  - Technologies with MIDDLE (0 ~ 100) abatement cost
  - Technologies with NEGATIVE abatement cost

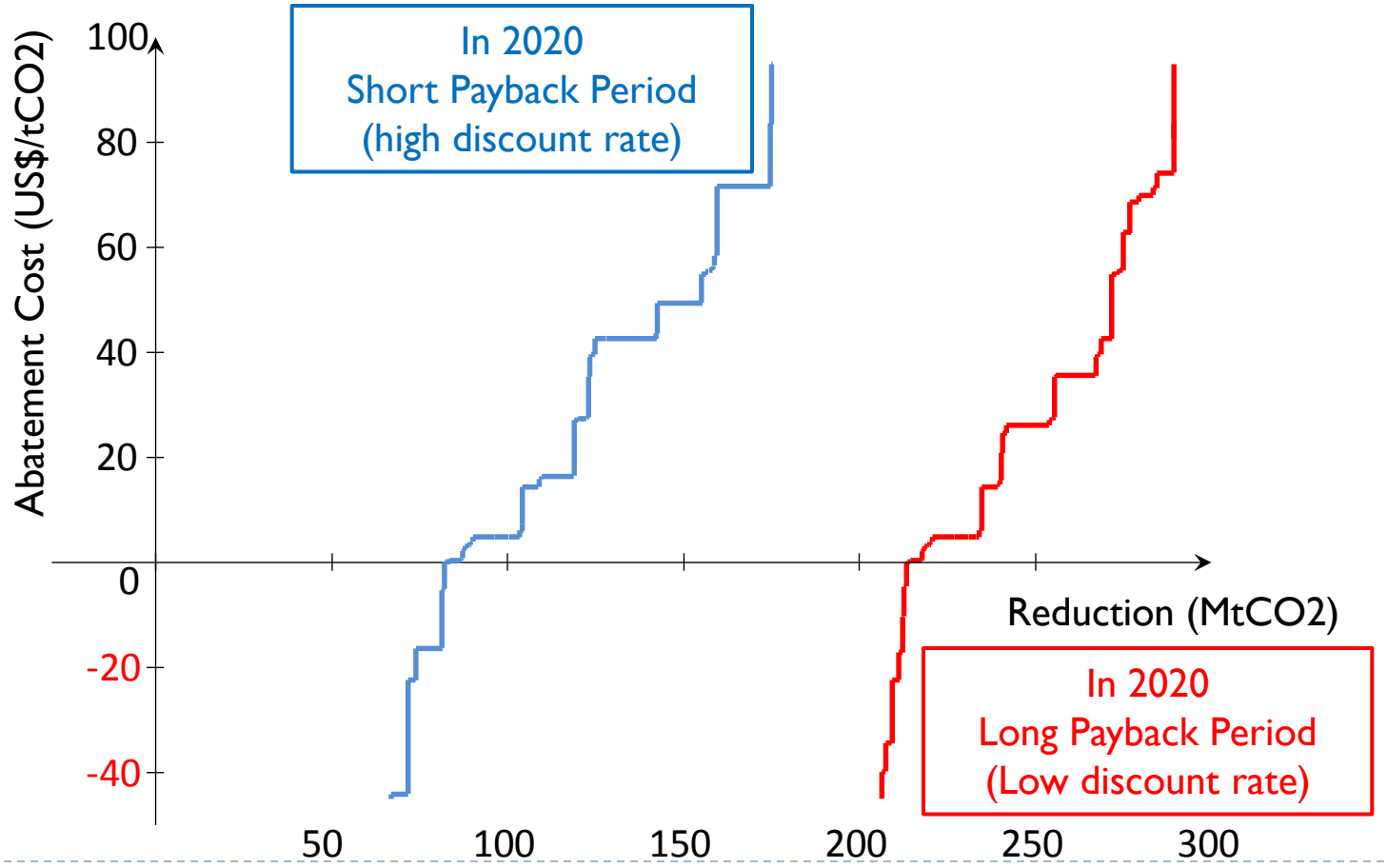


Policy implications
(1) Effective policy varies for the type of technologies



