Biomass Power as Major Power Source

~ Creation of Asia Biomass Community~

September 6th, 2018

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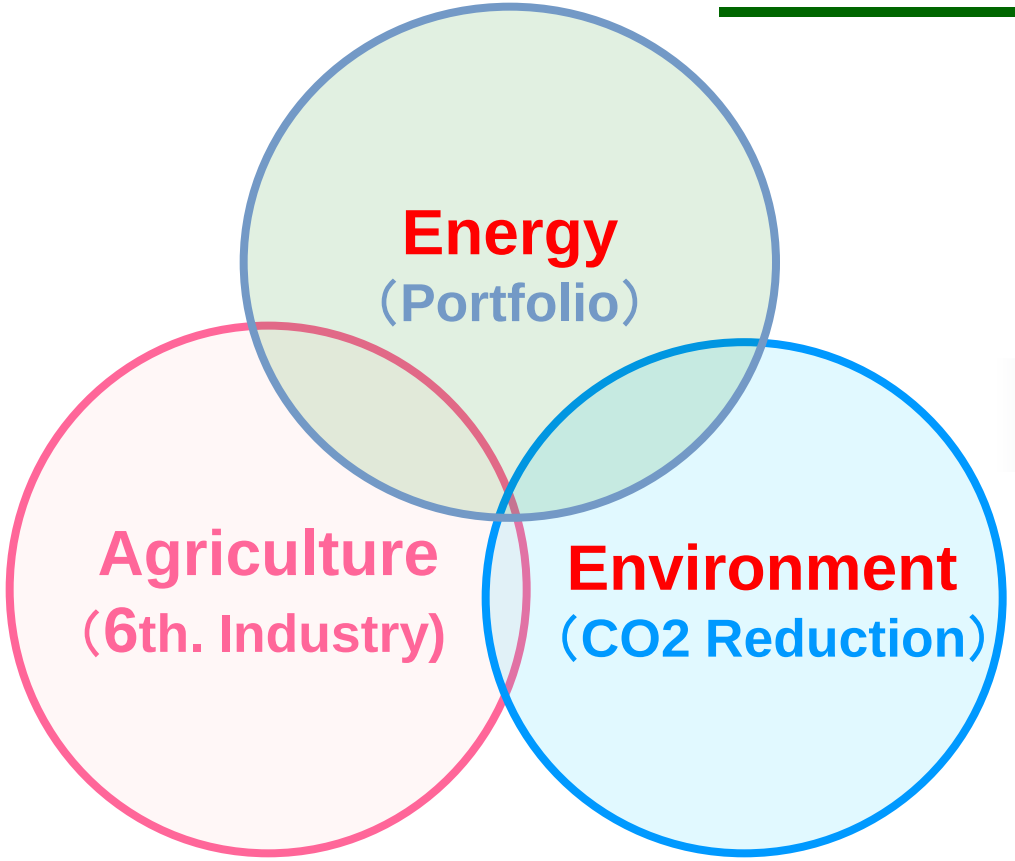
President , NEED

Driving force to create Biomass Energy Industry



Industrialization

Employment

- **Political Action**
- **Strategic Promotion**

Biomass Energy Policy EU & U.S. vs Japan

Policy	EU & U.S.	Japan
Energy	●As Energy Security ●As Energy Portforio ●Last Resort of Renewable Energies ●Ambitious Target ⇒ Industrial Scale ●Creation of Large Market	●Minority among Renewable Energies ●Limited Target ⇒ Small Market ●Small Scale
Agriculture	●New Application of Agro and Forest Product ⇒New Market , New Industry ●Creation of New Industry（6th. Industry）in Agro and Forest Industry. ●Increase Farmer and Forester's Income	●Tech. development project by Engineering Co. ● Small scale Demo Projects subsidized by Government are recognized as '' Not economically viable''
Environment	●Effective solution for GHG Reduction. ●BECCS (carbon negative) concept introduced by IPCC.	● Not recognized as GHG Reduction solution ● Too much attention on Food vs Fuel and Bio Diversification issues
Industry	●Promote as Strategic Industry ●New Employment Opportunity ●Sustainability Rule ⇒ Global Competition ●Subsidy・Tax Incentives ⇒ Obligation	●Projects based upon Governmental Subsidy（Tech. Development or Small Scale Demo Projects）

FIT (Feed in Tariff) for Biomass Power Generation

FIT was introduced on **July 1, 2012** by METI.

		Unutilized Wood (1)	General Wood (2)	Waste Materials Sewage sludge	Recycled Wood
Cost	Power Plant Cost	¥ 410,000/kW	¥ 410,000/kW	¥ 310,000/kW	¥ 350,000/kW
	Annual O& M Cost	¥ 27,000/kW	¥ 27,000/kW	¥ 22,000/kW	¥ 27,000/kW
Expected IRR (before tax)		**8%**	**4%**	**4%**	**4%**
Original FIT Rate (¥ /kWh)		**32**	**24**	**17**	**13**
Revision		**40 (3)**	21(4) ⇒ **Bid (5)**	No change	No change
Duration		**20 years**			

