

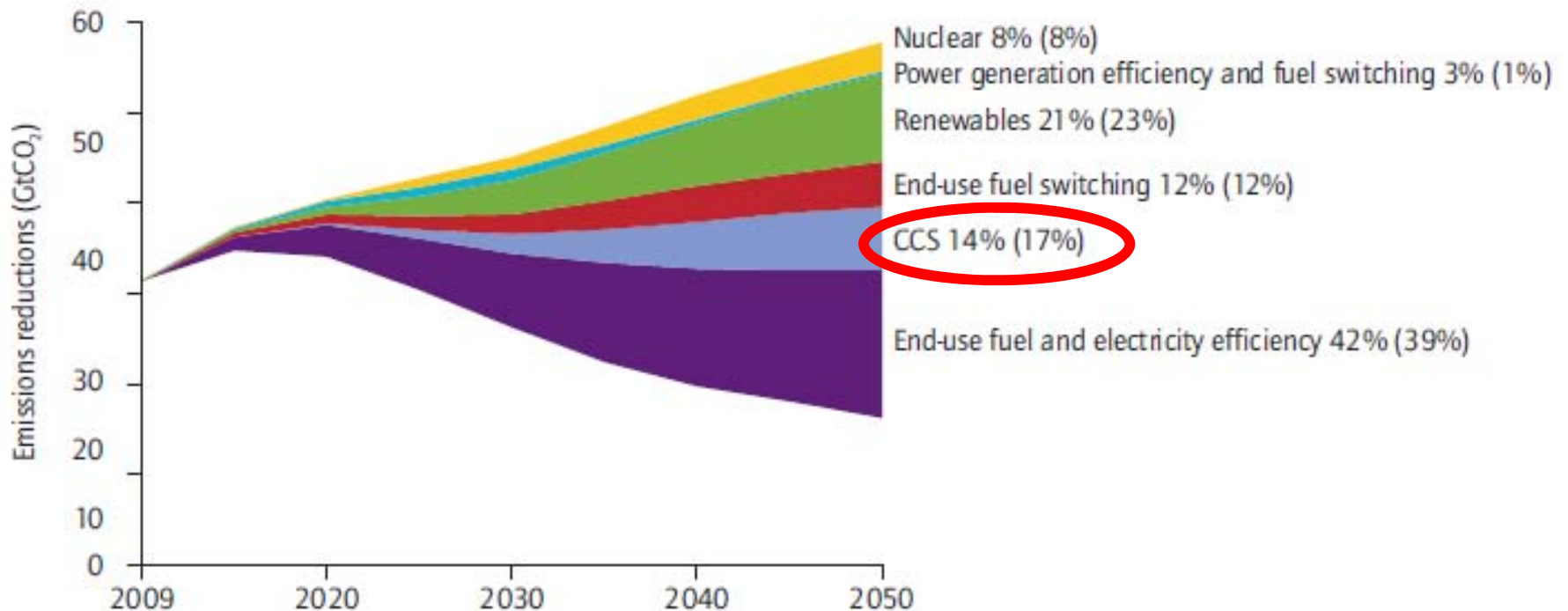
**International CCS Symposium for Low-Carbon Society**  
**Tokyo, Japan**  
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**Modalities of Incentives for CCS**  
**- Role of government and market -**

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# Role of CCS for climate change mitigation

Figure 6: CCS contributes 14% of total emission reductions through 2050 in 2DS compared to 6DS

