erex Co., Ltd. [9517]

To become a pioneer in the new era of electric power with renewable energy at its core

Development of Biomass Business

June, 2022

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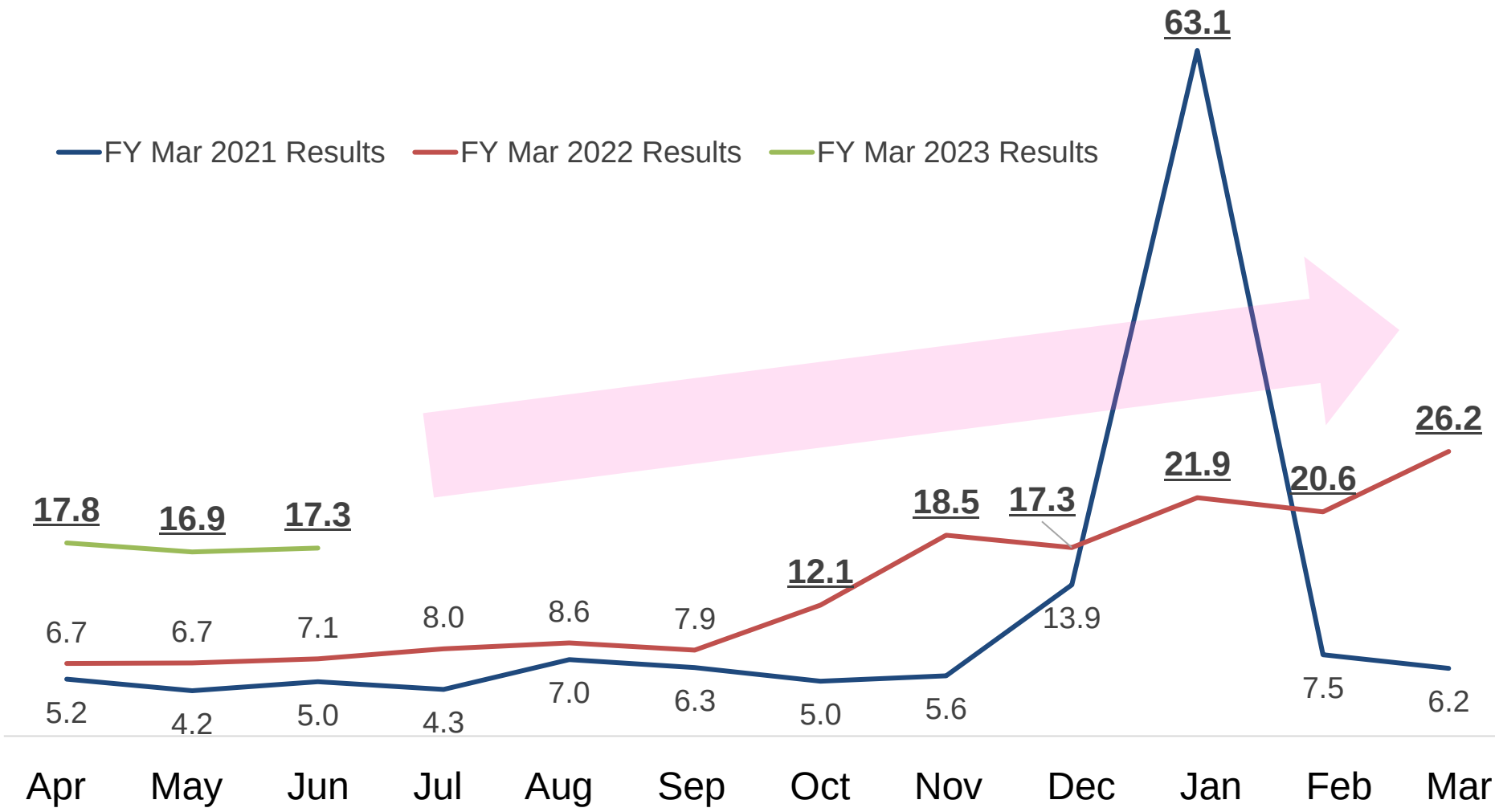
Current State of the Energy Market

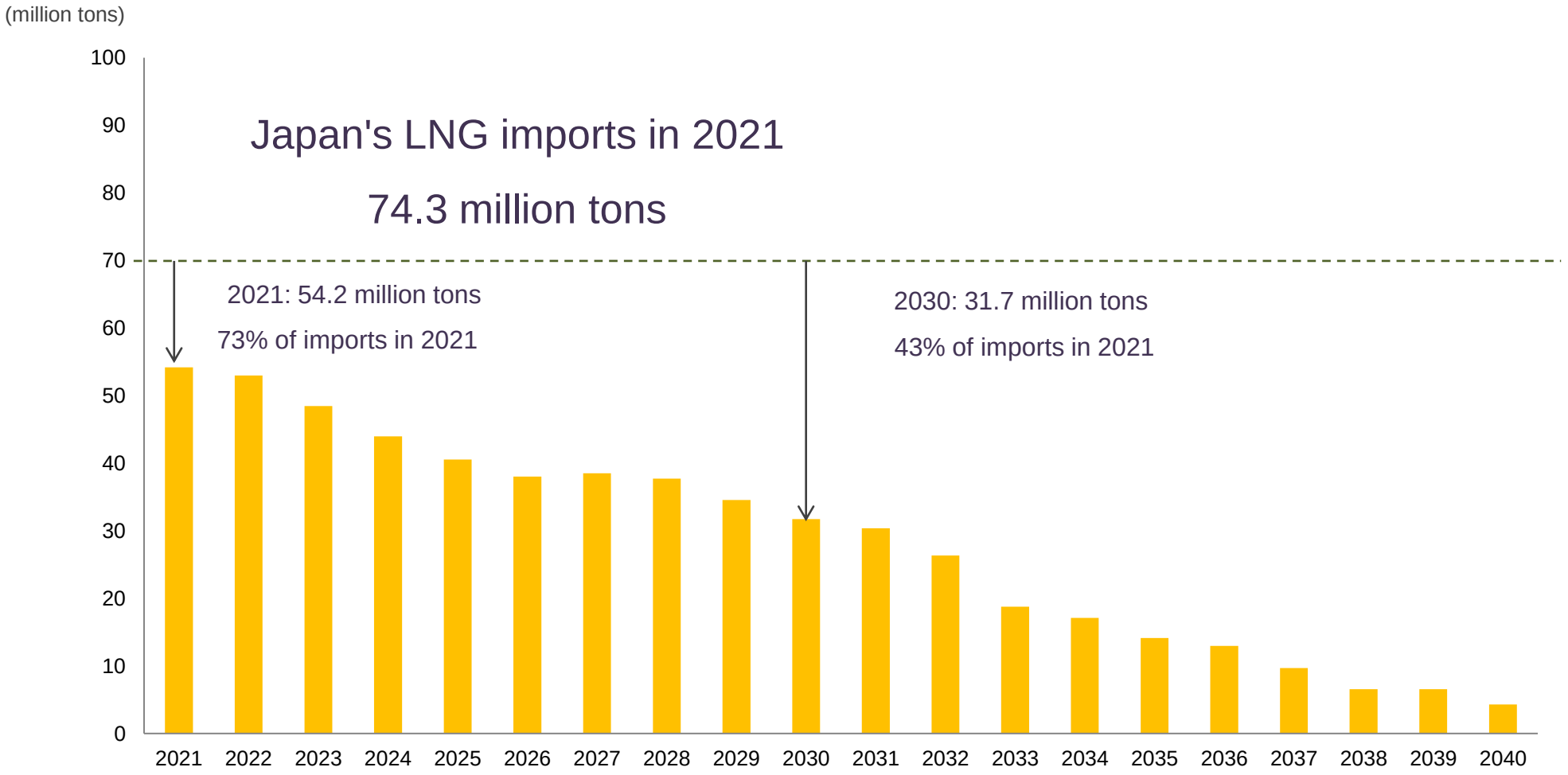
Electric Power Price Trends

- Soaring electric power prices are assumed to become the norm



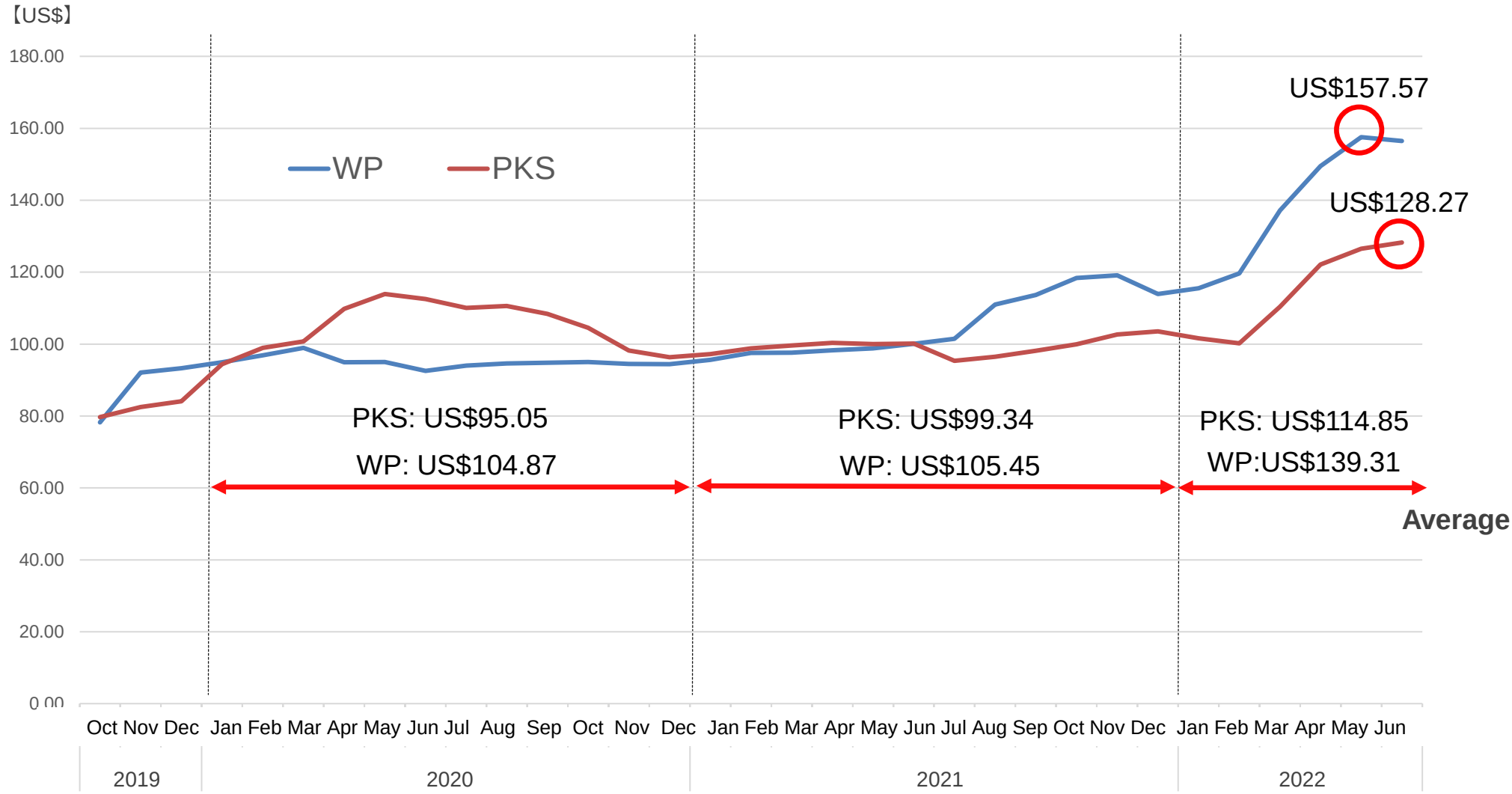
Japan's Long-Term Contracted LNG Capacity