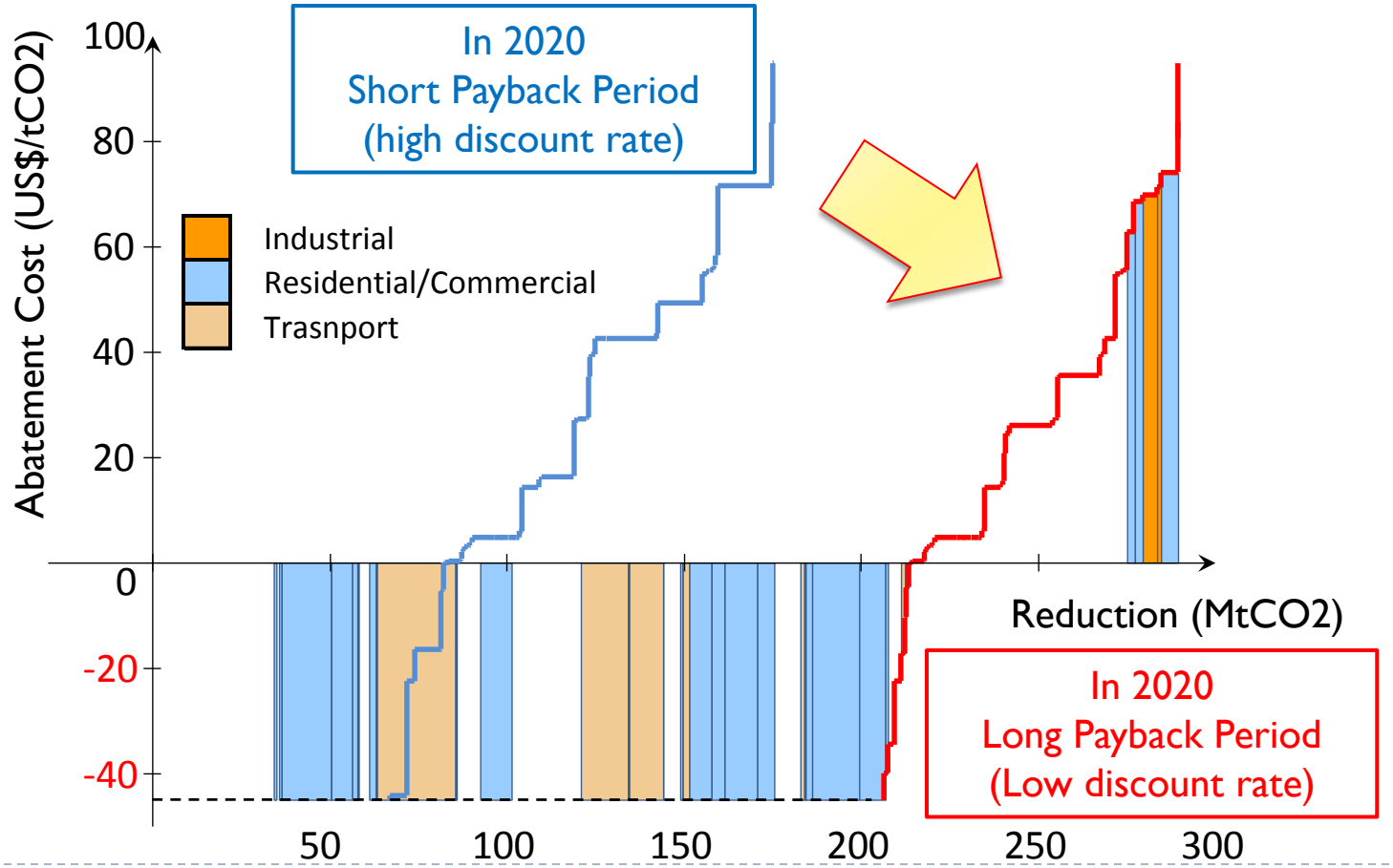
Policy implications
(2) Payback period has a large impact

- There are major changes in reduction potential depending on the payback period in Japan.