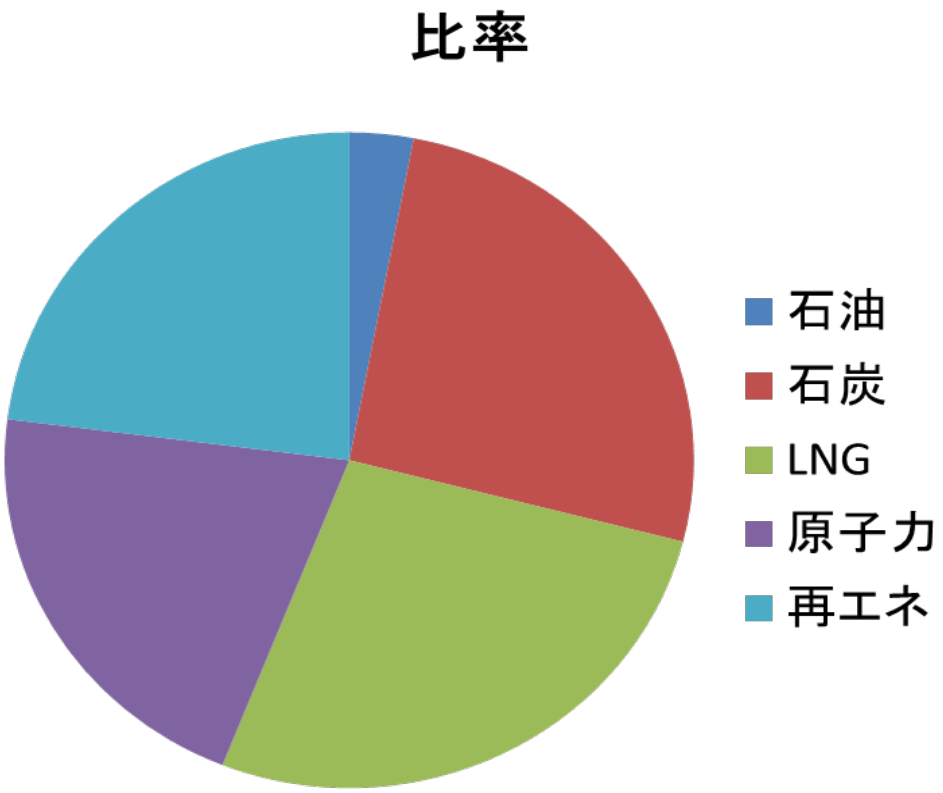
(1) Forest residues
(2) Wood Chips , Pellets etc. **including imported one** (even PKS, Palm Oil)
(3) Applicable for **less than 2MW** Projects since April 1, 2016
(4) After Oct. 1, 2017 for more than 20MW
(5) **After April 1, 2018** for **more than 10MW** (**180MW** in 2018 **including co-firing with coal**)

Energy Mix. of Power Generation in 2030

- Oil : 31.5 Bill. kWh 3%
- Coal : 281 Bill. kWh 26%
- LNG : 284.5 Bill.kWh 27%
- Nuclear : 231.7～216.8 Bill.kWh 22～20%
- Renewable : 236.6～251.5 Bill.kWh 22～24%

Total : 1,065 Bill.kWh * 100%

（*As assumption that electricity consumption shall be 980.8 Bill. kWh after 17% energy saving from current）



Breakdown of Renewable Energy (Ratio**)

・PV	74.9Bill.kWh	7.0%	(30%)
・Wind	18.2Bill.kWh	1.7%	(7%)
・Geothermal	10.2～11.3Bill.kWh	1.0～1.1%	(5%)
・Small Hydro	93.9～98.1Bill.kWh	8.8～9.2%	(39%)
・Biomass	39.4～49 Bill. kWh	3.7～4.6%	(19%)

（** Upside case ）

GHG Reduction Target in 2030
⇒▲ **26%** from 2013

Advantage of Biomass Power over VRE

1. Biomass PS is Stable base-road power source and Controllable like thermal PS
   ⇒・Considered as Coal-Fired PS Substitution.
   ・play a role as a carbon free regulator for VRE (PV/ Wind)

2. High Capacity Factor
   (Biomass 80% , PV13% , Wind 20%)

3. Power Source (Bio Fuel) can be transportable
   ⇒ Bio Fuel can be produced at different locations.

Target of Biomass Power Generation (2030)

Categoly	2014 .11	2030 Target （Ratio）	Additional Facility
1. Utilized Wood	30MW	240MW （8 times）	+ 210MW
2. Recycled Wood	330MW	370MW （1.1 times）	+ 40MW
3.General Wood	100MW	2,740 ～4,000MW (27.4 - 40 times）	+ 2,640 – 3,900MW
Wood Biomass Total （Sum of 1～3 ）	460MW (3.2Bill.kWh)	3,350 - 4,610MW (7 - 10times) (22 - 31 Bill. kWh)	+ 2890 - 4150MW (+ 19 - 28Bill.kWh)
4. Biogas（Methane）	20MW	160MW （8 times）	+140MW
5. Waste	780MW	1,240MW （1.6 times）	+ 460MW
6. RPS	1,270MW	1,270MW	
Biomass Total （Sum of 1～6）	2,520MW (17.7Bill.kWh)	6,020 -7,280MW(2.4-2.9times） (39.4 – 49 Bill. kWh)	+3,490 – 4,750 MW (+21.7-31.3BillkWh)

FIT Status as of Dec., 2017 (Certified & Operated)

	Certified	Operated	Unoperated
1. **General Wood** :	**11.31GW**	**0.57 GW**	**10.74GW**
(1) **Dedicated** :	**5.05 GW**	**0.57 GW**	**4.48GW**
(2) **Coal Co-fired** :	**1.74 GW**	--	**1.74GW**
(3) Palm Oil :	4. 51GW	--	(4.51GW)
2. Others :	0.93GW	0.58GW	(0.35GW)
Total :	**12.24GW**	**1.15GW**	11.09GW