- Japan's long-term contracted LNG capacity is on a declining trend



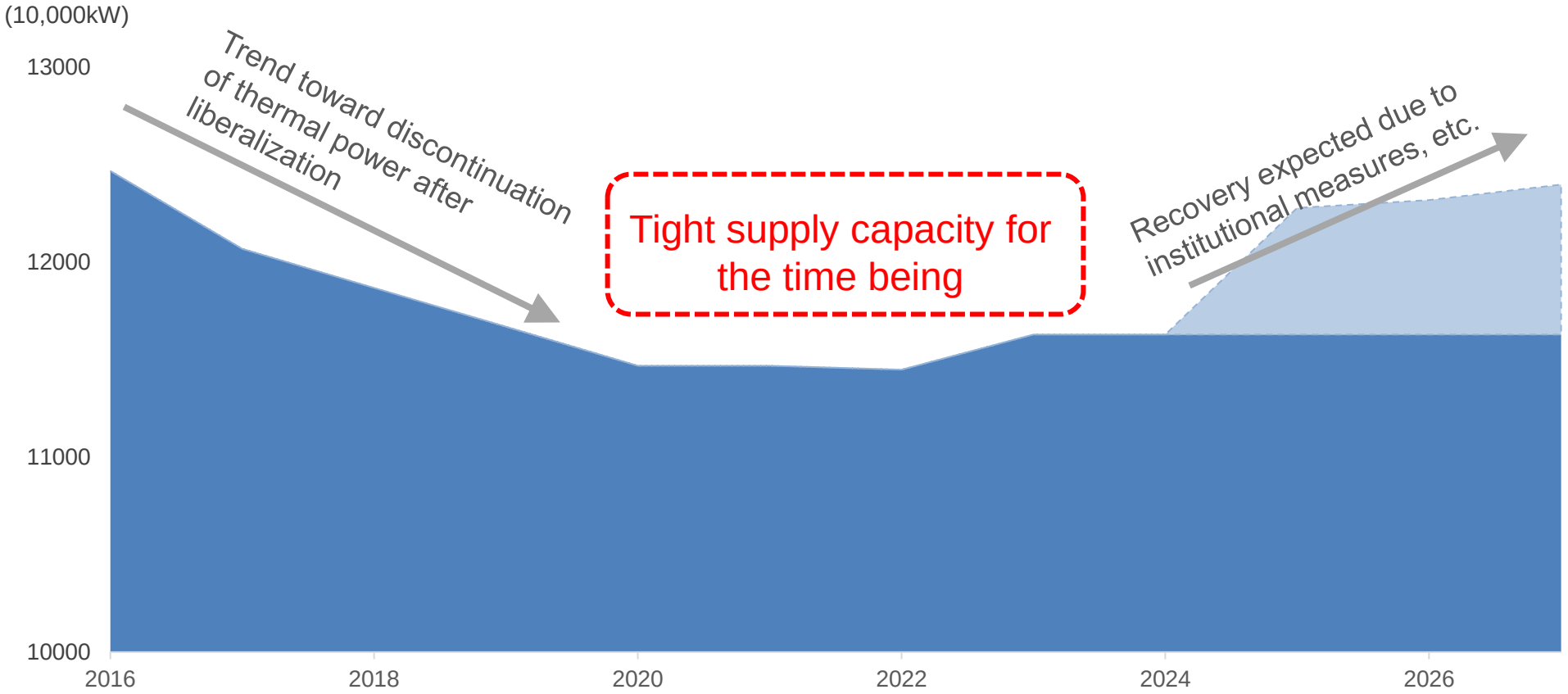
Price Trends of PKS and WP

- Trending most recently at 1.5 times of last year's average PKS price



Japan's Domestic Thermal Power Supply Forecast

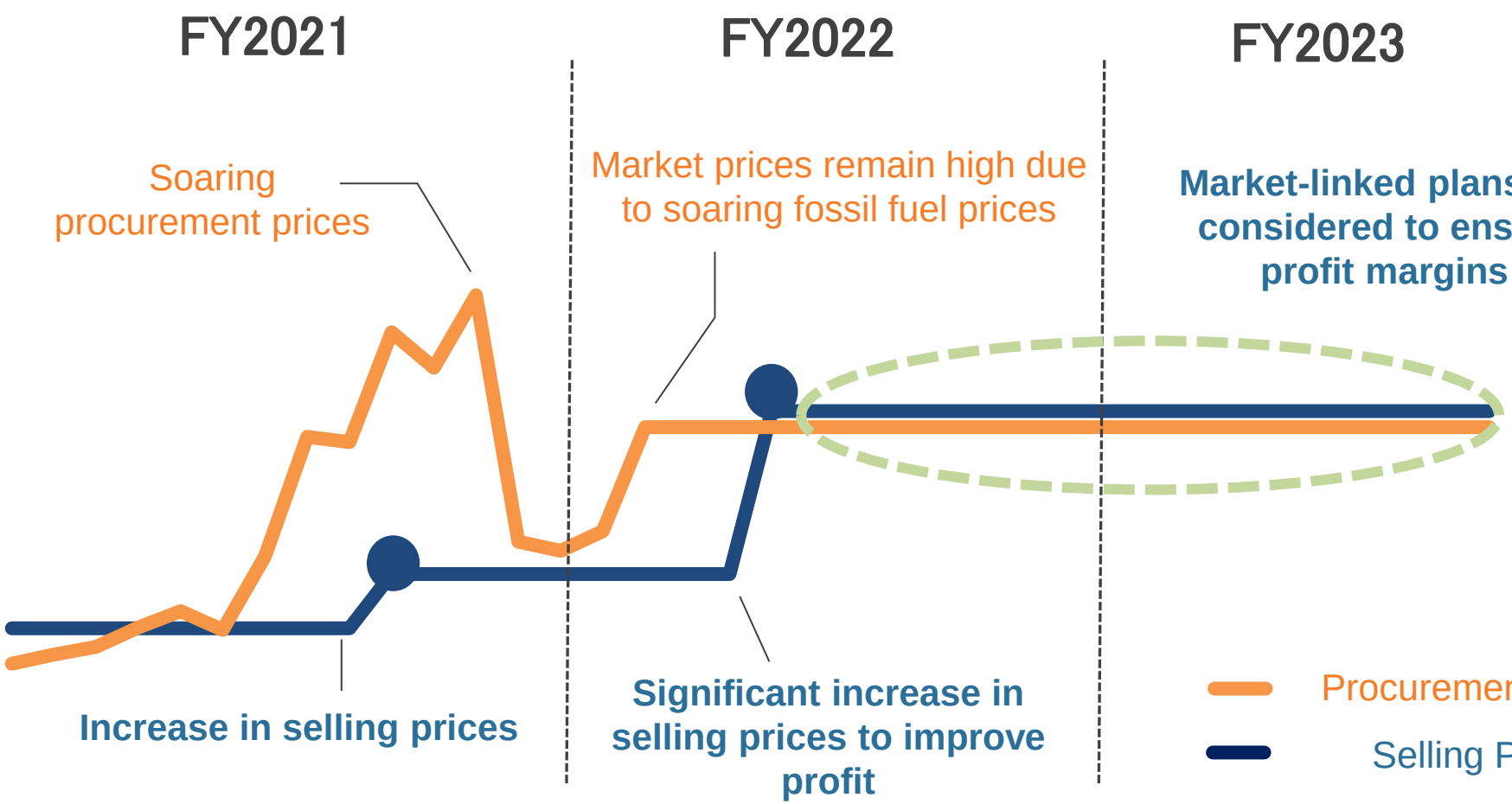
- Supply capacity of thermal power is gradually declining after full-liberalization, and securing supply capacity is an immediate issue
- Utilization of existing supply capacity through transitions is expected to be a realistic solution



※ Prepared by erex Group based on data published by the Agency for Natural Resources and Energy and others

Profit Structure of Power Retail Business

- Selling price setting is more important than before



※ Rough sketch

Potential by Power Source

Comparison by Power Source

※100MW	Capacity Factor	Cost (Construction Cost, Billion Yen)	CO2 Reduction	Potential			
				Stability	De-carbonization	Economy	Economy (Fuel)
Biomass	80%	39.8	629,000 t	○	○	○	○
Coal-Fired Power Transition	80%	N/A ※ Related to power generation facilities	629,000 t	○	○	○ ※Costs vary depending on transfer agreements	○
Thermal (Coal)	80%	31.3	Base	○	×	○	○
Thermal (LNG)	80%	21.6	280,000 t	○	△	○	○
Solar	17%	31.2	197,000 t	×	○	○	○
Wind	25%	17.2	134,000 t	×	○	○	○

Planned production of fast-growing fuels

Reference: Ministry of Economy, Trade and Industry（https://www.enecho.meti.go.jp/committee/council/basic_policy_subcommittee/mitoshi/cost_wg/2021/data/08_05.pdf）
Ministry of Economy, Trade and Industry（https://www.meti.go.jp/shingikai/enecho/denryoku_gas/denryoku_gas/seido_kento/pdf/067_05_00.pdf）

(Reference) CO2 Emissions by Country

Total CO2 Emissions (Top 10 Countries)

100 Million Tons

	Country	① 2010	② 2015	③ 2019	Increase/ Decrease (③-①)
1	China	78.7	91.8	99.2	+20.5
2	U.S.A.	53.5	49.3	47.5	▲6.0
3	India	15.7	20.4	23.1	+7.4
4	Russia	15.3	15.3	16.4	+1.1
5	Japan	11.3	11.5	10.6	▲0.7
6	Germany	7.6	7.3	6.4	▲1.2
7	South Korea	5.5	5.8	5.9	+0.4
8	Iran	5	5.6	5.8	+0.8
9	Indonesia	3.9	4.6	5.8	+1.9
10	Canada	5.3	5.5	5.7	+0.4
21	Vietnam	1.3	1.8	2.8	+1.5
	Global Total	305.8	323.6	336.2	+30.4

CO2 Emissions from Power Generation (Top 10 Countries)

100 Million Tons

	Country	① 2010	② 2015	③ 2019	Increase/ Decrease (③-①)
1	China	35.1	43.0	52.7	+17.6
2	U.S.A.	23.5	19.9	17.0	▲ 6.5
3	India	7.9	10.6	11.7	+3.8
4	Russia	8.9	8.1	8.2	▲ 0.7
5	Japan	5.0	5.7	5.1	+0.1
6	South Korea	2.9	3.1	3.2	+0.3
7	Germany	3.9	3.2	2.4	▲ 1.5
8	Saudi Arabia	1.8	2.3	2.4	+0.6
9	South Africa	2.4	2.3	2.3	▲ 0.1
10	Indonesia	1.2	1.7	2.3	+1.1
14	Vietnam	0.4	0.7	1.5	+1.1
	Global Total	142	150	158	+16.0

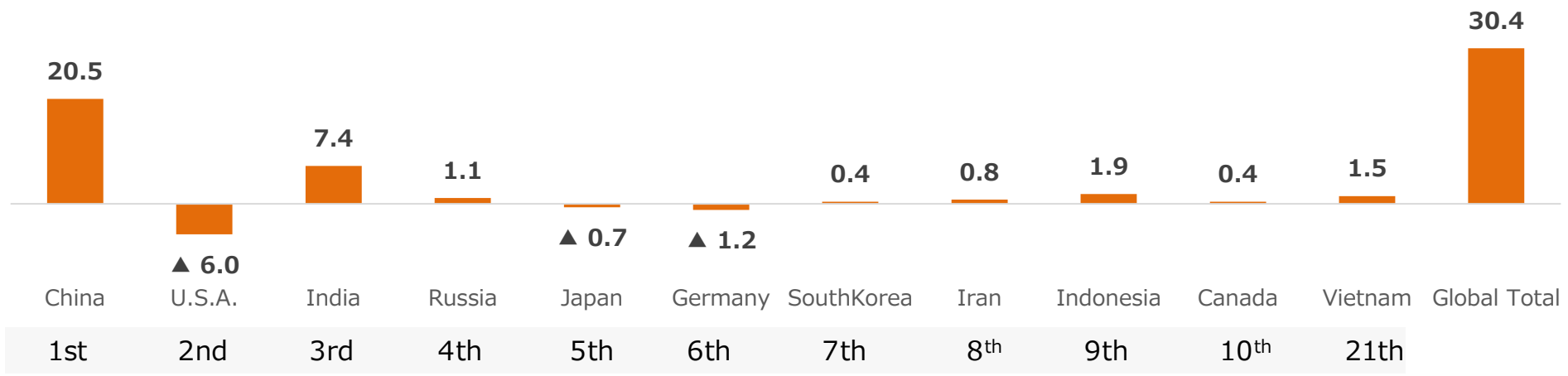
Reference: IEA （https://www.globalnote.jp/category/9/43/73/）

(Reference) CO2 emissions by country

Change (2010-2019)

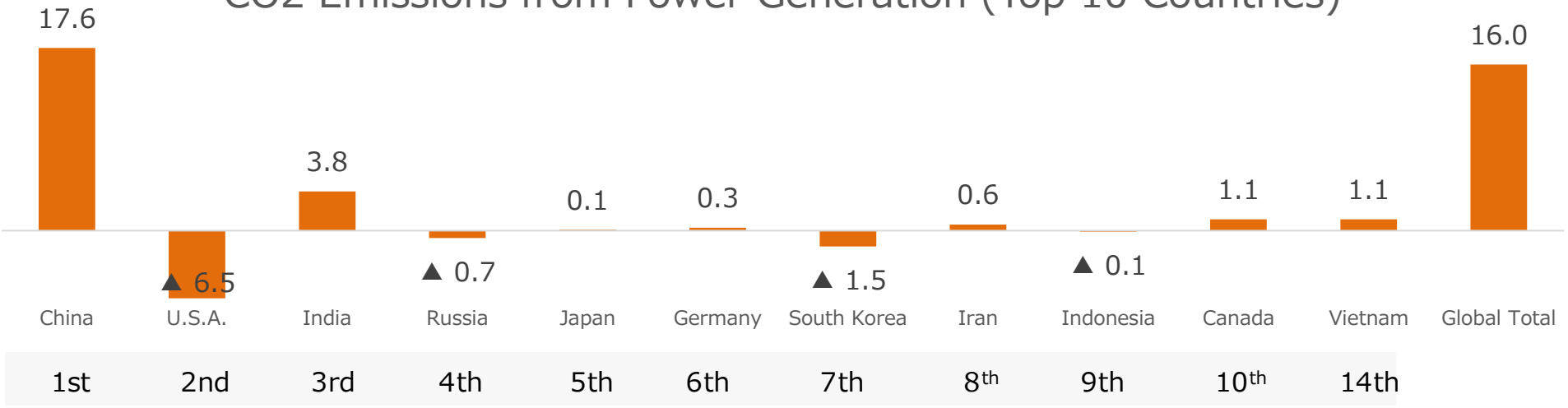
Total CO2 Emissions (Top 10 Countries)

Unit: billion tons



CO2 Emissions from Power Generation (Top 10 Countries)