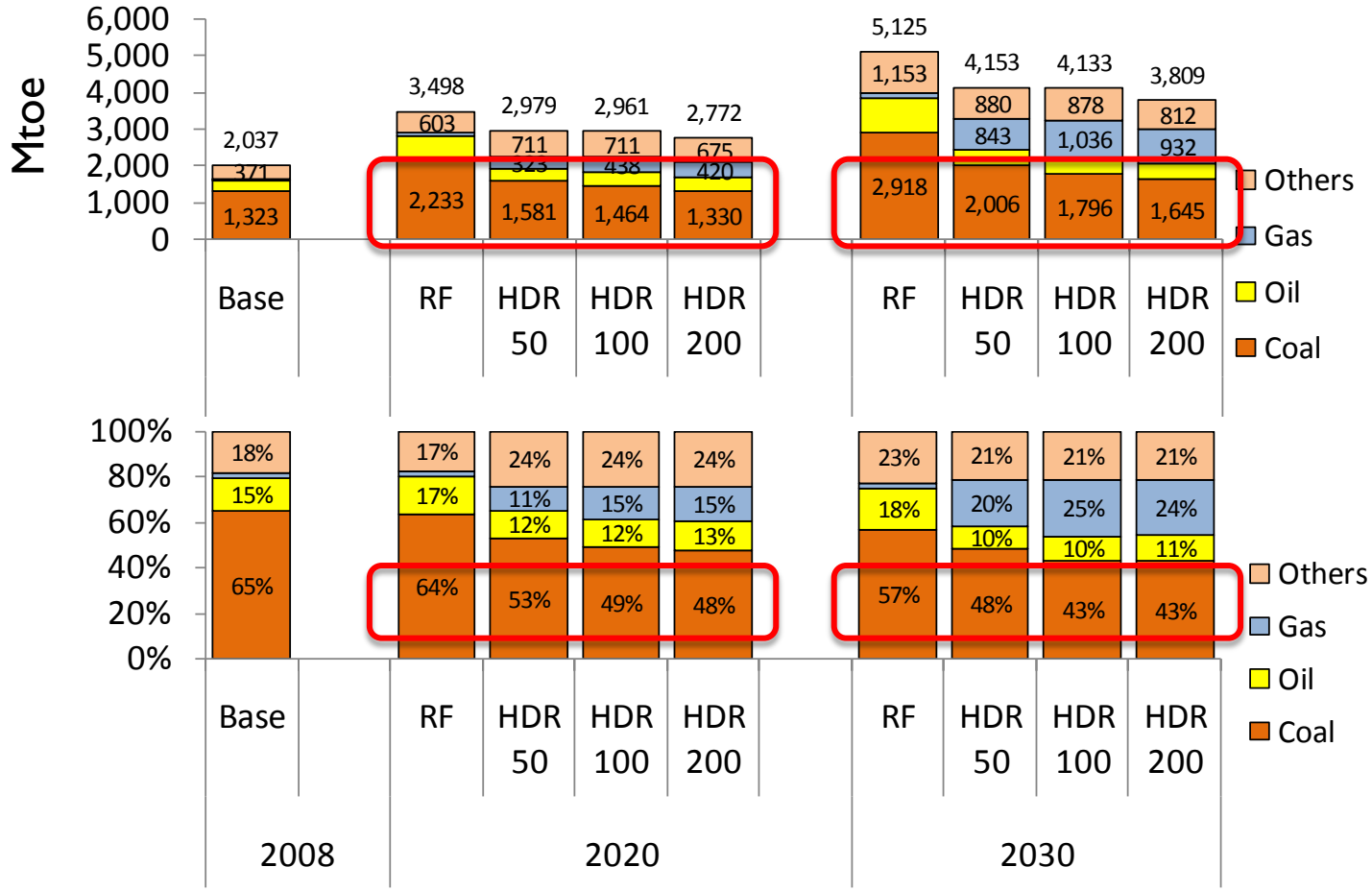
Policy implications
(2) Payback period has a large impact

- Measures for extending payback period are required to make reduction larger.



Policy implications
(3) Measures for climate change and energy security

- Energy consumption structure in 2020/30 in China.



Policy implications
(3) Measures for climate change and energy security

- Energy consumption structure in 2020/30 in China.
  - Coal consumption in China would increase tremendously in the event that no mitigation options were introduced.
  - On the other hand, in the event that measures are taken, it was found that the increase from the base year could be held to a small amount.

Measures for GHG emission reduction are thought to be an important policy from the standpoint of energy security as well.

Conclusion

- Emission Projection, MAC curve
  - Emission/mitigation in 2020/2030
  - Abatement cost curve

- Policy Implications
  - The effective policy will vary for technologies and countries.
  - Policy for extending payback period is crucial for Japan.
  - Actions for GHG emission reduction seem to be able to realize more stable energy security for China.

Thank you for your attention