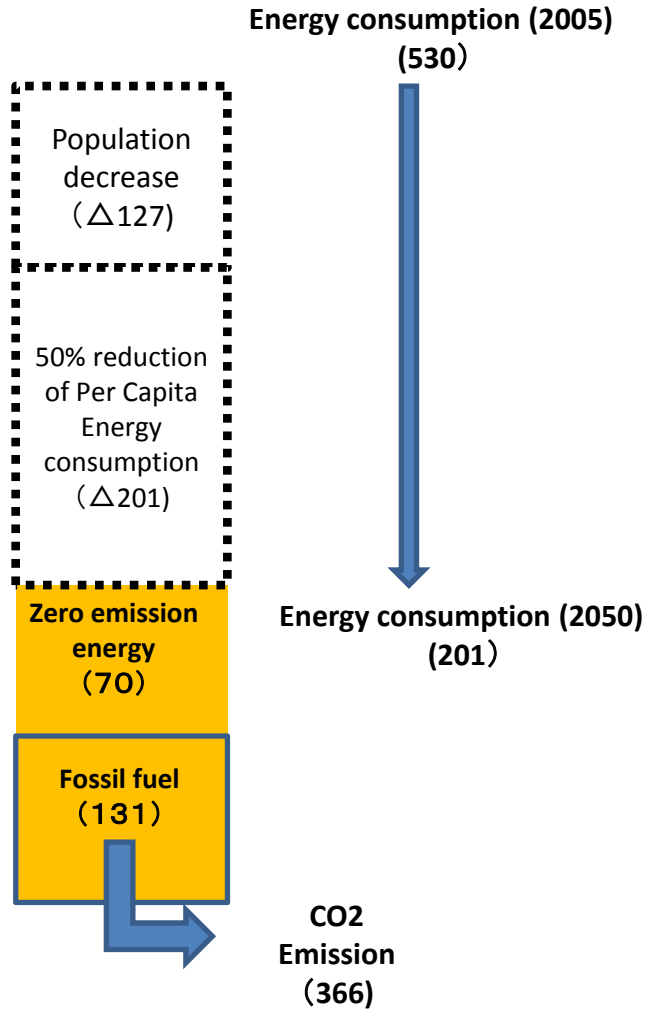


Note: numbers in brackets are shares in 2050. For example, 14% is the share of CCS in cumulative emission reductions through 2050, and 17% is the share of CCS in emission reductions in 2050, compared with the 6DS.

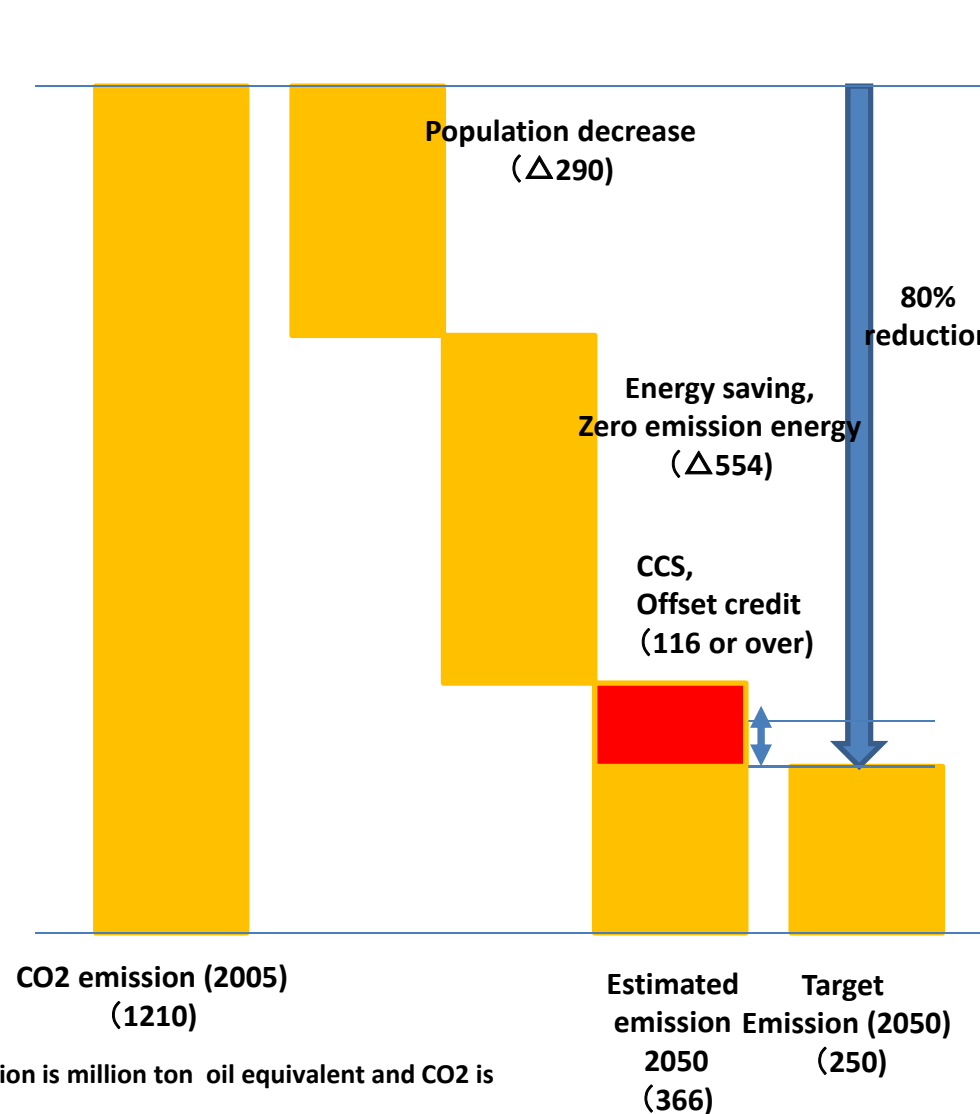
Source: IEA, 2012c.

# Toward 2050 ; Energy consumption and CO2 Emission

## Energy consumption(2050)



## CO2 Emission(2050)



**Note:**

1 Data of 2005 is from IEA World Energy Outlook . Unit of energy consumption is million ton oil equivalent and CO2 is million ton CO2 equivalent

2 Assumption in 2050 ; Population is 97 million (24% decrease). Per capita energy consumption is 50 % decrease. 70% of energy is electricity and half of electricity is zero emission energy

# New demand for CCS from Japan

FCV(Fuel Cell Vehicle) is at pilot program phase. FCV car price has dropped to below USD50,000 by using the government incentives.

Bottle necks

- Hydrogen station ⇒ 100 stations in 2015, 2000 stations by 2020 (government strategy)
- Life cycle emission ⇒ CCS is needed when hydrogen comes from fossil fuels.