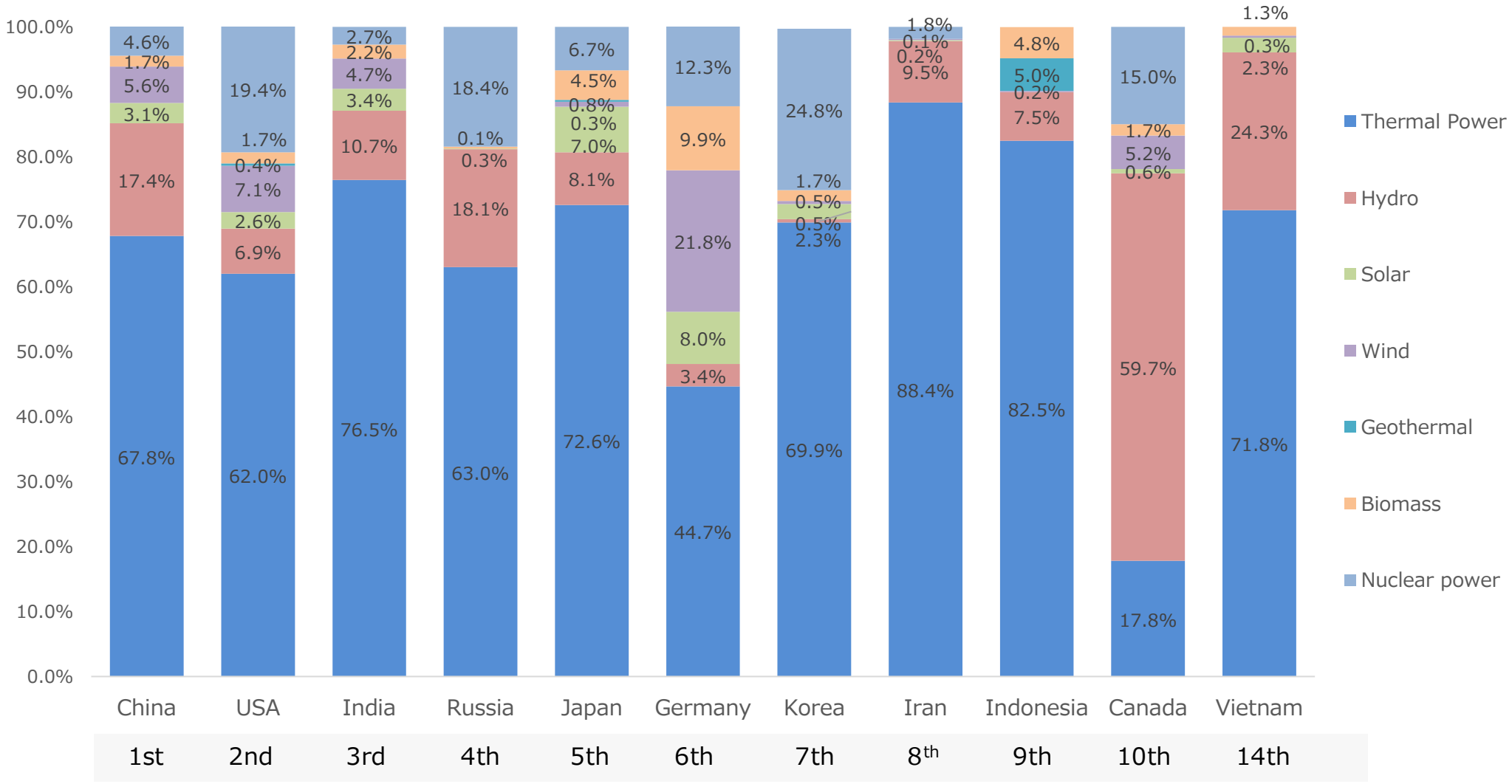
Unit: billion tons



reference : IEA (https://www.globalnote.jp/category/9/43/73/)

(Reference) Power source composition ratio in each country

Power source composition of the top 10 CO2 emitting countries



reference： IEA （https://www.globalnote.jp/category/9/43/73/）

erex Group's Biomass Business

Summary of biomass resource volume survey in Vietnam

FY2021

- Study of biomass fuels and other resources needed for power plant development (up to 1.2 GW) for which a PDP8 application is being considered.

Northern/Central Region

Potential of woody residue: 10-15 million tons/year

(2-3 ton/year・ha)

Southern Region

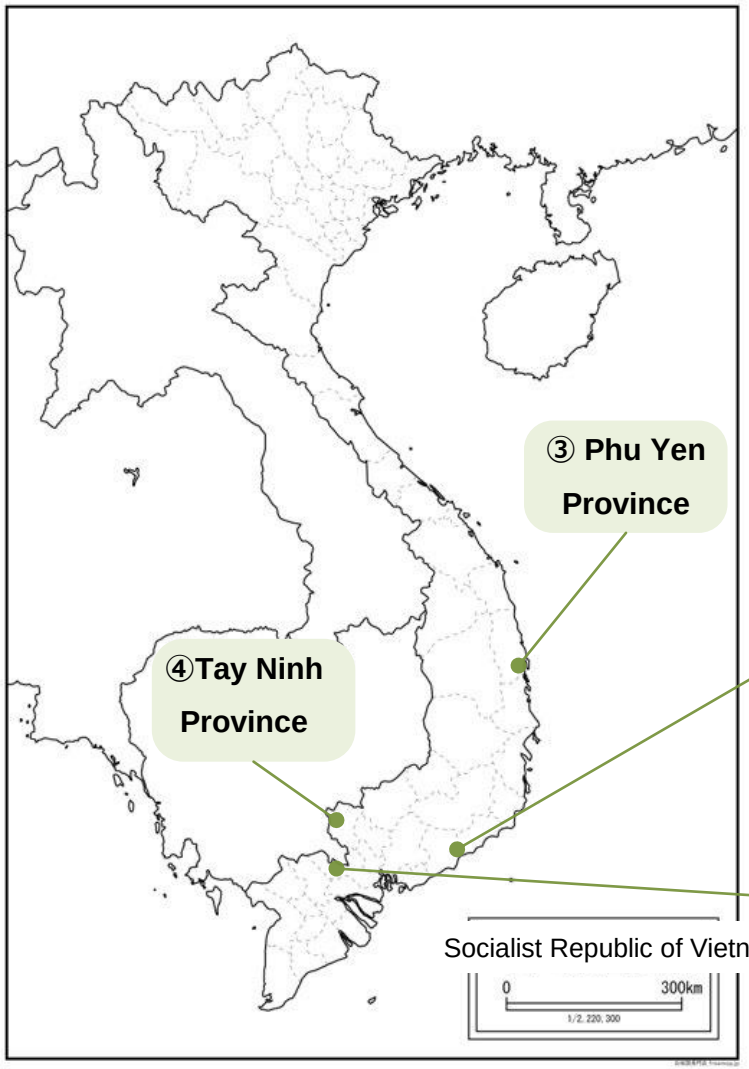
Potential of rice husk: about 5 million tons/year

FY2022

- For each site nominated for PDP8, the following surveys are planned
  - ① Understanding of the available volume of woody residue/rice husk
  - ② Logistics considerations
  - ③ Negotiation on available procurement volume/price/contract term

Biomass Business in Vietnam / Candidate Sites for New Sorghum Cultivation

- Full-scale cultivation is scheduled to start in stages, starting with candidate sites where trial cultivation (50ha~100ha at 4 locations) has been completed



Basis for selection of suitable areas for sorghum cultivation

① Southern-central region with low typhoon risk

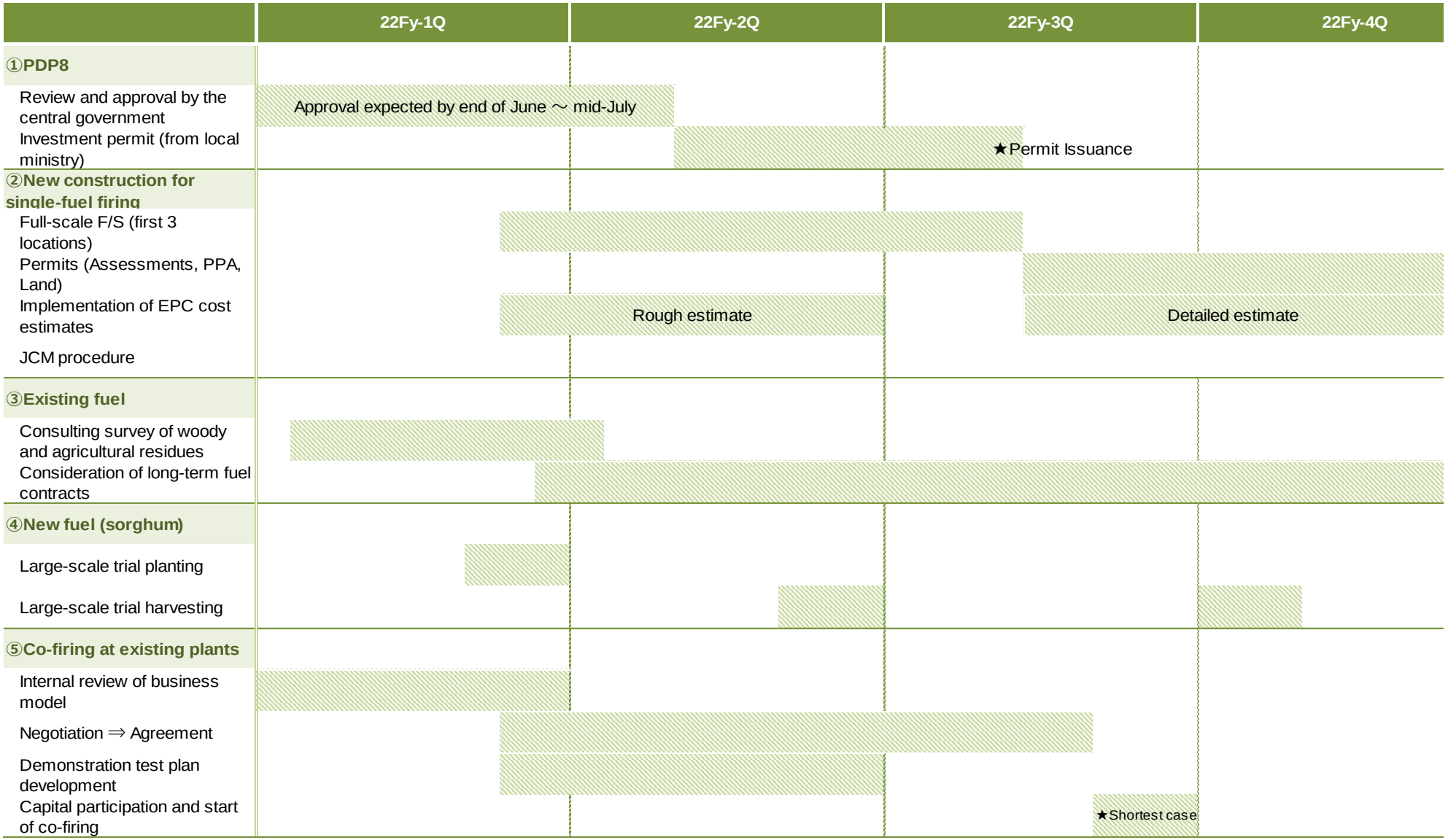
② Good access to international ports for easy exports to Japan