Assumption of Practical FIT Certified Projects

(based on FIT Status as of Dec., 2017)

1. Assumption of Operation : **1.77 ～ 2.21GW**

   (1) **20～30%** of Dedicated 4.48 GW : 0.90GW～1.34GW

   (2) **50%** of Wood Coal Co-fired 1.74GW : 0.87GW

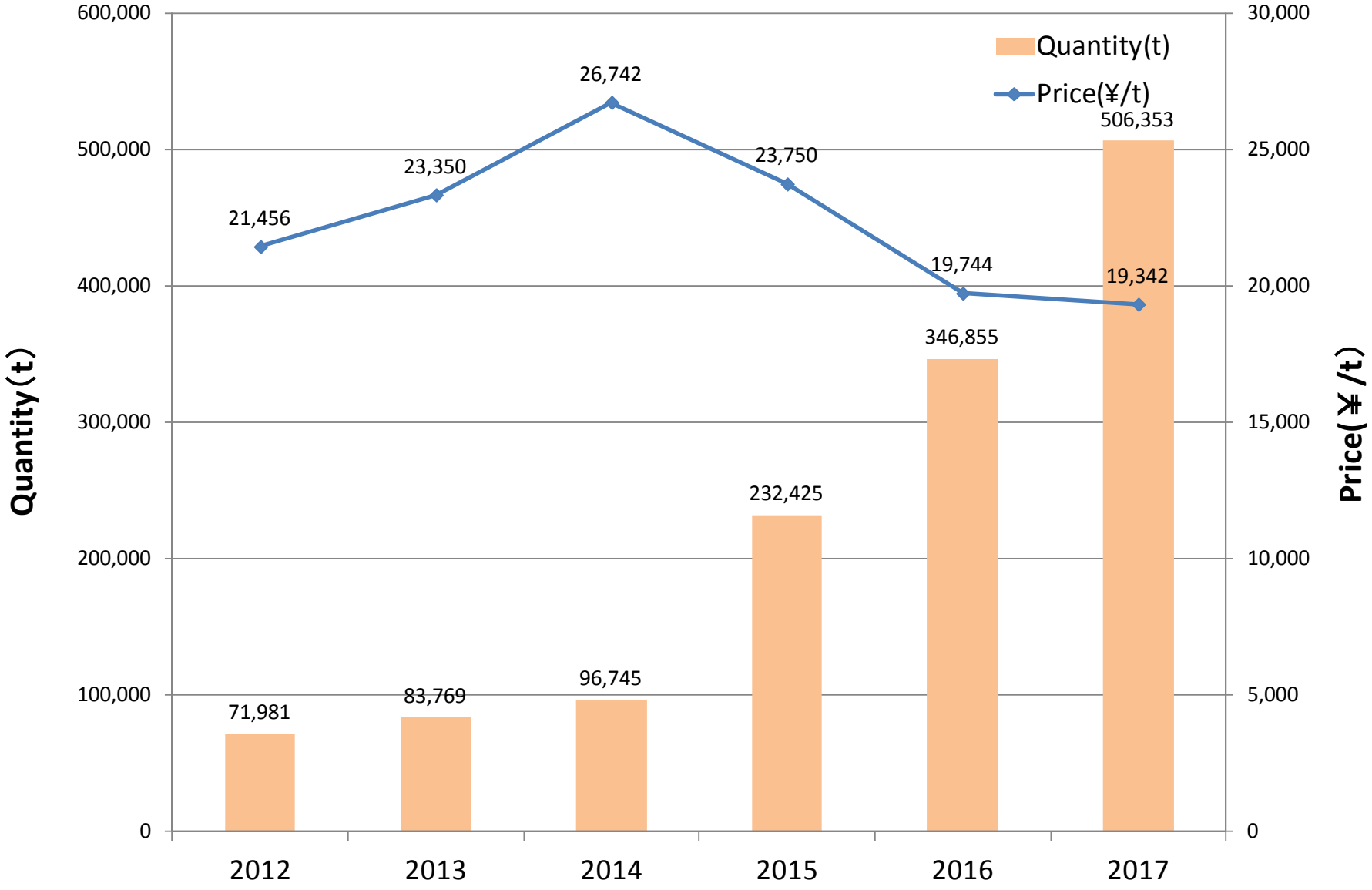