⇒ CCS is a condition of hydrogen as climate mitigation option.



Hydrogen station.

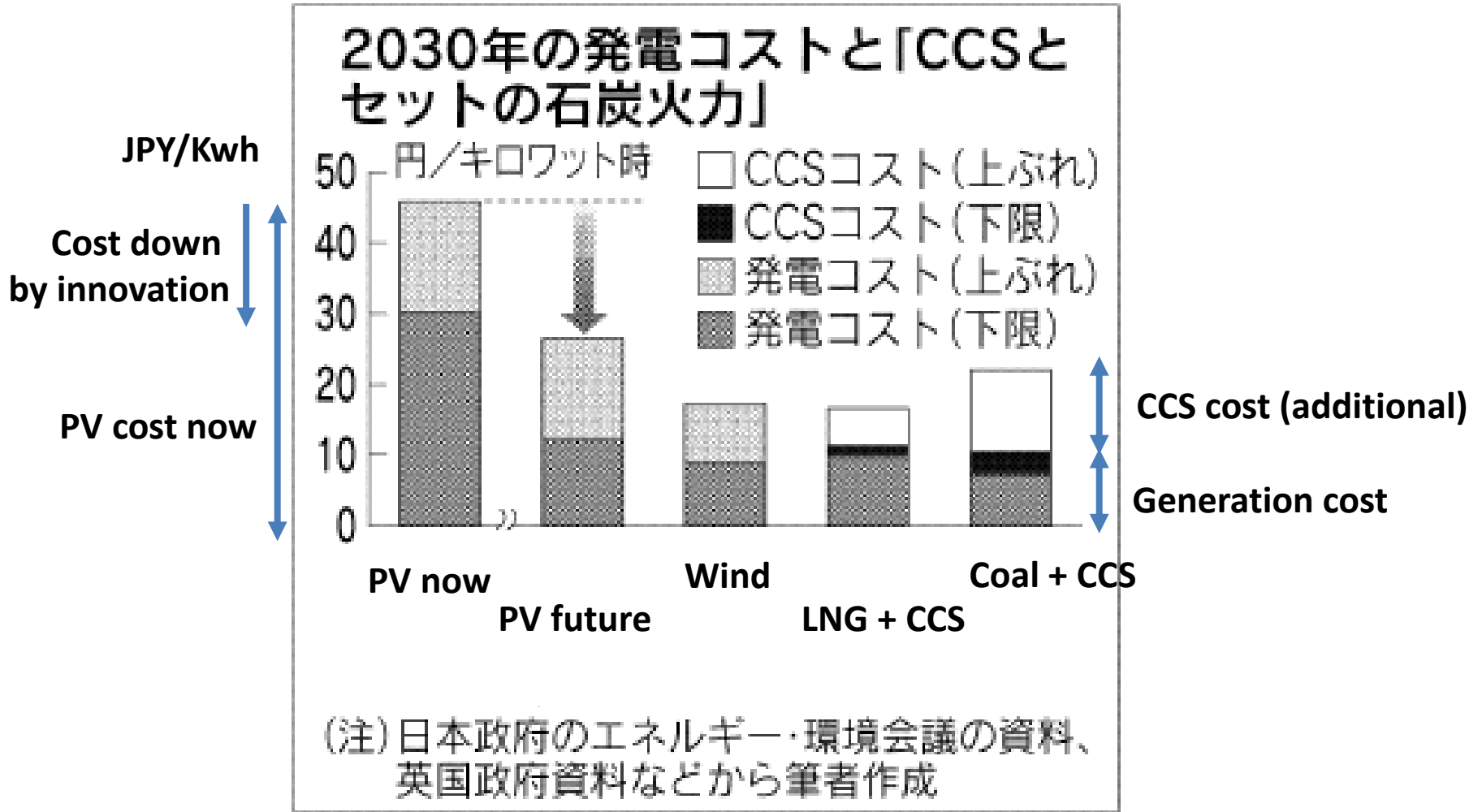
41 stations will be available by June 2015.



Toyota : Mirai. JPY7million, but JPY5million  
By using incentives.