③ Areas where it is easy to acquire farmland for large-scale agriculture

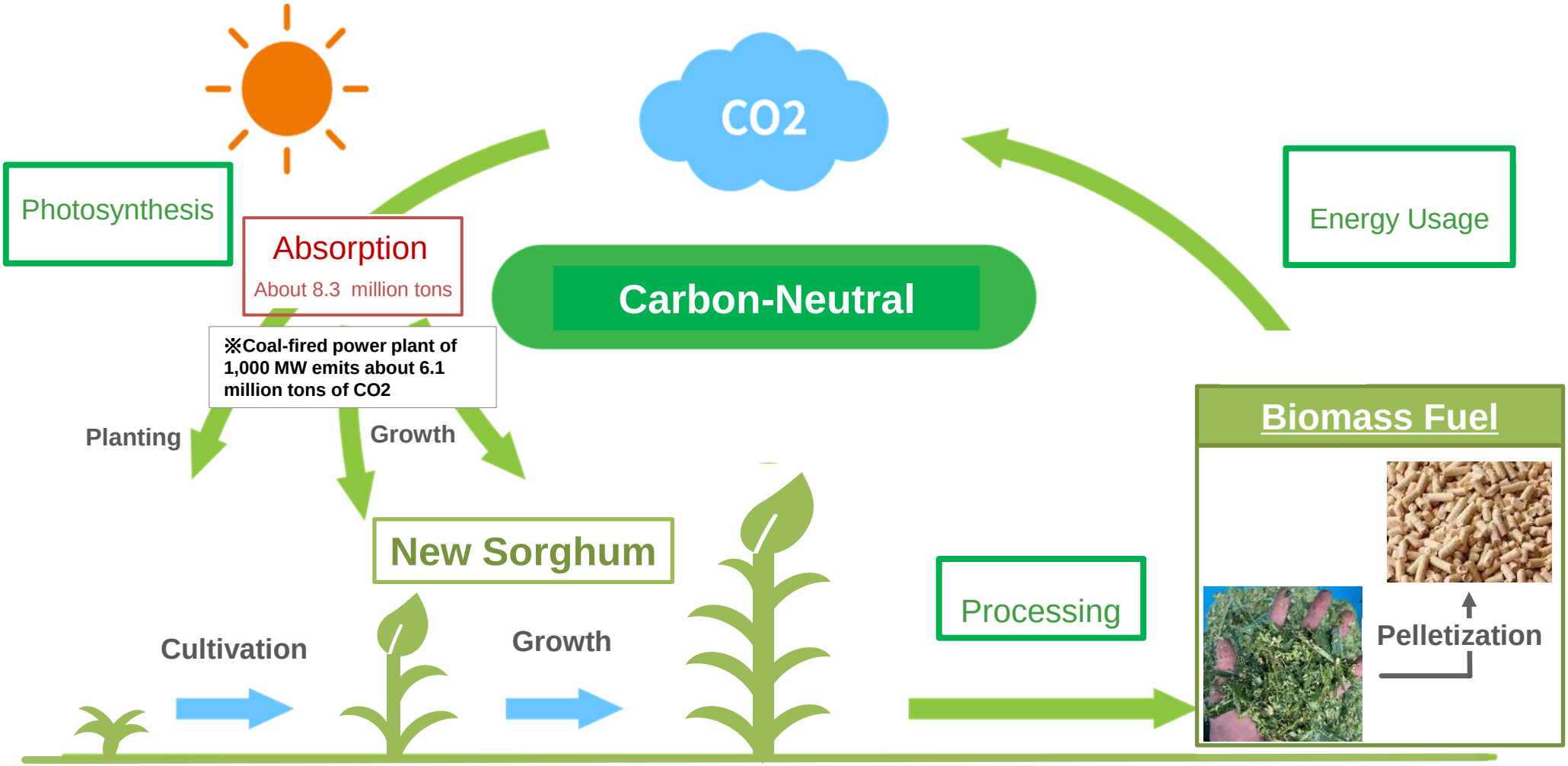
① Binh Thuan Province

② Long An Province

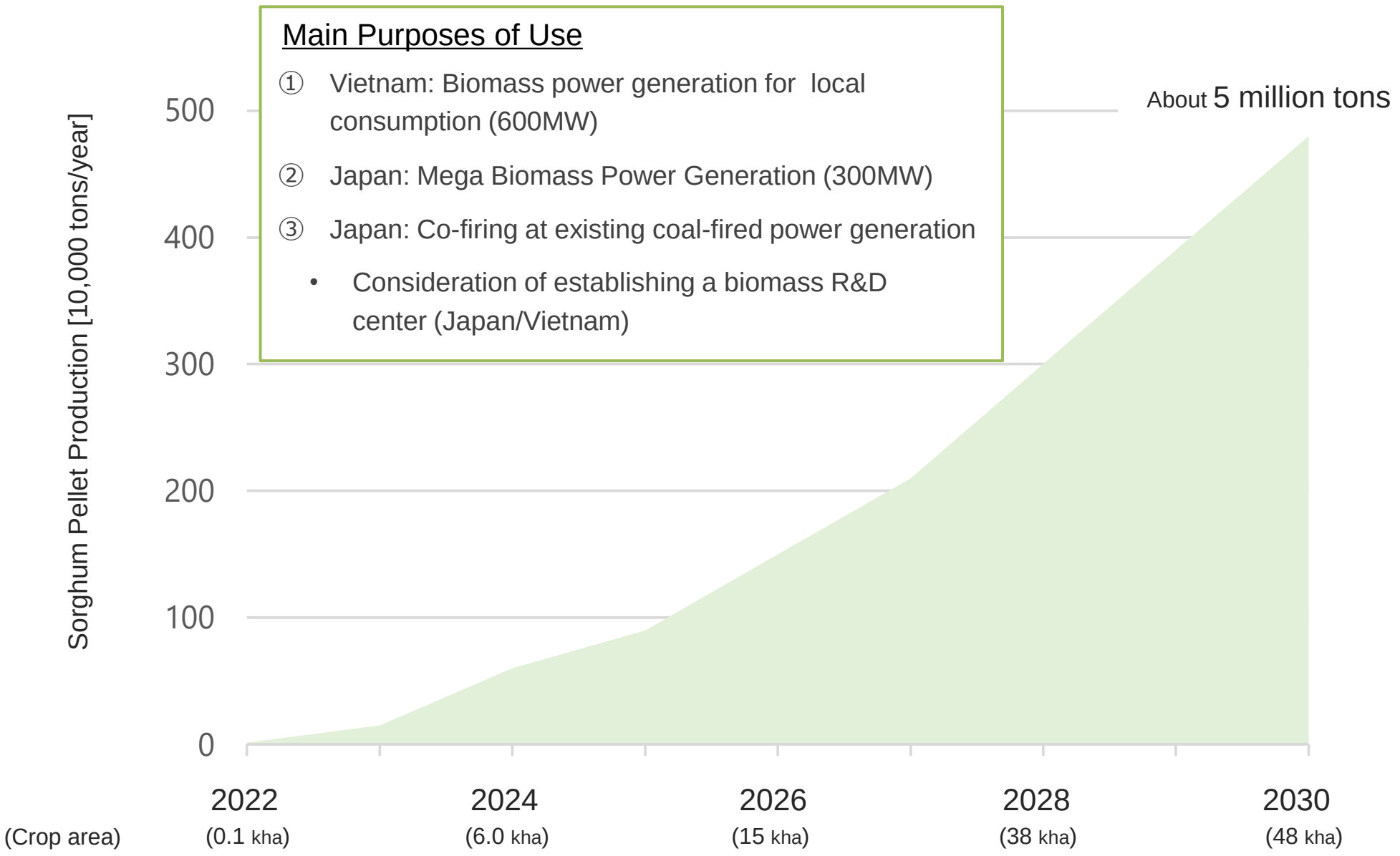
Progress of Vietnam Business



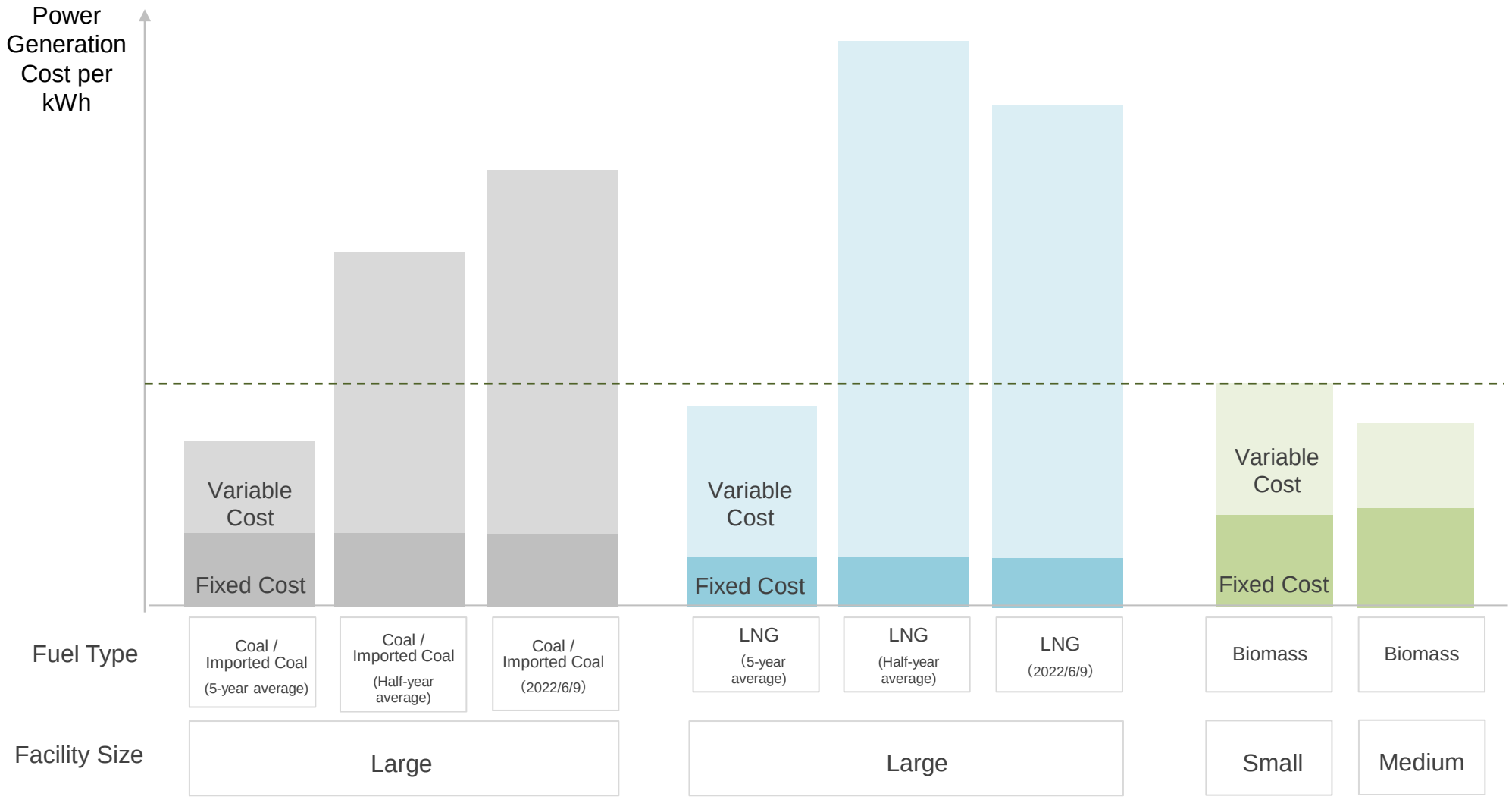
Carbon-Neutral



Biomass Business in Vietnam / New Sorghum Development Plan



Cost Advantages of Biomass Business

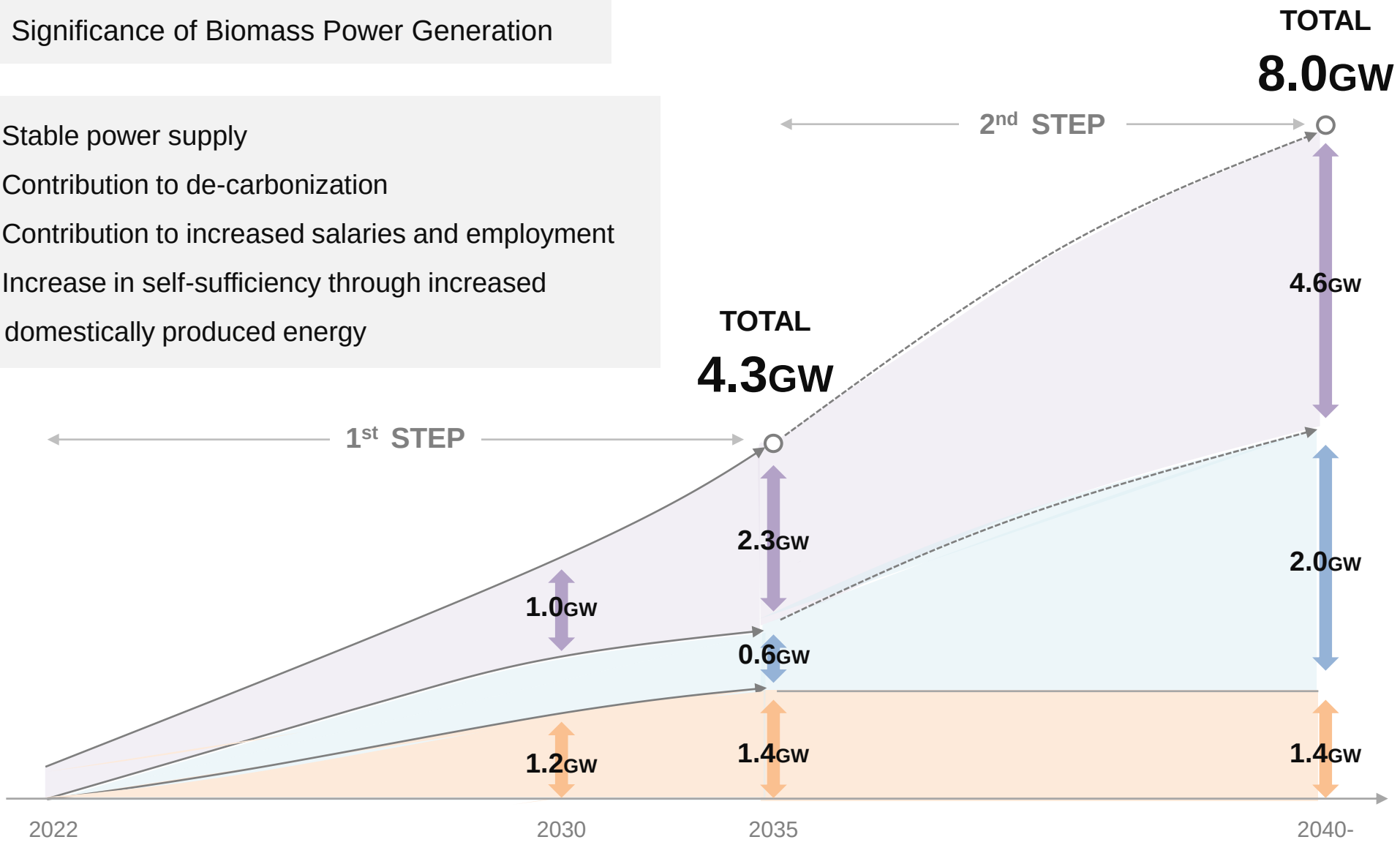


Note: erex Group's trial calculations with certain assumptions

Promotion of Biomass Business in Vietnam

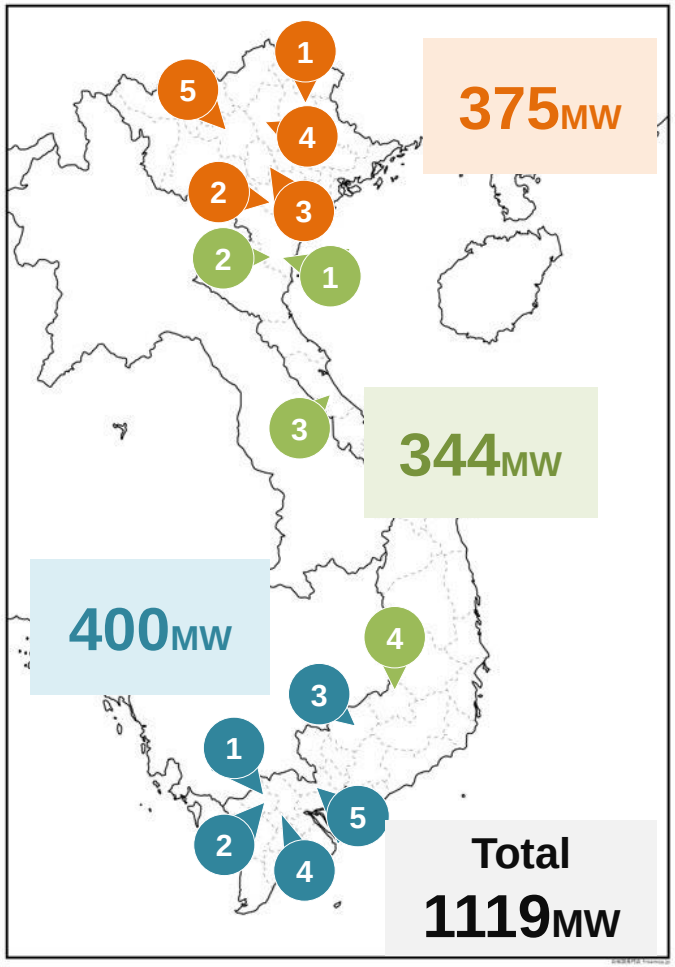
Significance of Biomass Power Generation