2. Biomass Operated : **3.46GW**

   (1) FIT newly Certified : 1.15GW

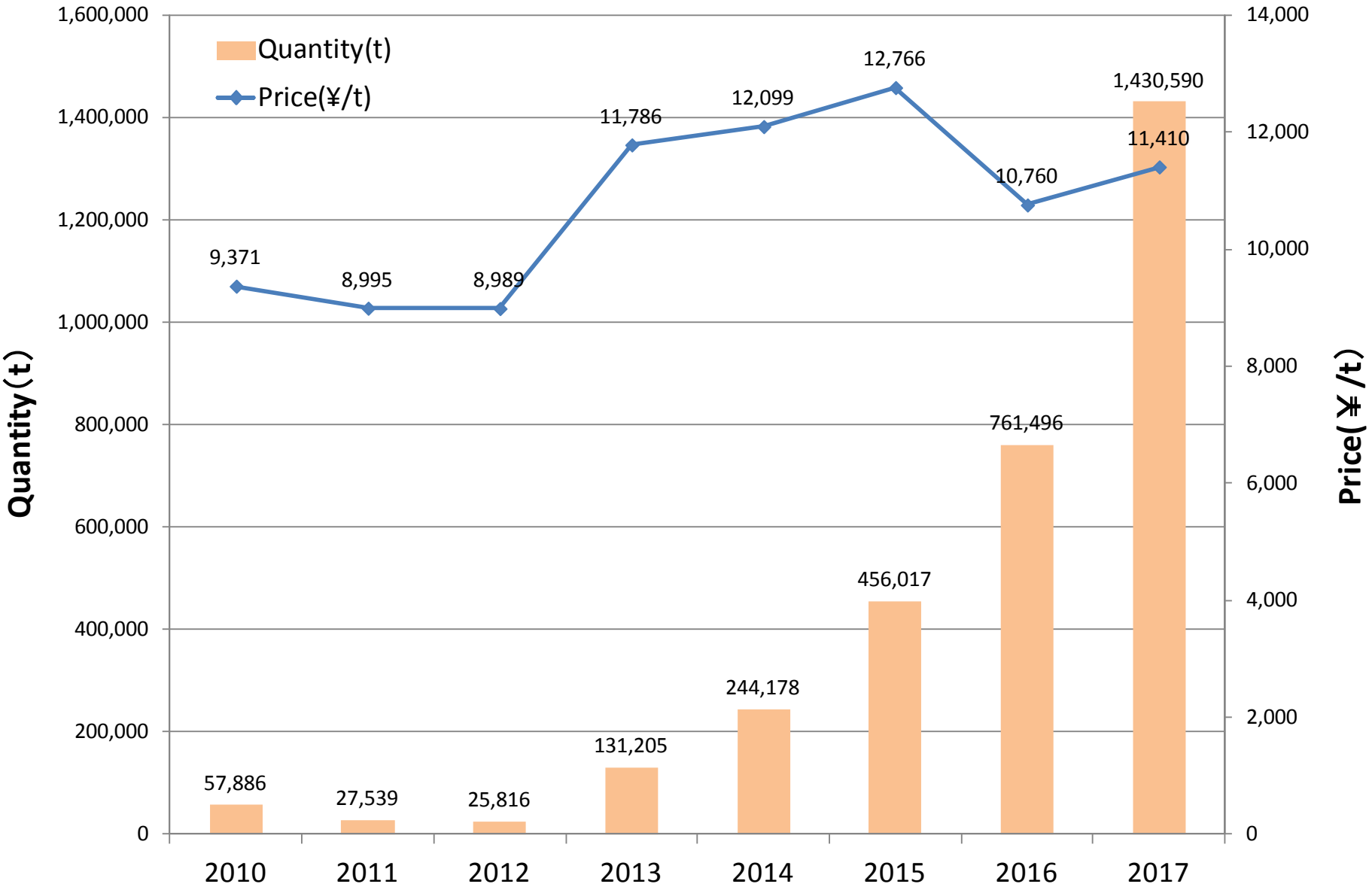
   (2) Before FIT : 2.31GW (including RPS→FIT 1.12GW)

3. Above 1 + 2 : **5.23 ～ 5.67GW**

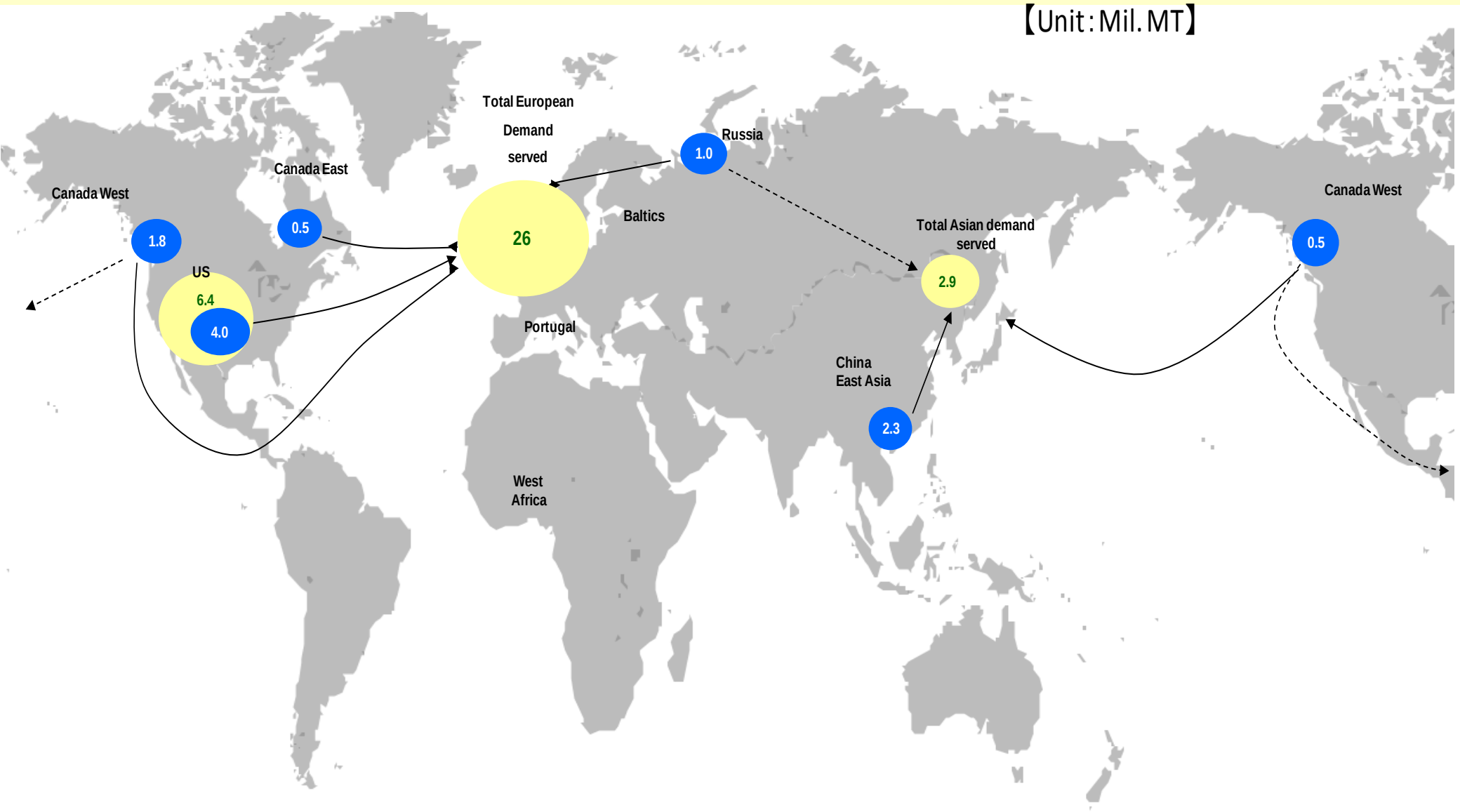
Quantity & Price of Imported Wood Pellet (Japan)