# Cost of CCS and Renewable in Japan

## Power generation cost in 2030



Source, Takashi Hongo, at Nikkei Sangyo News Paper, July 2012

# Modalities of incentives

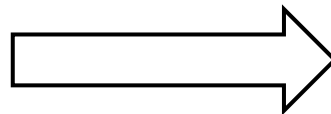
Measures	Applicability	Limitation
<b>Subsidies for CAPEX</b> ▪ Subsidies for construction cost etc.	▪ Suitable for the stage of R&D t and pilot project	▪ Budgetary limitation, particularly at the commercial stage
<b>Long term low cost finance</b> ▪ Public finance such as 20 years	▪ Suitable for the commercial stage	▪ Combination with subsidies and other incentives is possible e.g Petra Nova Parish project
<b>Investment tax credits</b> ▪ Credit amount can be determined depending on reduction amount	▪ Efficient use of incentives by avoiding moral hazard for investment risk ▪ Various players may be involved when tax credit is tradable.	▪ Tax system adjustment is highly political agenda.
<b>Premium Tariff under FIT</b> ▪ eg Similar scheme of FIT for CCS	▪ Cash flow can be fixed ▪ Suitable for early stage of commercialization ▪ Government can avoid bid burden of subsidies.	▪ Additional cost will be paid by consumers ▪ Tariff shall be adjusted to the progress of innovation
<b>Carbon Credit</b>	▪ CCS is recognized as the last resort of supply source of credits when credit demand is enormous.	▪ Price fluctuation risk ▪ Cost of credit by CCS seems to be expensive compare to others
<b>Purchase of CO2 reduction by CCS</b> ▪ Reduction will be purchased by government at fixed price	▪ Outcome base incentive ▪ Price risk can be avoided.	▪ Cost will be paid by government
<b>PPP for necessary infrastructure</b> e.g Capture by private power producer transportation by BOT, storage by government	▪ Responsibility and cost for private is limited ▪ Analogy of RE power (Concentration on generation)	▪ Policy coordination is needed

# Price Curve and Modalities of Incentives

- Transition to “government” to “market” -

CCS cost

< R&D >



< Commercialization >

(Direct subsidies)

(Market approach)