① Stable power supply
② Contribution to de-carbonization
③ Contribution to increased salaries and employment
④ Increase in self-sufficiency through increased domestically produced energy



(Reference) Candidate Sites for New Biomass Power Plants

erex Group's Ideas on 2030 Biomass Power Plant Potential in Vietnam



Northern Region 375MW

1	Bac Kan	50MW
2	Hoa Binh	100MW
3	Phu Tho	50MW
4	Tuyen Quang	100MW
5	Yen Bai	75MW

Central Region 344MW

1	Thanh Hoa 1	50MW
2	Thanh Hoa 2	60MW
3	Quang Binh	109MW
4	Dak Lak	125MW

Southern Region 400MW

1	An Giang 1	75MW
2	An Giang 2	100MW
3	Binh Phuoc	50MW
4	Can Tho	100MW
5	Long An	75MW

※ Potential based on erex Group's survey as of April 2022

(Reference) Existing Coal-Fired Power Plants in Vietnam

NO	Power Plant	Capacity (MW)				Owner	Type	Start of Operation	Coal
1	Duyen Hai 1	2 x 623	623	2unit	1,246	EVN	PC	2016	Hard Coal
2	Duyen Hai 3	2 x 623	623	2unit	1,246	EVN	PC	2017	Imported Coal
3	Duyen Hai 3 Expansion	1 x 688	688	1unit	688	EVN	PC(SC)	2019	Imported Coal
4	Hai Duong	2 x 600	600	2unit	1,200	BOT	CFB	2020-2021	Hard Coal
5	Hai Phong 1,2	4 x 300	300	4unit	1,200	EVN	PC	2014	Hard Coal
6	Mong Duong 1	2 x 540	540	2unit	1,080	EVN	CFB	2015	Hard Coal
7	Mong Duong 2	2 x 620	620	2unit	1,240	BOT	PC	2015	Hard Coal
8	Nghi Son 1	2 x 300	300	2unit	600	EVN	PC	2014	Hard Coal
9	Ninh Binh	2x 50	50	2unit	100	EVN	PC	1974	Hard Coal
10	Pha Lai 1	4 x 110	110	4unit	440	EVN	PC	1983	Hard Coal
11	Pha Lai 2	2 x 300	300	2unit	600	EVN	PC	2001	Hard Coal
12	Quang Ninh 1,2	4 x 300	300	4unit	1,200	EVN	PC	2014	Hard Coal
13	Thai Binh 1	2 x 300	300	2unit	600	EVN	PC	2017	Hard Coal
14	Uong Bi 1 Expansion	300	300	1unit	300	EVN	PC	2006	Hard Coal
15	Uong Bi 2 Expansion	330	330	1unit	330	EVN	PC	2011	Hard Coal
16	Vinh Tan 1	2 x 620	620	2unit	1,240	BOT	PC	2018	Hard Coal
17	Vinh Tan 2	2 x 622	622	2unit	1,244	EVN	PC	2015	Hard Coal
18	Vinh Tan 4	2 x 600	600	2unit	1,200	EVN	PC(SC)	2018	Imported Coal
19	Vinh Tan 4 Expansion	1 x 600	600	1unit	600	EVN	PC(SC)	2018	Imported Coal
20	An Khanh 1	2x 57.5	57.5	2unit	115	IPP	CFB	2015	Hard Coal
21	Formusa Dong Nai	3 x 150	150	3unit	450	IPP	PC	2015-2018	Imported Coal
22	Formusa Ha Tinh	3 x 150	150	3unit	450	IPP	PC	2015-2020	Imported Coal
23	Thang Long	2 x 310	310	2unit	620	IPP	CFB	2018	Hard Coal
24	Vung Ang 1	2 x 600	600	2unit	1,200	PVN	PC	2015	Hard Coal
25	Song Hau I#1	1 x 600	600	1unit	600	PVN	PC(SC)	2021	Imported Coal
26	Cam Pha 1,2	2 x 335	335	2unit	670	VINACOMIN	CFB	2011	Hard Coal
27	Cao Ngan	2 x 57.5	57.5	2unit	115	VINACOMIN	CFB	2007	Hard Coal
28	Mao Khe	2 x 220	220	2unit	440	VINACOMIN	CFB	2012	Hard Coal
29	Na Duong	2 x 55	55	2unit	110	VINACOMIN	CFB	2005	Local sub-bituminous coal/Brown Coal
30	Son Dong	2 x 110	110	2unit	220	VINACOMIN	CFB	2011	Hard Coal
31	Nong Son	30	30	1unit	30	VINACOMIN	CFB	2015	Local sub-bituminous coal/Brown Coal
Total	–	–	–	64unit	21,374	–	–	–	–
Breakdown	CFB	–	–	19unit	4,600	–	–	–	–
	PC	–	–	45unit	15,528	–	–	–	–

EVN: VIETNAM ELECTRICITY Group

PVN: Vietnam Oil and Gas Group

VINACOMIN: Vietnam Coal and. Minerals Industry Group

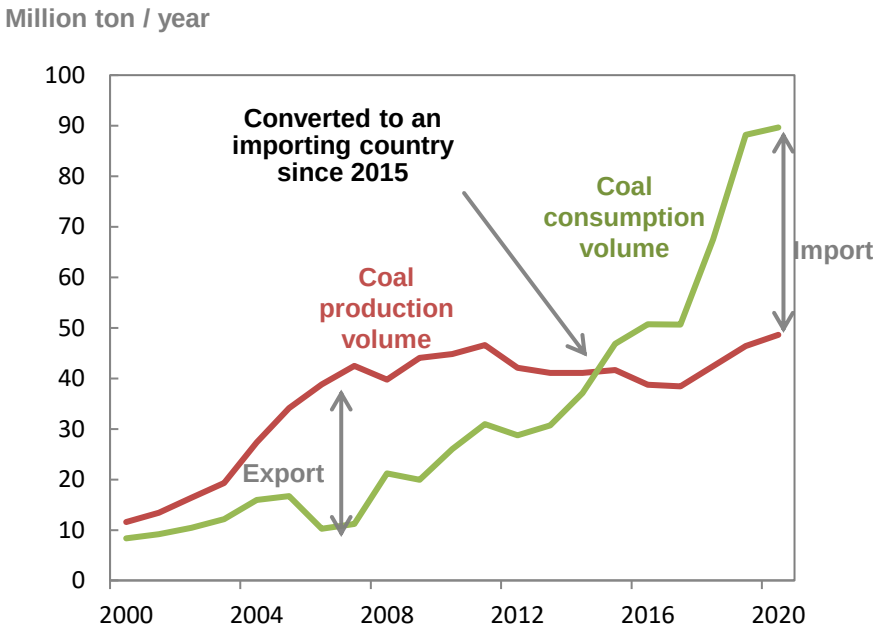
BOT: Build-Operate-Transfer

IPP: Independent Power Producer

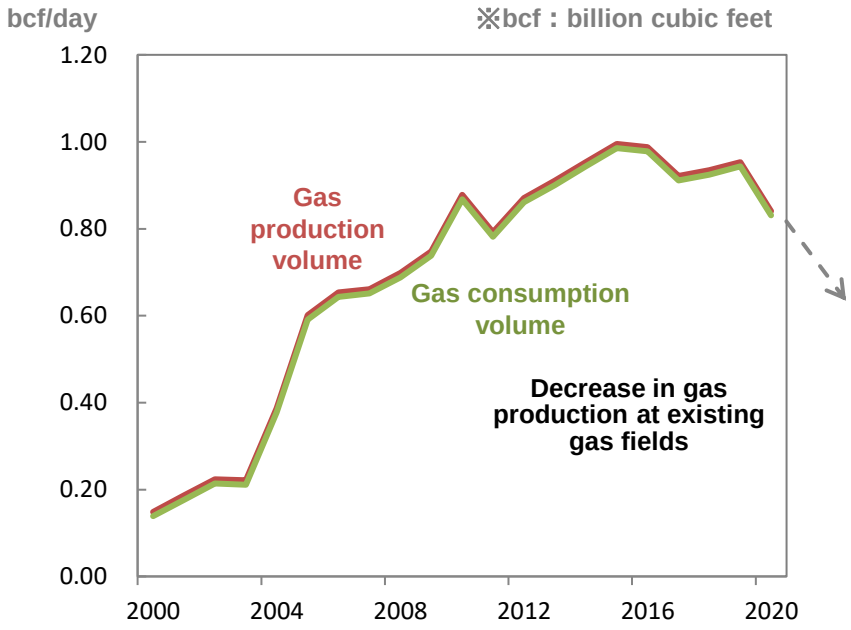
※ Based on erex Group's survey

Biomass Business in Vietnam / Trend of Coal and Gas Production Volume

- Vietnam's domestic coal and gas production has reached a ceiling, and the country faces a shortage of domestically produced fuel



Coal Production and Consumption in Vietnam



Gas Production and Consumption in Vietnam

Biomass Business in Vietnam / Significance of Biomass Introduction

Stable Power Source

Biomass power generation is a stable power source that is not affected by weather conditions. Since biomass fuels are developed in Vietnam, energy self-sufficiency can also be improved, which will support the economic growth of Vietnam.

De-Carbonization

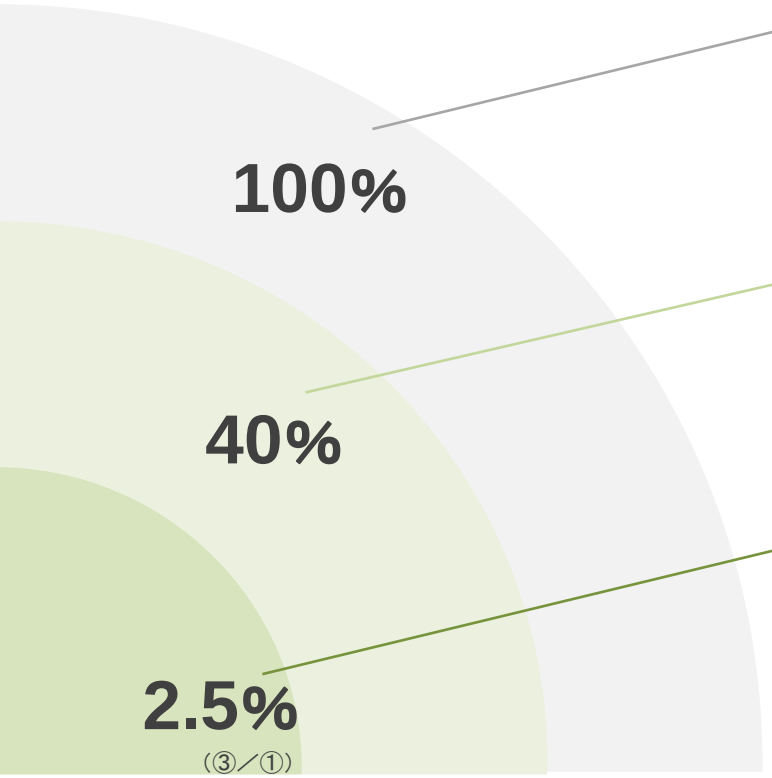
De-carbonization is a global issue, and without de-carbonization, Vietnam will not be able to cope with an increasingly globalized society. Biomass is the best resource for Vietnam, especially toward 2030, as solar power cannot be further increased.

Contribution to Employment

The planned production of biomass fuels inevitably requires biomass producers. Since the biomass fuel will naturally be purchased for fees, the wages of the producers will be guaranteed. In addition, a wide range of fields are expected, including power generation, fuel accumulation, and transportation.