Quantity & Price of Imported PKS (Japan)



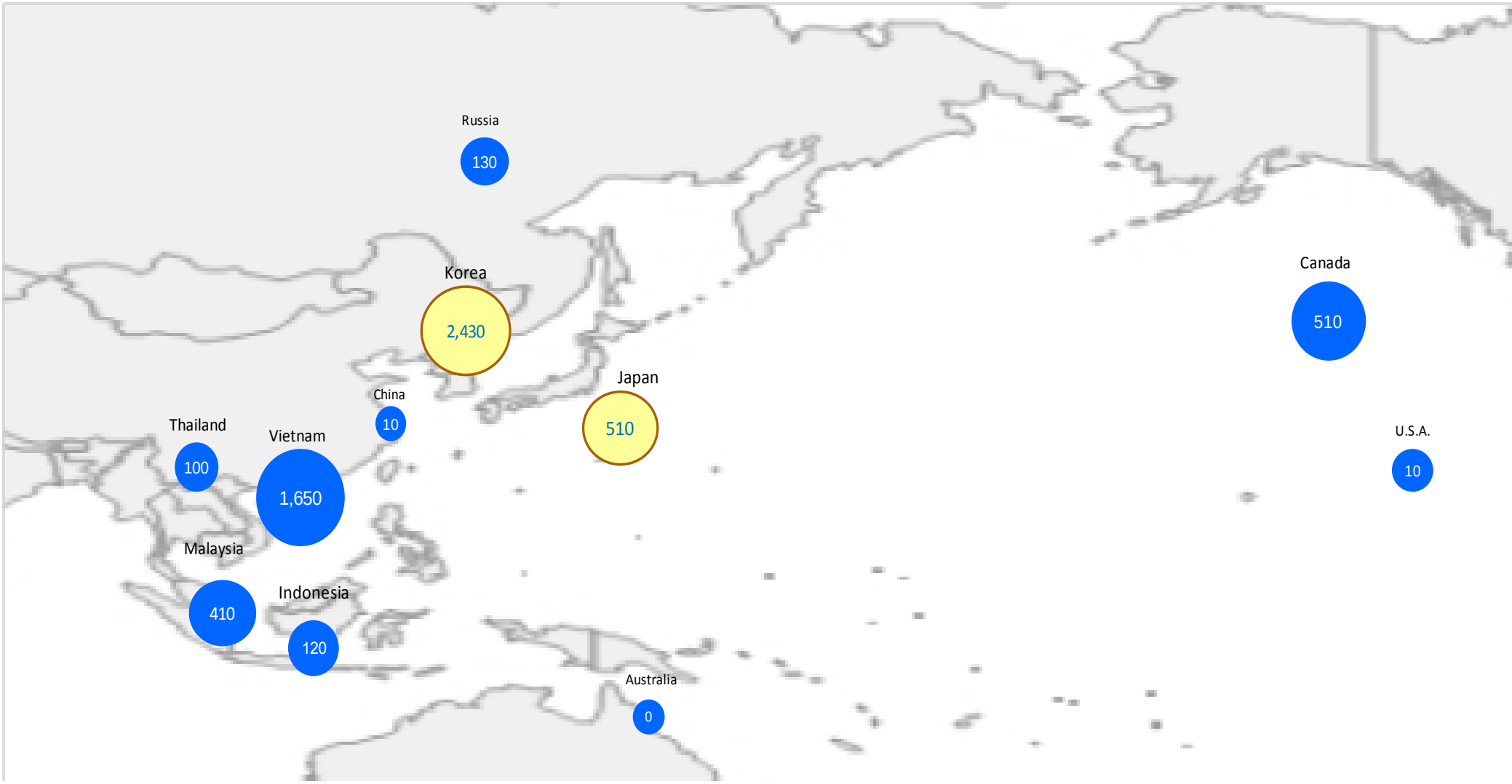
Global wood pellets trading volume (2017)