R&D subsidies

Incentives for  
Capex

Tax Credit/  
Tradable tax credit

FIT

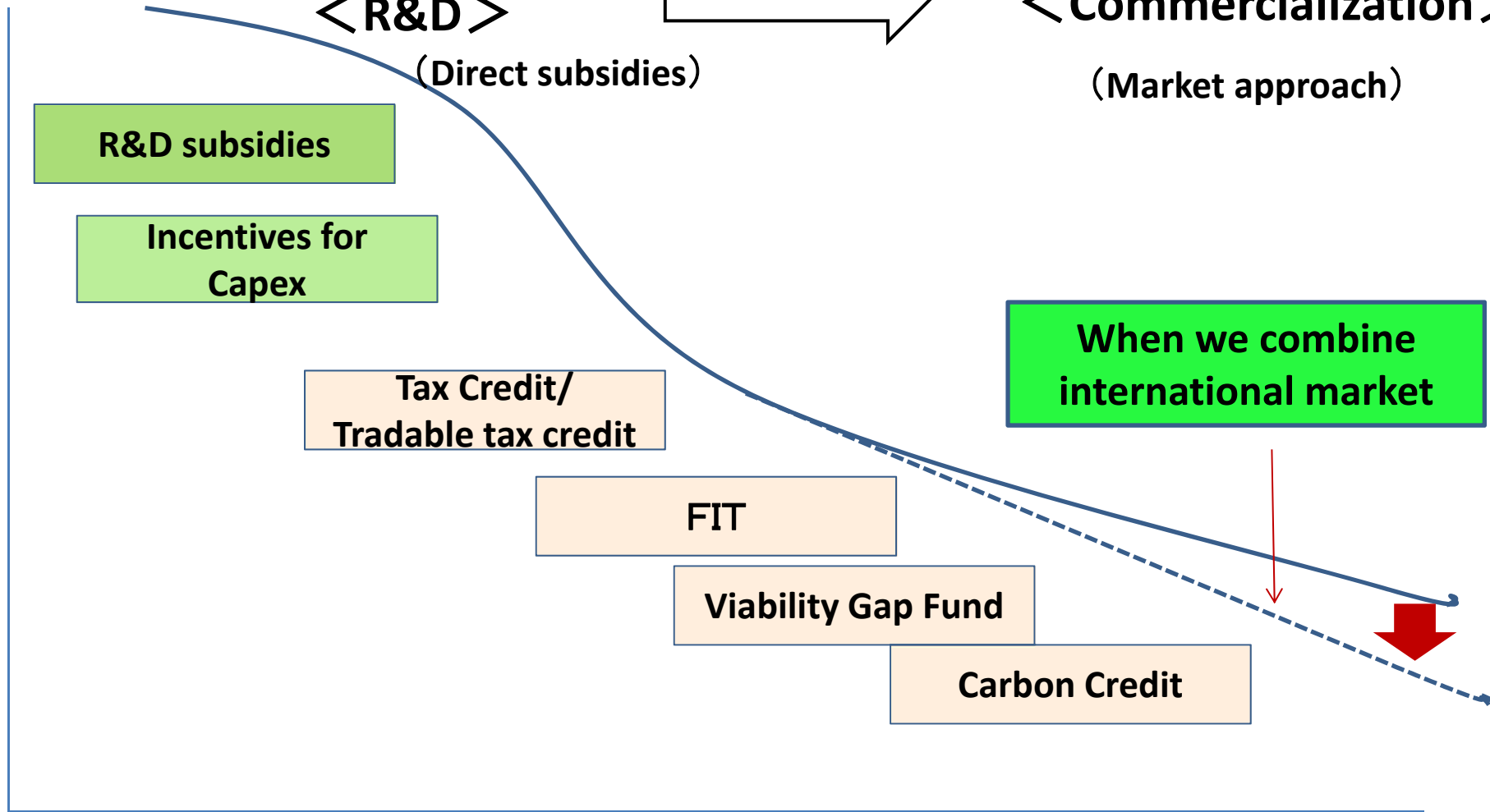
Viability Gap Fund

Carbon Credit

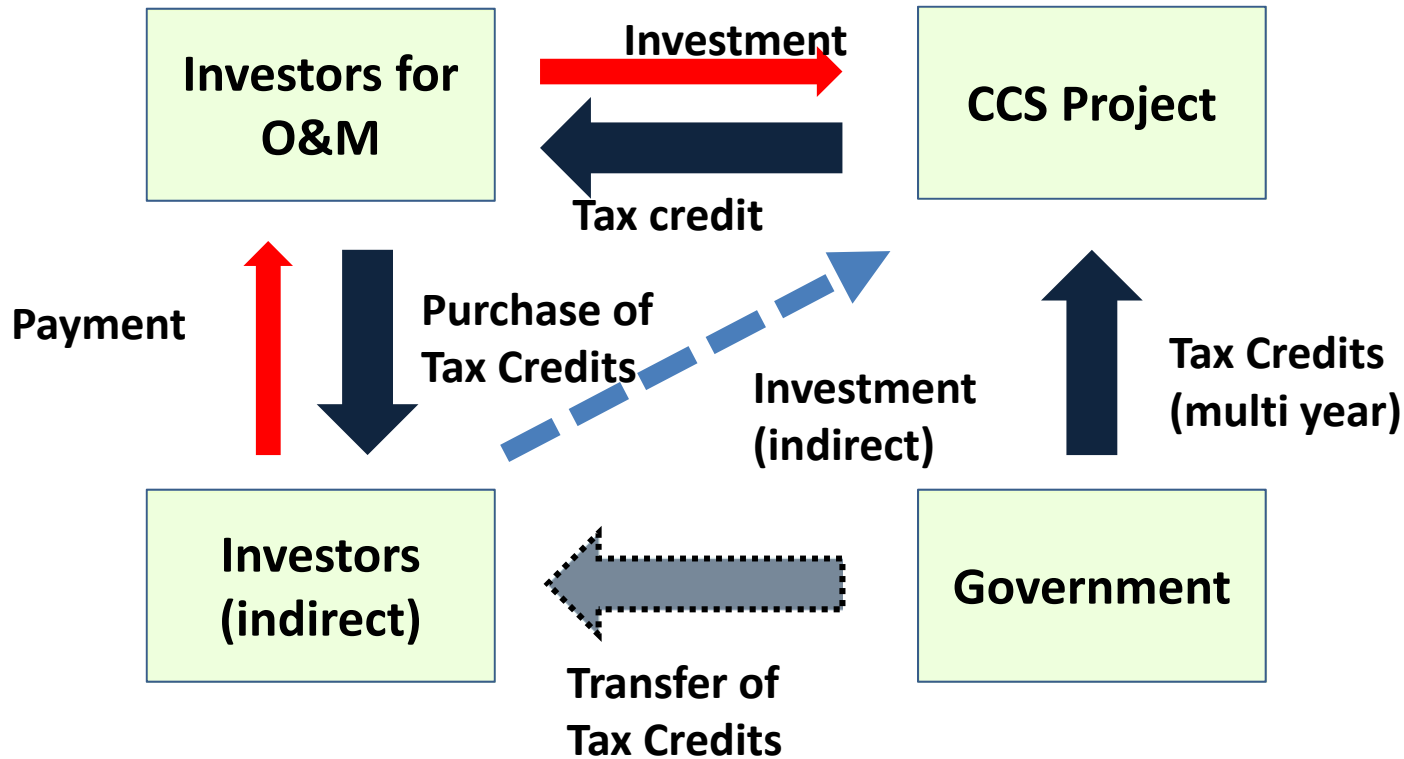
When we combine  
international market

Time

7



# Tradable tax credit for CCS pilot project



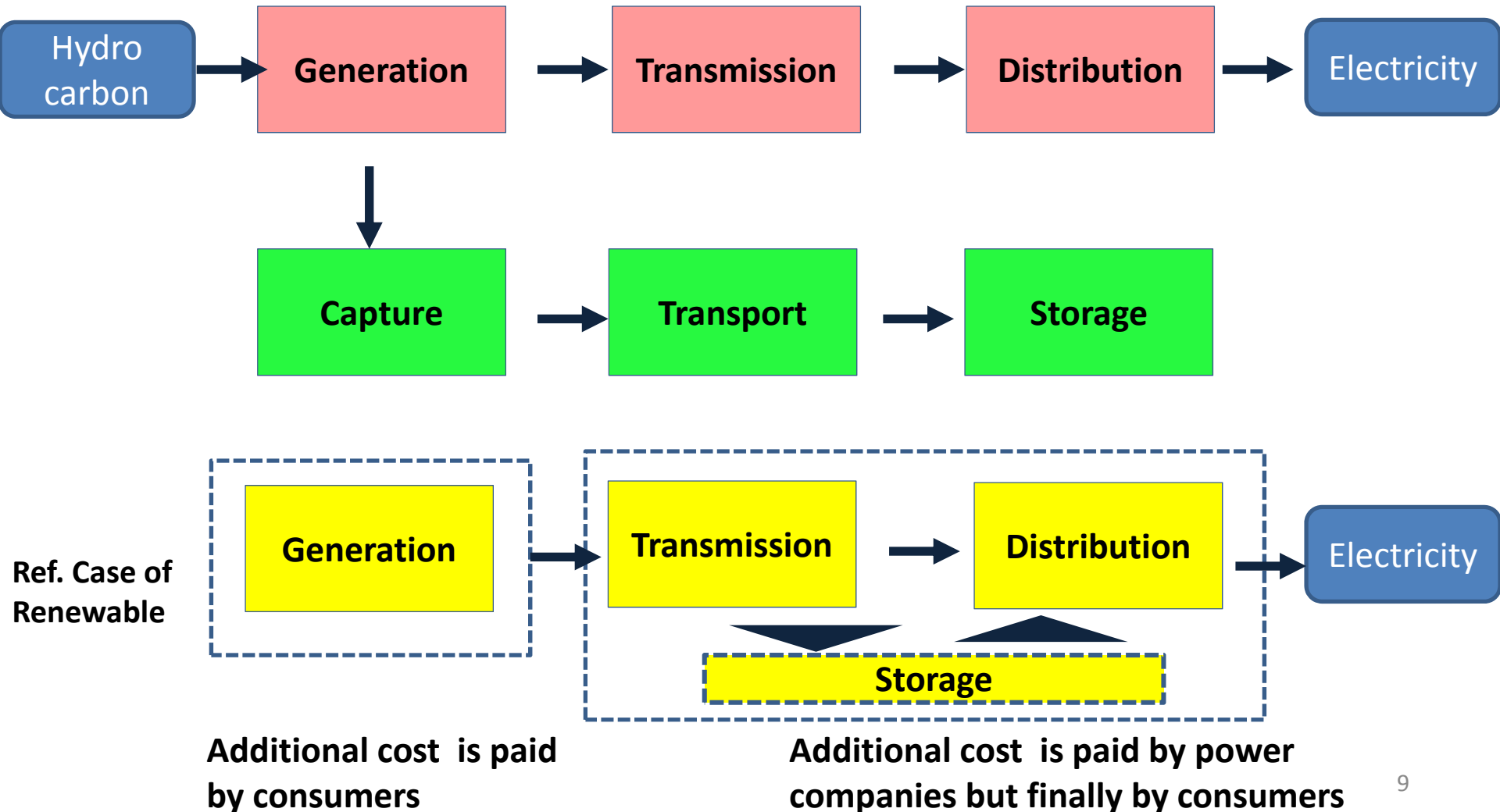
## Benefit

- Multi year Tax Credits
- Access for non-operation investors
- Reduction of investment exposure for O&M investors



# PPP approach for infrastructure

Capture by private, transportation and storage by government



# Major CCS projects

Emirate Steel  
(EOR, 0.8mil ton PA)  
(UAE, 2016)

Boundary Dam  
(EOR, 1mil ton PA)  
(Canada, 2014)

Kemper County  
(EOR, 3mil ton PA)  
(US, 2016)



In Salar Gas  
(total 3.8mil ton)  
(Algeria, 2004)

Source Global CCS Institute etc

Petra Nova  
(EOR, 1.4mil ton PA)  
(US, 2016)<sup>10</sup>

# CO2 EOR : Fast Track to Geological CCS

- ◆ A critical barrier for CCS is cost and cost can be decreased by the accumulation of projects.
- ◆ CO2 EOR generates cash flow by increase of oil production and may come earlier than geological CCS.
- ◆ Geological CCS is ultimate goal but CO2 EOR is a bridge to future geological CCS.

## Barriers for CO2 EOR

### ➤ Monitoring cost

- “CO2 emission reduction at the site =

injected amount – recovered amount with oil – “leaked amount”.

⇒ Measurement of leak (long term) is crucial

① Measured directly

② Seismic Survey

③ Estimation by modeling

### ➤ Liability after project

- Transfer to “concession” to government when it meet the requirements.

### ➤ Life cycle emission

- How should we deal the emission from increased oil?

# CO2 EOR : As climate change mitigation

Life Cycle Analysis is a key for CCS EOR (CO2 EOR) as climate change mitigation

CO2 emission reduction (LCA) = Amount of storage at the site  
- Emission from EOR process  
- Emission from oil increased by EOR

## ◆ Technology solution

Conventional CO2 EOR seeks for maximizing oil production. New technology which maximize both storage and oil production is needed

⇒ Net Negative Carbon Oil

## ◆ Policy driven solution

CO2 EOR should be supported as a climate change mitigation until geological CCS become commercialized. (Innovation and cost down is expected)