CO2 Reduction Target for 2030

Reduce **CO2 emissions** in Japan by **2.5%** (compared to 2020)



CO2 emissions in Japan in 2020

1,044 million tons...①

CO2 emissions from power generation and heat generation

422 million tons...②

erex Group's CO2 reduction target for 2030

25 million tons...③

[Reference] Percentage of erex Group's CO2 reductions in the electric power sector

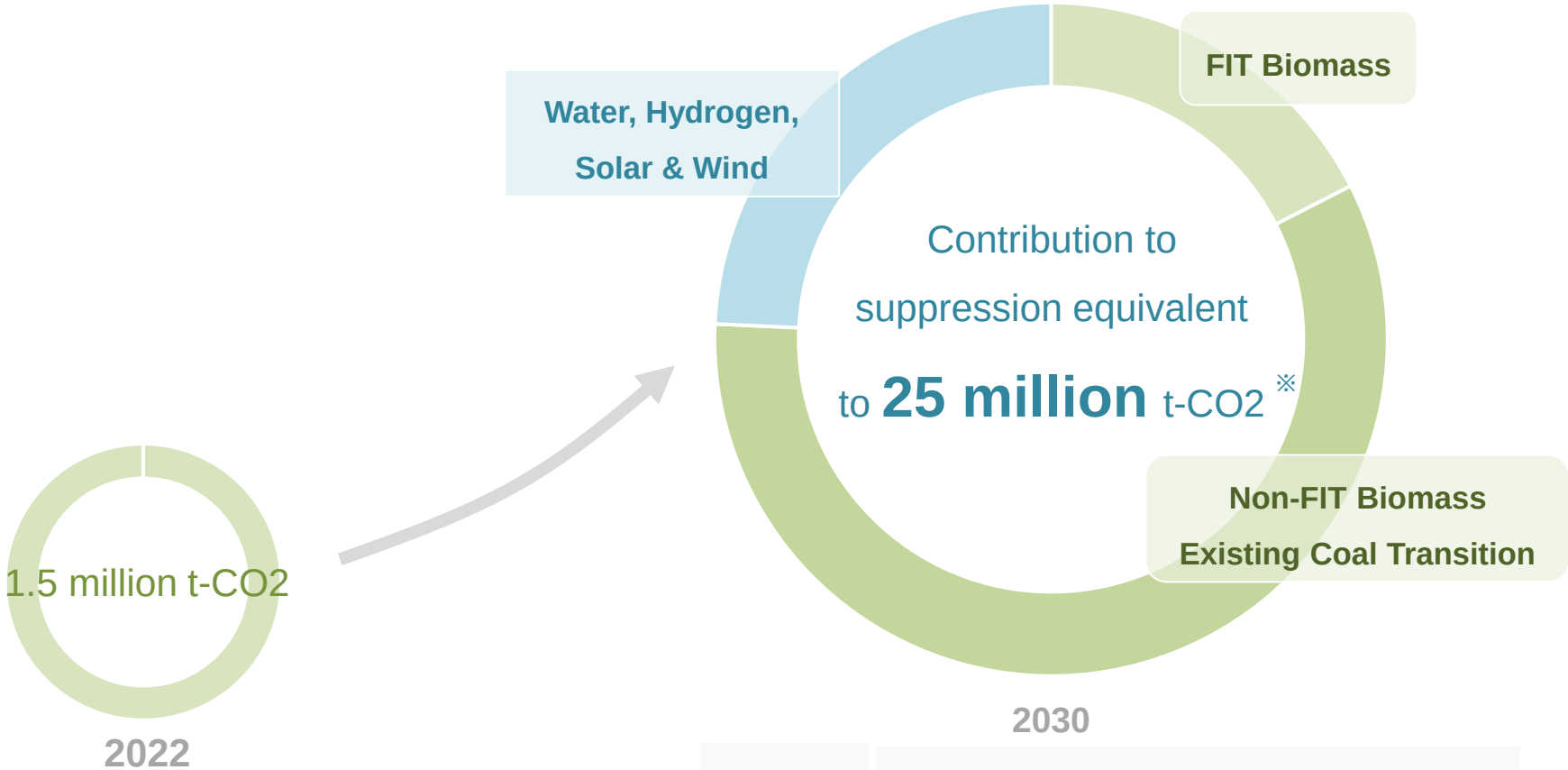
6%(③／②)

Reference: https://www.globalnote.jp/post-3235.html

CO2 Reduction Target for 2030

Accelerate development of de-carbonization power sources, especially biomass

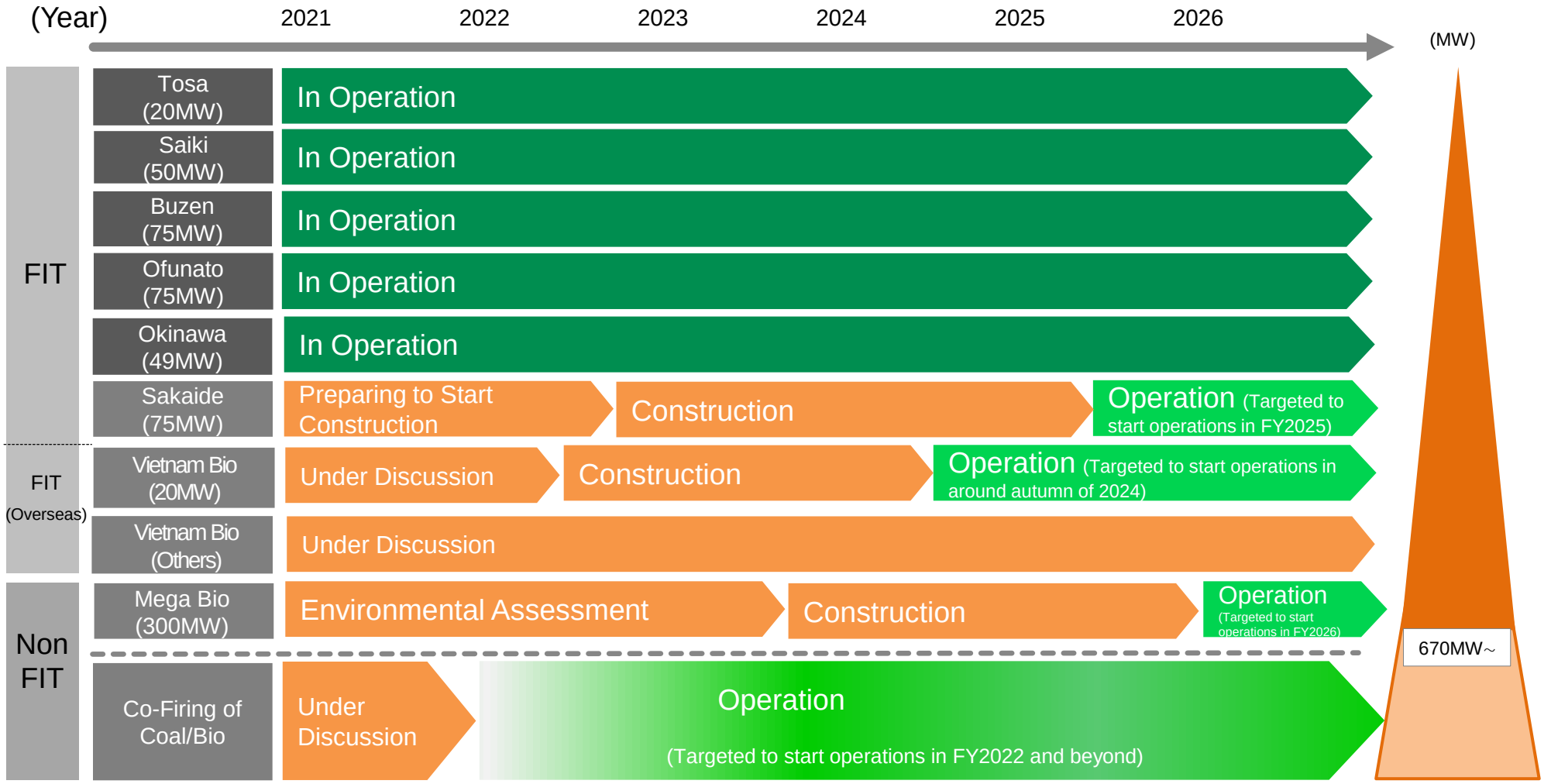
Aim to curb **25 million** t-CO2



※ CO2 equivalent of the effect of reduced consumption of coal and other fossil fuels due to the de-carbonization power sources built by erex Group

Progress of Biomass Power Generation Business

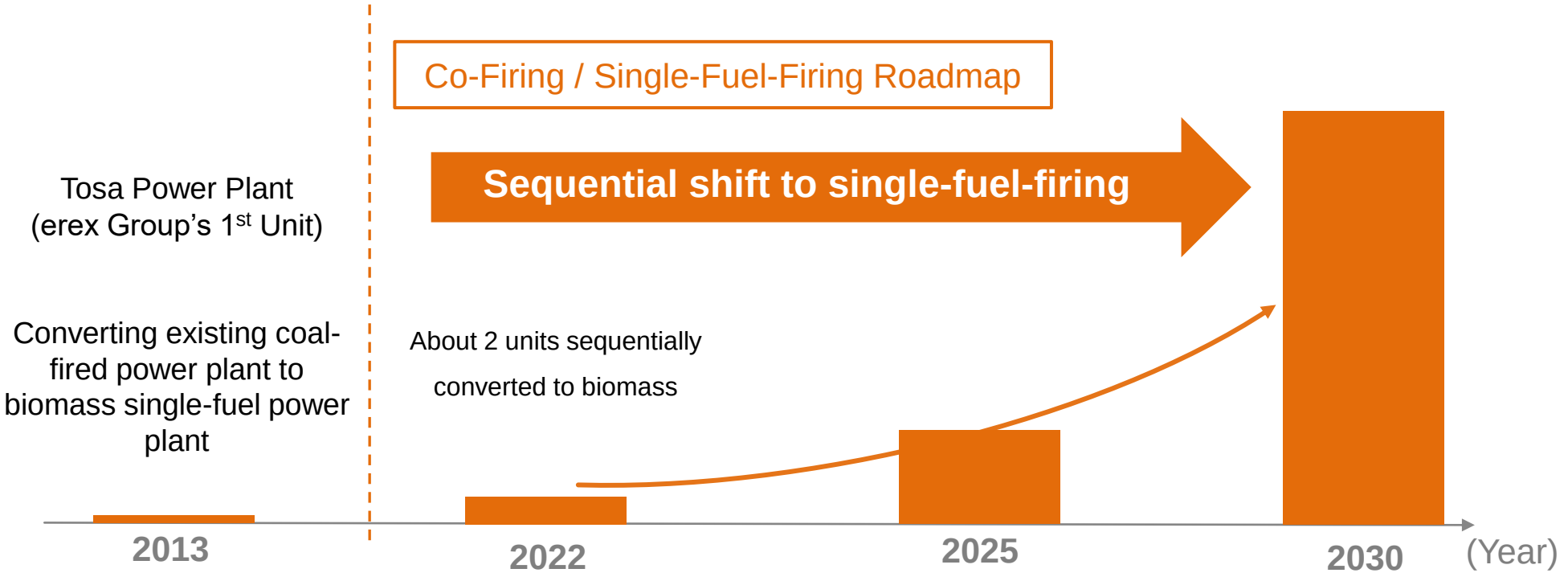
- Five large biomass power plants are currently in operation. Total output is approximately 270MW, which is the largest level in Japan.
- erex Group plans to build biomass power plants in Japan and overseas.
- Discussions are underway toward biomass co-firing and single-fuel-firing of coal-fired power



Biomass Co-Firing / Single-Fuel-Firing Project for Existing Coal-Fired Power Plants

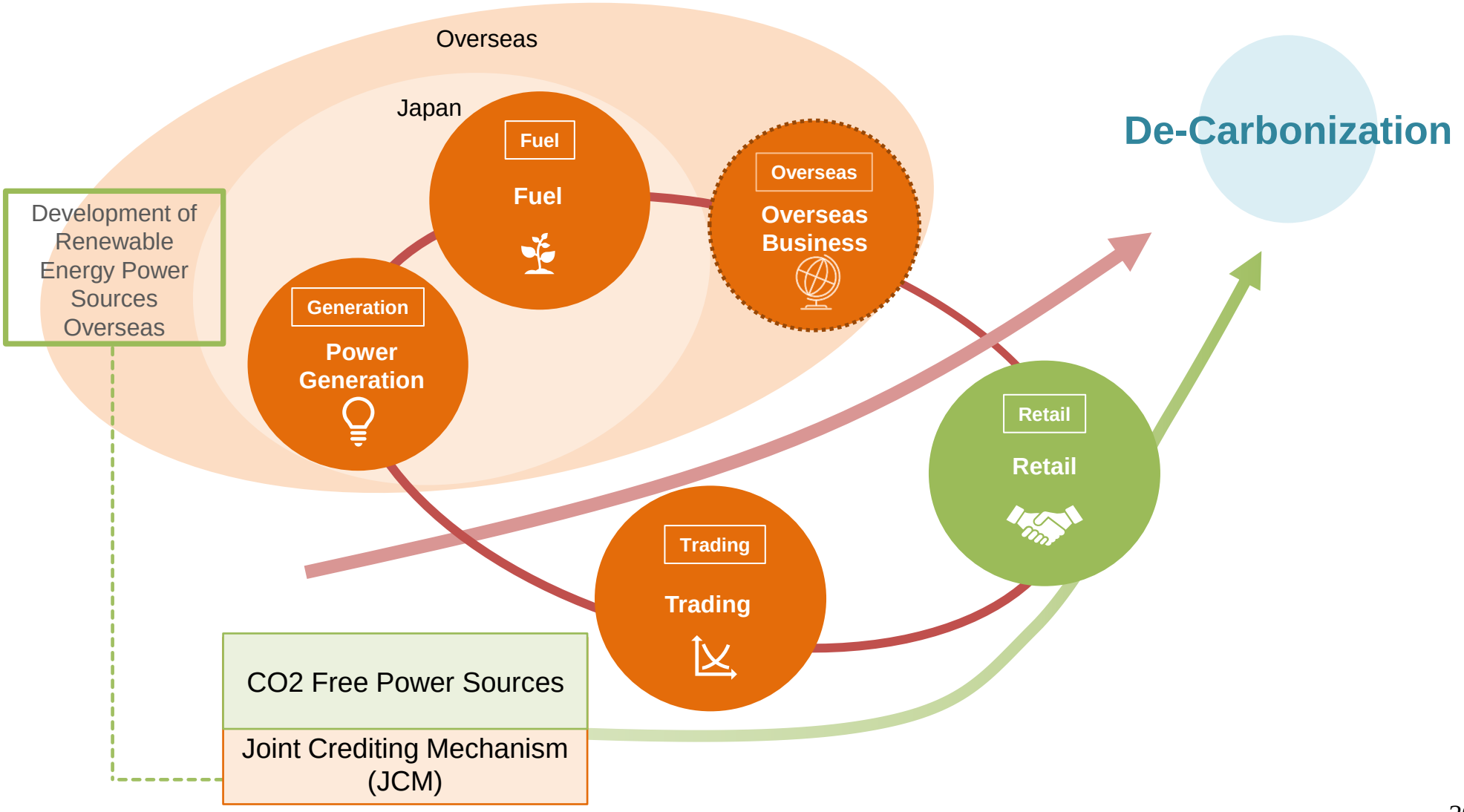
Significance

① Contributing to reducing CO2 emission by replacing coal with biomass fuel
② Contributing to the local economy and securing employment
③ Reducing investment costs through effective use of existing facilities and stably sharing renewable energy power sources
④ Creating new value of renewable energy as a base-load power source