Source : KBLT

Pellets Trading in the Far East 【2017】

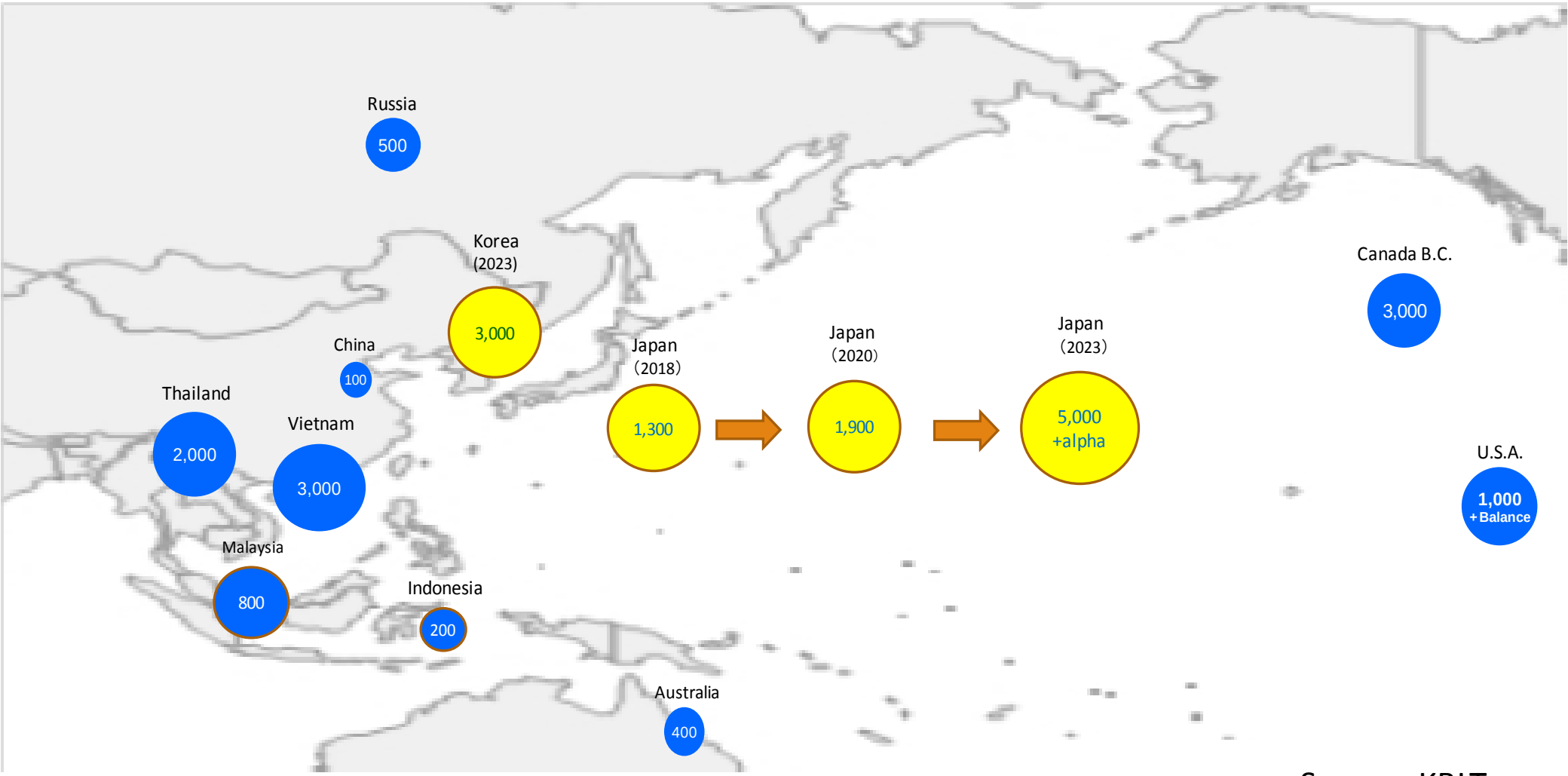
【Unit : thousand MT】



Source : KBLT

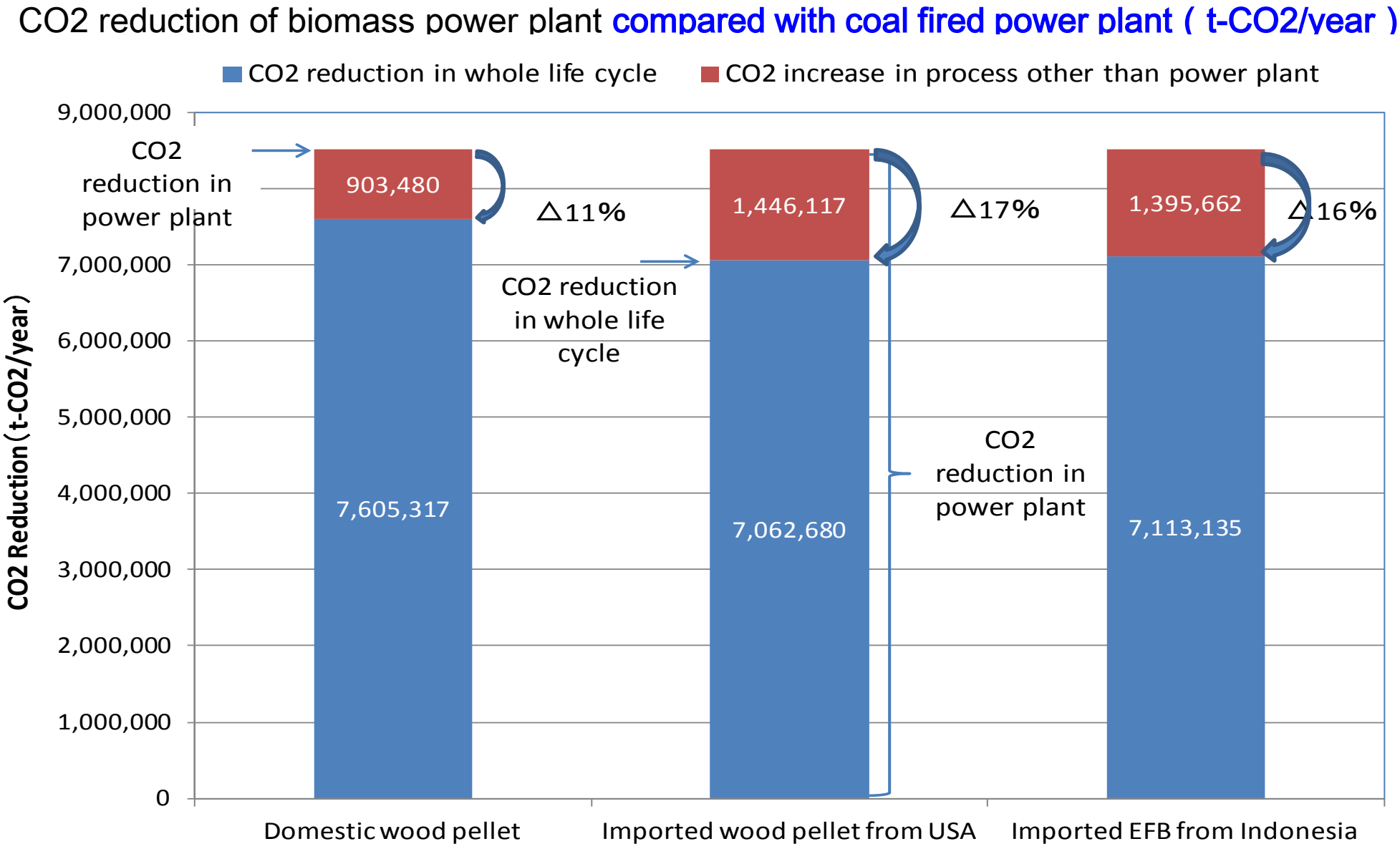
Pellets Import to the Far Eastern Market