⊗ Emission from oil by EOR is less than that of conventional oil

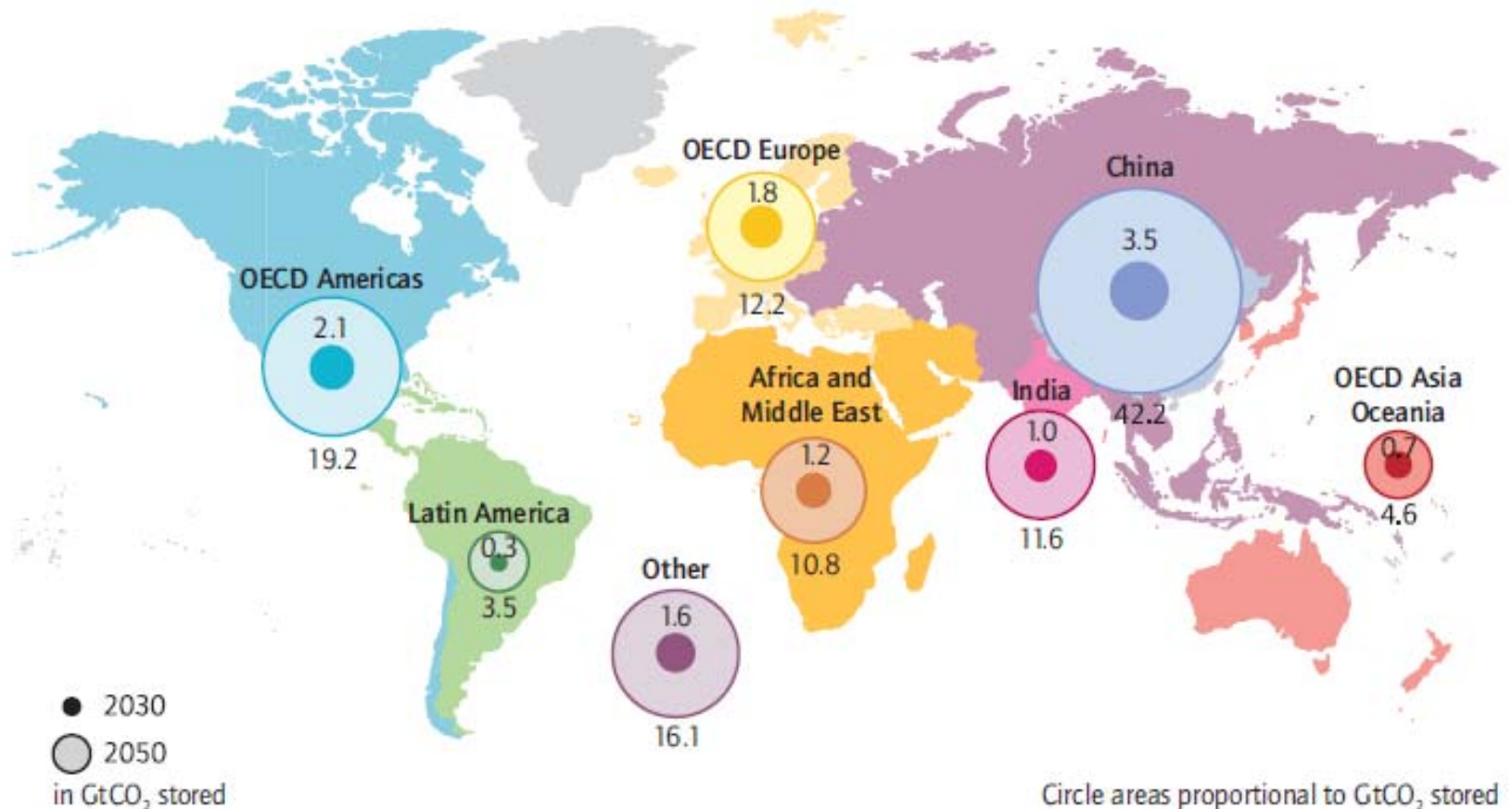
## ➤ Approach for evaluation of emission reduction

- CDM
- JCM
- ISO : TC265 WG6

# Where is CCS market?

## Market is crucial for cost reduction\_

Figure 5: Cumulative CO<sub>2</sub> captured 2015-30 and to 2050, by region in the 2DS



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

Note: geographic distribution of cumulative captured CO<sub>2</sub> is aligned with locations of large point sources of CO<sub>2</sub> emissions.

Source: IEA, 2012c.

# Joint Credit Mechanism (JCM)

Japan has framework with 12 countries for JCM, including Indonesia and Mexico, and it is designed for utilizing unused GHG emission reduction space.