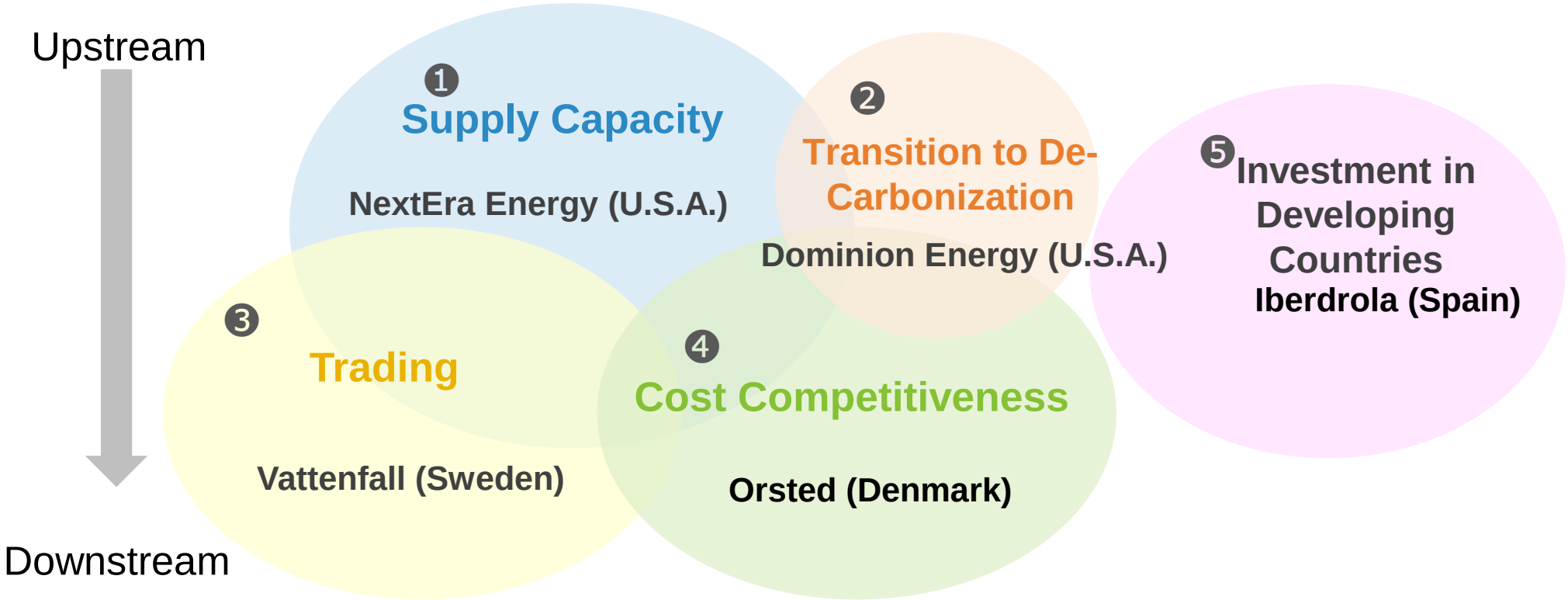
erex Group's Initiatives

- By promoting five businesses together as one, profits are stabilized and risks are diversified
- erex Group aims to achieve de-carbonization by reducing CO2



Benchmark Companies

Promote business with reference to advanced overseas electric power companies



Views on Biomass in Japan and Overseas

Views on Biomass in Japan and Overseas

	Opinions on Biomass	erex Group's Opinion
Environment	Deforestation (Taking away habitat for orangutans)	PKS⇒By-products are used Wood pellets ⇒ Logged for fuel, but within the scope of confirmation by certification (certification has been completed, and the amount procured is only about 15% of the total)
	Food Competition	PKS and pellets are not fuels of food competition
Labor	Child Labor, Forced Labor	Existence of child labor and forced labor is checked in the certification of PKS and wood pellets.
Transportation (Transportation of Raw Materials and Fuel)	CO2 Emissions in Logistics	CO2 emitted during the transportation phase is small compared to the CO2 reduction effect of biomass power generation. For example, greenhouse gas emissions associated with transporting pellets between North America and Europe represent less than 5% of the full chain GHG emissions of hard coal. (Excerpt from IEA materials)

Reference: Ministry of Economy, Trade and Industry（https://www.meti.go.jp/shingikai/enecho/shoene_shinene/shin_energy/biomass_sus_wg/pdf/008_02_00.pdf)
Ministry of Economy, Trade and Industry（https://www.meti.go.jp/shingikai/enecho/shoene_shinene/shin_energy/biomass_sus_wg/pdf/011_01_00.pdf)
FSC (https://jp.fsc.org/jp-ja/Policy_for_Association)

IEA's View (Original Text ※ Excerpts)

Technology Collaboration Programme
by IEA

IEA Bioenergy

The use of forest biomass for climate change mitigation: response to statements of EASAC

IEA Bioenergy, November 2019

The EASAC[1] press release "Experts call for international action to restrict climate-damaging forest bioenergy schemes"[2], and the scientific paper by Norton et al. [3], that EASAC references, call attention to the critical need to ensure sustainability of forest bioenergy. We agree with a number of points in the paper; however, it also includes several errors, half-truths and generalisations, overlooks several important roles for bioenergy in climate change mitigation, and draws some conclusions with which we disagree. Below we present key facts about the use of forest biomass for climate change mitigation.

1. **The term "carbon neutral" is ambiguous; emissions in the supply chain and impacts on forest carbon stock must be included.**

Bioenergy is sometimes said to be "carbon neutral", but this is an unhelpful term because it is ambiguous and used differently in different contexts. Within the biospheric carbon cycle, bioenergy can be considered carbon neutral because the carbon that is released during combustion has previously been sequestered from the atmosphere and will be sequestered again as the plants regrow. However, the full supply chain must be considered, including all emissions associated with the production, processing, transport and use of bioenergy. Furthermore, if extraction of biomass for energy leads to a decline in the forest carbon stock, such fluctuations need to be accounted for.

2. **Forest biomass is not treated as carbon neutral in national greenhouse gas inventories.**

The EASAC press release claims that there is an accounting loophole as imported biomass is treated as zero emissions when burned. Under the agreed approach for preparation of national GHG inventories, countries report harvest of forests as a CO_2 emission in the land use sector[4]. CO_2 emissions from combustion of biomass for energy are excluded in the energy sector to avoid double counting with the land use sector. Thus, there is no accounting error that requires correction, or emission that is overlooked, and bioenergy is not assumed to be carbon neutral: if bioenergy leads to a reduction in forest carbon stock this is reflected in national inventories[5]. Fuel use in the supply chain is counted in the energy sector of the country where the fuel is consumed, as for all other traded materials including energy carriers.

Reference: IEA （https://www.ieabioenergy.com/wp-content/uploads/2019/12/WoodyBiomass-Climate_EASACresponse_Nov2019.pdf）

Key Points of IEA's View

- EASAC and others, especially in Europe and the U.S., are of the opinion that biomass is not renewable energy
- IEA(International Energy Agency) agrees with a number of points, however, states that this paper includes several errors, half-truths and generalisations, and overlooks several important roles of bioenergy in mitigating climate changes

Below are examples of IEA's response to EASAC's statement

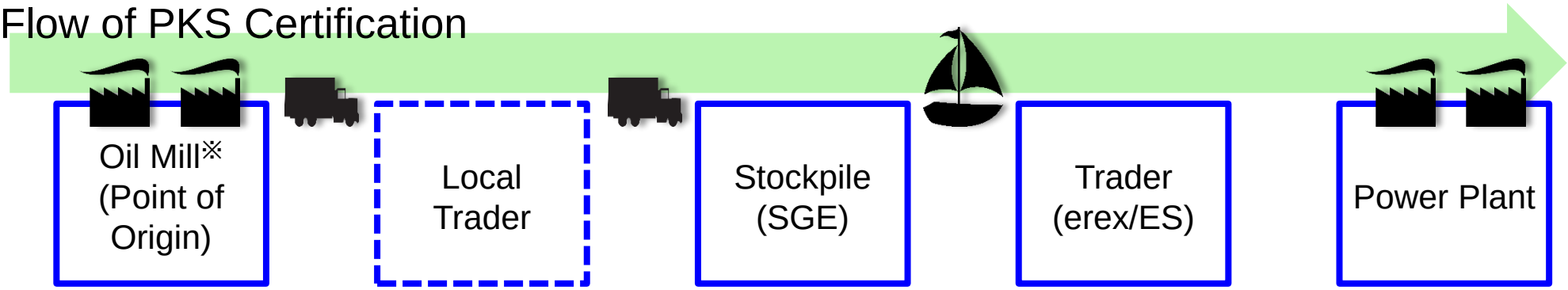
Is biomass carbon neutral?
The carbon released during combustion is sequestered from the atmosphere and can be considered carbon neutral as it is sequestered again when the plant regenerates. However, the entire supply chain must be considered, including all emissions associated with the production, processing, transportation, and use of bioenergy.
Cutting down forests and plants that absorb CO2 releases carbon that would otherwise be stored in the forest and does not contribute to CO2 reduction
There is no net reduction in carbon sequestration in forests unless annual harvesting exceeds annual growth
During combustion, biomass generates more carbon per kWh than coal combustion
It is incorrect to determine the climate change effect of using biomass for energy by comparing greenhouse gas (GHG) emissions at the point of combustion. Instead, it should be assessed in terms of life cycle GHGs
Isn’t CO2 emission during transportation high?
In long-distance transportation, CO2 emitted during the transportation phase is small compared to the CO2 reduction effect of biomass power generation. For example, greenhouse gas emissions associated with transporting pellets between North America and Europe represent less than 5% of the full chain GHG emissions of hard coal.

Reference: IEA（https://www.ieabioenergy.com/wp-content/uploads/2019/12/WoodyBiomass-Climate_EASACresponse_Nov2019.pdf）

(Reference) Requirements for Biomass Power Producers Using PKS

① Confirmation of traceability of local fuel suppliers and thereafter
② Obligation to purchase third-party certified PKS (RSB or RSPO or GGL)
③ Segregation management of PKS from oil mill to power plant (※ Segregation management in IP or SG)
④ Information Disclosure (※ Updated annually)

Flow of PKS Certification



Example 1. If the oil mill is not RSPO certified

GGL or RSB Certification

Example 2. If the oil mill is RSPO certified

RSPO Certification → GGL or RSB Certification (Supply Chain Certification)

※ The local trader is not required to be certified if it only conducts transportation operations

(Reference) Biomass Business / erex Group's Initiatives

- Five companies within erex Group have already obtained GGL certification for PKS, the existing biomass fuel. As to other power plants, the traceability and legality of the production, manufacturing, processing, and transportation of each fuel are confirmed through audits by third-party certification organizations.
- For newly developed biomass fuels, erex Group aims to develop sustainable fuels by cultivating them in-house without new forest developments. Cultivating fast-growing herbaceous biomass fuel leads to being able to absorb a large amount of CO2 in the growth process.

Existing Biomass Fuel

FIT

PKS

(Palm Kernel Shell)

- Obtaining GGL certification

Power generation using certified material will become mandatory in April 2023 and thereafter

【Already Obtained】

erex Co., Ltd.

erex Singapore

STRAITS GREEN ENERGY PTE.LTD.

STRAITS GREEN ENERGY SDN.BHD.

Saiki Power Plant

※ Other power plants are to obtain certification before it becomes mandatory.