【2023 Forecast】

【Unit : thousand MT】



Source : KBLT

Comparison of LCA - CO2 Reduction for Import vs Domestic Wood Pellet

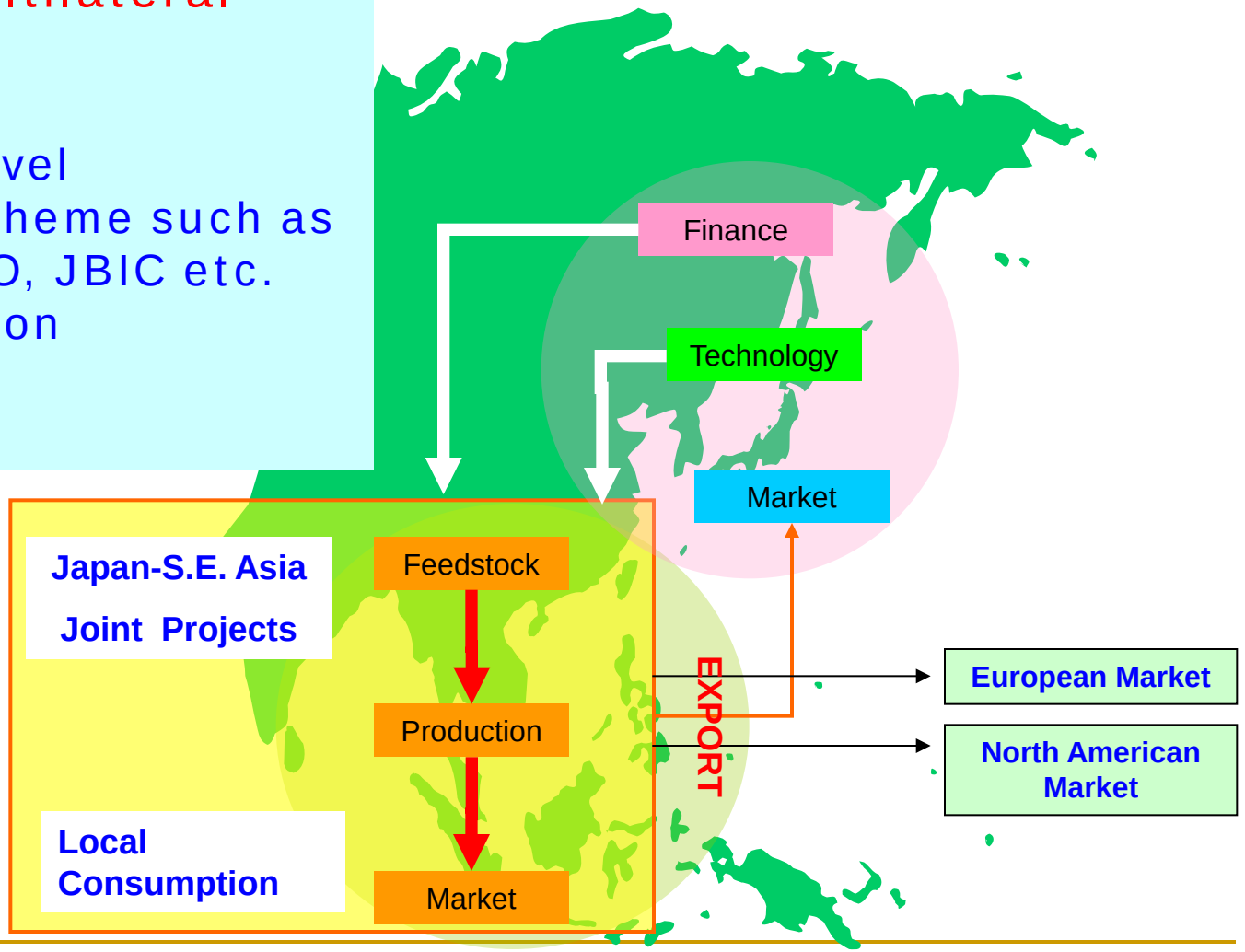


Creation of "Asia Biomass Community"