Mongolia  
Jan. 8, 2013  
(Ulaanbaatar)

Bangladesh  
Mar. 19, 2013  
(Dhaka)

Ethiopia  
May 27, 2013  
(Addis Ababa)

Kenya  
Jun. 12, 2013  
(Nairobi)

Maldives  
Jun. 29, 2013  
(Okinawa)

Viet Nam  
Jul. 2, 2013  
(Hanoi)



Lao PDR  
Aug. 7, 2013  
(Vientiane)

Indonesia  
Aug. 26, 2013  
(Jakarta)

Costa Rica  
Dec. 9, 2013  
(Tokyo)

Palau  
Jan. 13, 2014  
(Ngerulmud)

Cambodia  
Apr. 11, 2014  
(Phnom Penh)

Mexico  
Jul. 25, 2014  
(Mexico City)

## <Procedure of JCM>

MOU by both parties

Start of Joint committee by both parties

Project approval by Joint committee

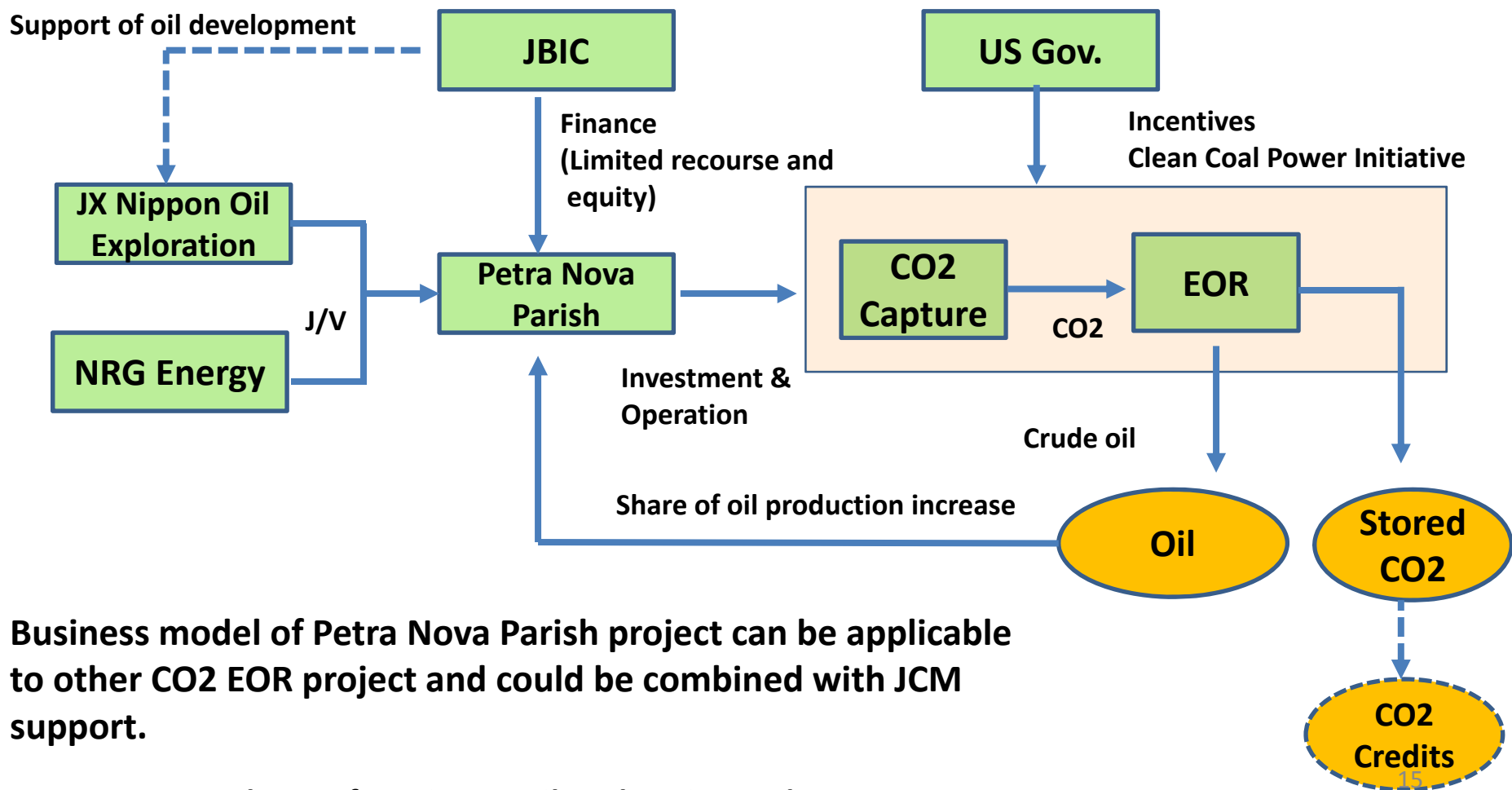
Methodology approval Joint committee

Issuing and sharing credits by project proponent

- JCM has similar governing structure of CDM.
- Joint committee, consists of representatives of both parties, play a key role of implementation.
- Methodology can be practical but take into account of international practice,

# Finance by JBIC

**JBIC (Japan Bank for International Cooperation) is a government owned bank and provides finance for industrial investment, infra development and resources development.**



**Business model of Petra Nova Parish project can be applicable to other CO2 EOR project and could be combined with JCM support.**

# Conclusion : Public Acceptance is a crucial key for CCS

## 2 scenes at Lima COP20



**Sir Nikolas Stern**  
He spoke about carbon budget, carbon pricing and role of CCS.



**Demonstration of anti-CCS**  
A group opposes upstream development and ask for energy companies to disclose upstream development plan. They concerns the delay of CCS.