Enhance the Multilateral partnership

■Governmental level
- Governmental scheme such as ODA , JCM, NEDO, JBIC etc.
- Biomass Plantation

■Private level

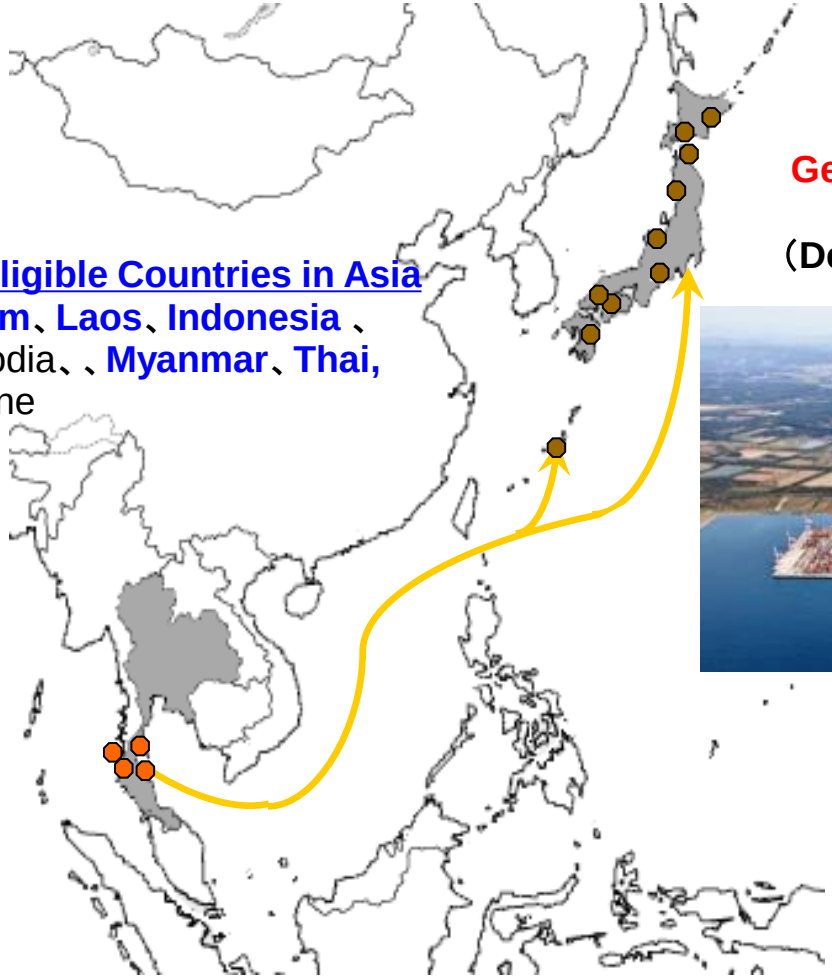


Phase-1 Production of Biomass Fuel in Asia and Biomass Power Generation in japan

Pellet Production in Asia under JCM scheme
（JV with Local Co.）

Wood Pellet

Torrefaction



JCM Eligible Countries in Asia
Vietnam、Laos、Indonesia 、
Cambodia、、**Myanmar、Thai,**
Phillipine

Biomass Power Generation in Japan under FIT
（Dedicated, Co-fired）

Phase-2 Biomass Power Generation and Production of Fuel in same location in Asia under JCM Scheme

Pellet Production in Asia under JCM scheme
（JV with Local Co.）

Wood Pellet

Torrefaction

Biomass Power Generation under JCM scheme
（JV with Local Co.）

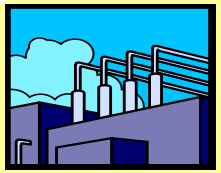
Establish Sustainable Biomass Industry

Biomass Plantation

・Next Generation Agriculture and Forestry "Contract Farming & Afforestation for Various usages"
・Biomass Plantation under ODA.

- Improvement of Yield
- Mechanization
- Infrastructure
- Logistics

Biomass Refinery



Biomass Industrial Complex

- Bio Ethanol（Cellulosic）
- Bio Pellet (⇒Torrefaction)
- Bio Jet Fuel (at existing Petrochemical Refinery)
- BDF (⇒High Quality)
- Biomass Power Generation
- Bio Chemical
- Feed, Fertilizer

Market

Stable & Matured Market

- Local Consumption
- Export to Japan
- Export to the other countries

- Long Term Offtake Agreement
- Reasonable Sales Price

Feedstock Management
(Stable Supply・Cascade Usage)

Industrialization
(Co-Production・Co-Location)

Establish Relationship with Buyers
(Utilities, Industries, Others)

Creation of Sustainable Supply Chain of Industrial Complex

Thank you for listening !!

NEED (**N**ippon **E**nvironmental **E**nergy **D**evelopment Co. ,Ltd.)

HP: http://need.co.jp