Newly-Developed Biomass Fuel

Non-FIT

New Fuel

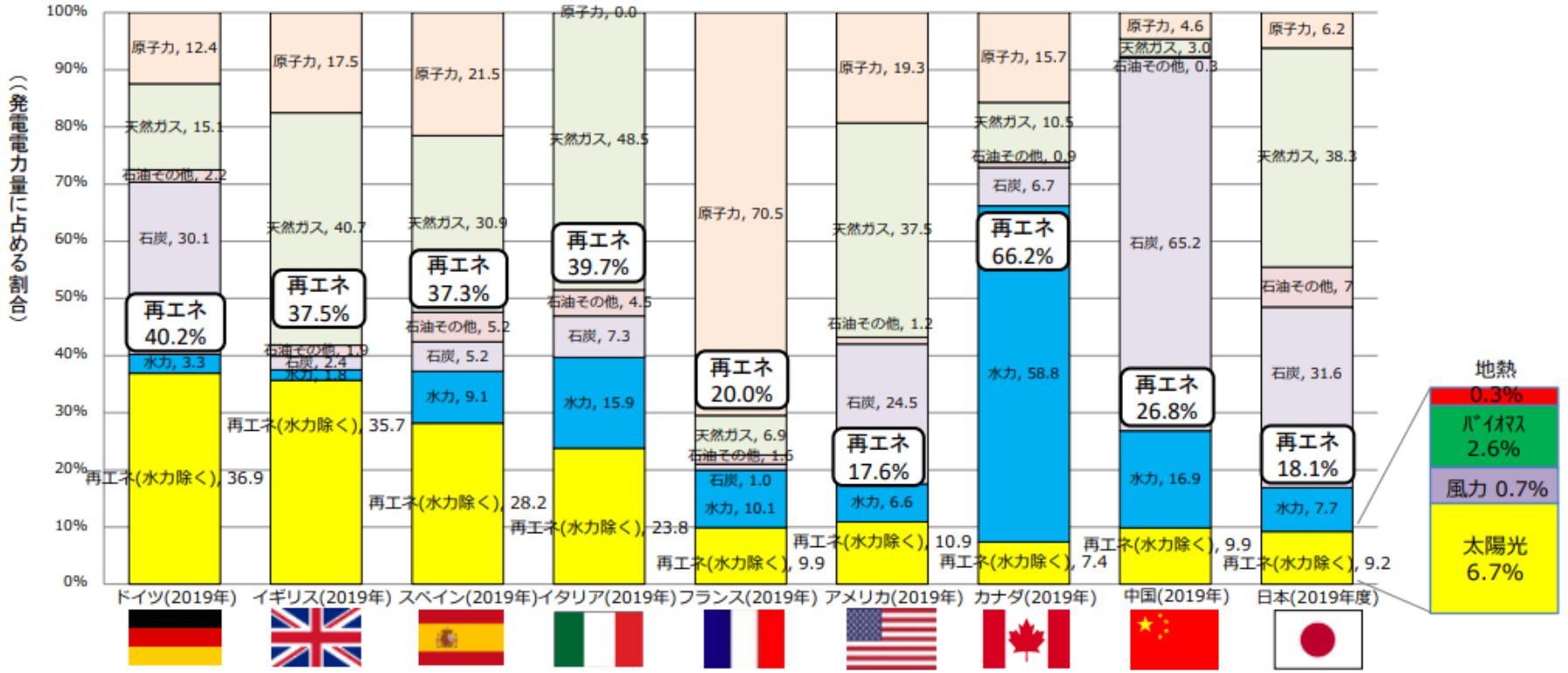
- Planting without new forest developments
- Shifting crops from slow-growing plants

Wood Pellet

- Third-party certification is required under the FIT system, and only certified wood pellets are used

Appendix

Renewable Energy Power Sources in Each Country ①



主要再エネ ※水力除く	風力 20.9%	風力 20.0%	風力 20.5%	太陽光 8.1%	風力 6.1%	風力 6.8%	風力 5.1%	風力 5.4%	太陽光 6.7%
再エネ 発電量	2,424 億kWh	1,205 億kWh	1,001 億kWh	1,159 億kWh	1,131 億kWh	7,670 億kWh	4,273 億kWh	20,150 億kWh	1,852 億kWh
再エネ 発電量 ※水力除く	2,227 億kWh	1,146 億kWh	763 億kWh	695 億kWh	562 億kWh	4,772 億kWh	477 億kWh	7,424 億kWh	1,056 億kWh
発電量	6,031 億kWh	3,211 億kWh	2,710 億kWh	2,920 億kWh	5,661 億kWh	43,710 億kWh	6,453 億kWh	75,091 億kWh	10,238 億kWh

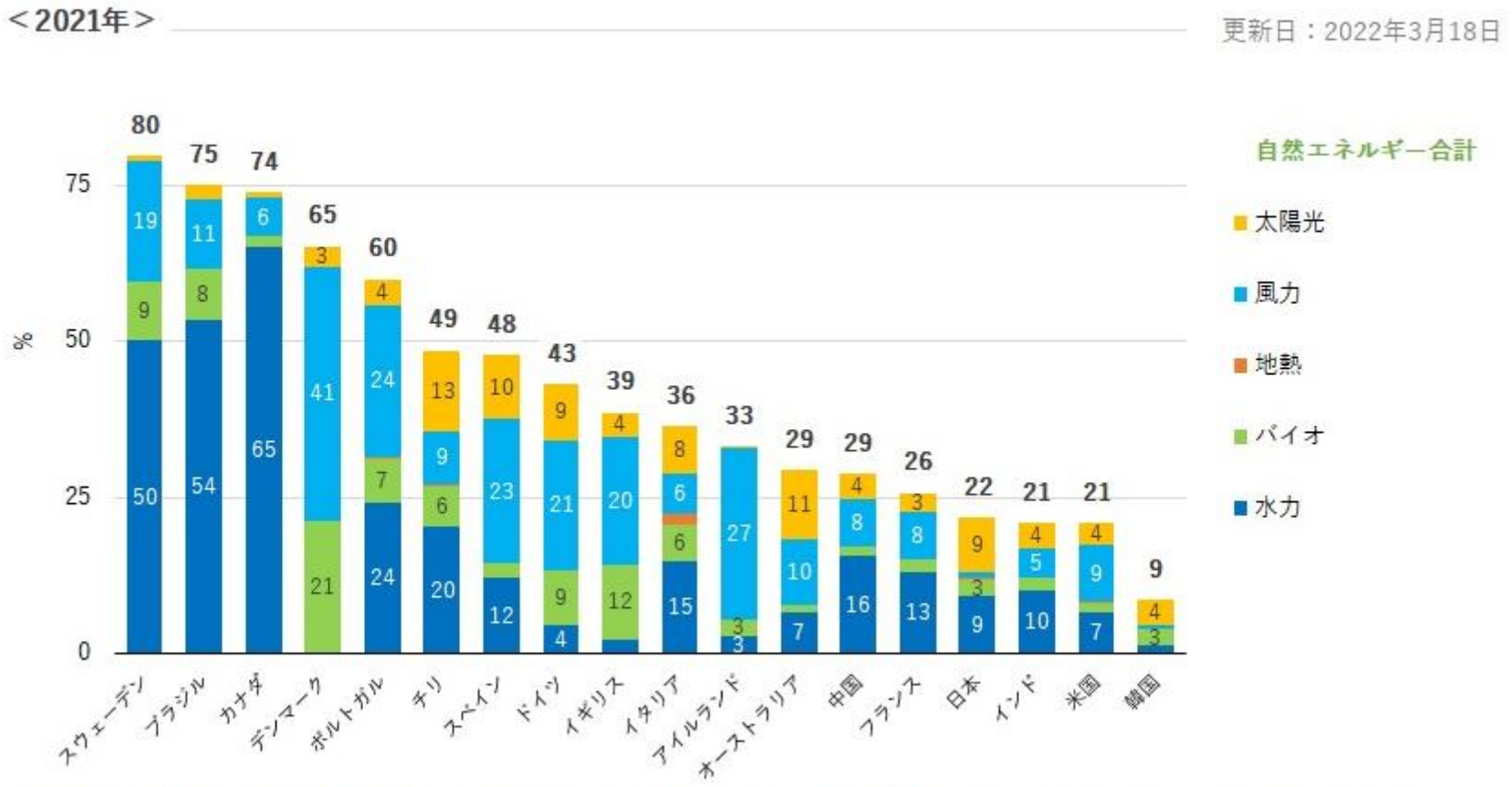
出典：IEA Market Report Series - Renewables 2020（各国2019年時点の発電量）、IEA データベース、総合エネルギー統計(2019年度確報値)等より資源エネルギー庁作成

Reference: https://www.enecho.meti.go.jp/category/saving_and_new/saiene/community/dl/05_01.pdf

Renewable Energy Power Sources in Each Country ②

自然エネルギー財団

電力消費量に占める自然エネルギーの割合



・注：各国の電力消費量＝［国内の発電電力量］＋［他国からの輸入量］－［他国への輸出量］。グラフにおけるデータは、所内電力量（ネット発電量）に基づく。
・出典：IEA, Monthly Electricity Statistics－Data up to December 2021（2022年3月）（2022年3月16日ダウンロード）。

Reference: https://www.renewable-ei.org/statistics/international/

Renewable Energy Power Sources in Each Country ③

自然エネルギー財団

Reference: https://www.renewable-ei.org/statistics/re/?cat=bio

Japan's Renewable Energy Introduction Targets for 2030

再生可能エネルギーの導入推移と2030年の導入目標

- 2012年7月のFIT制度（固定価格買取制度）開始により、再エネの導入は大幅に増加。特に、設置しやすい太陽光発電は、2011年度0.4%から2019年度6.7%に増加。再エネ全体では、**2011年度10.4%から2020年度19.8%に拡大**。
- 今回のエネルギーミックス改定では、2030年度の温室効果ガス46%削減に向けて、施策強化等の効果が実現した場合の**野心的目標**として、**電源構成36-38%**（合計3,360～3,530億kWh程度）の導入を目指す。

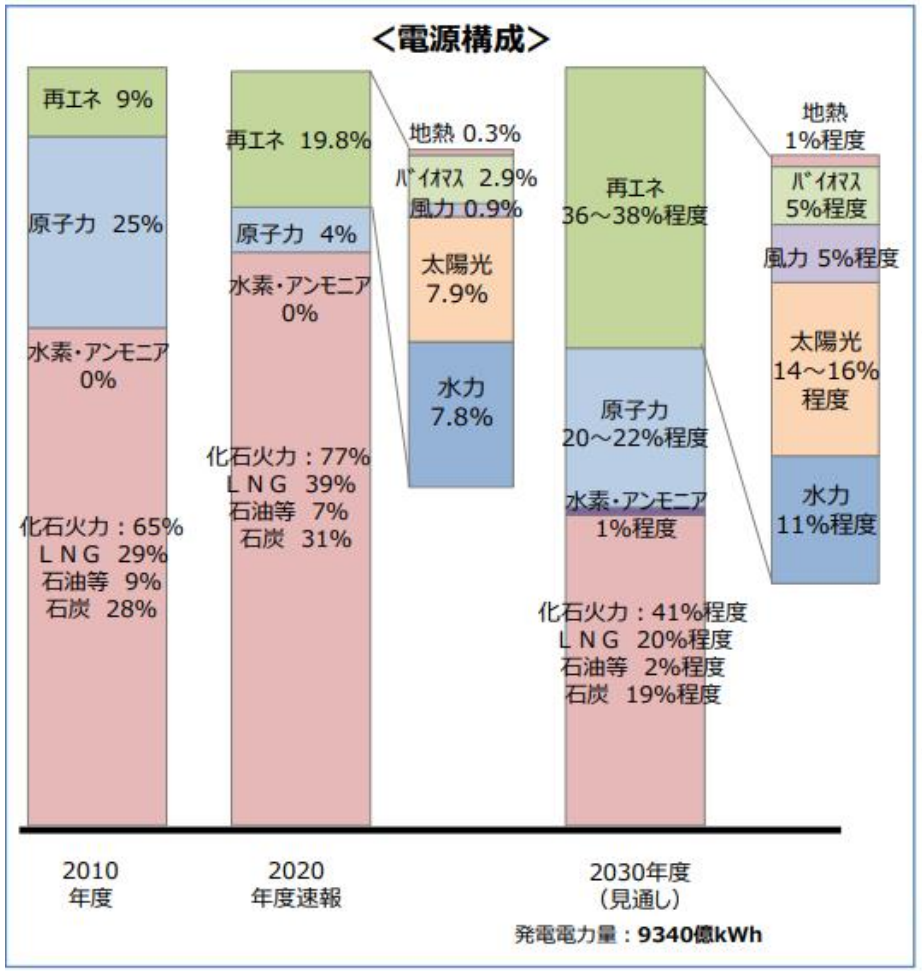
<再エネ導入推移>

	2011年度	2020年度		2030年旧ミックス	2030年新ミックス	
再エネの電源構成比 発電電力量:億kWh 設備容量:GW	**10.4%** （1,131億kWh）	**19.8%** （1,983億kWh）		**22-24%** （2,366-2,515億kWh）	**36-38%** （3,360-3,530億kWh）	
太陽光	0.4%	**7.9%**		7.0%	**14-16%程度**	
		61.6GW	**791億kWh**		**104~118GW**	**1,290~1,460億kWh**
風力	0.4%	0.9%		1.7%	5%程度	
		4.5GW	90億kWh		23.6GW	510億kWh
水力	7.8%	7.8%		8.8-9.2%	11%程度	
		50GW	784億kWh		50.7GW	980億kWh
地熱	0.2%	0.3%		1.0-1.1%	1%程度	
		0.6GW	30億kWh		1.5GW	110億kWh
バイオマス	1.5%	2.9%		3.7-4.6%	5%程度	
		5.0GW	288億kWh		8.0GW	470億kWh

Reference: https://www.meti.go.jp/shingikai/enecho/denryoku_gas/saisei_kano/pdf/040_01_00.pdf

Japan's Renewable Energy Introduction Targets for 2030

（参考）新たな「エネルギーミックス」実現への道のり



(GW)	導入水準 (21年9月)	FIT前導入量＋FIT認定量 (21年9月)	ミックス (2030年度)	ミックスに対する導入進捗率
太陽光	63.8	81.6	103.5～117.6	約58%
風力（上段：陸上 下段：洋上）	4.6 －	15.3 0.7	17.9 5.7	約19%
地熱	0.7	0.7	1.5	約41%
中小水力	9.8	10.0	10.4	約94%
バイオマス	5.3	10.3	8.0	約66%

※バイオマスはバイオマス比率考慮後出力。
※改正FIT法による失効分（2021年9月時点で確認できているもの）を反映済。
※太陽光の「ミックスに対する進捗率」はミックスで示された値の中間値に対する導入量の進捗。

出典）総合エネルギー統計(2020年度速報値)等を基に資源エネルギー庁作成

Reference: https://www.meti.go.jp/shingikai/enecho/denryoku_gas/saisei_kano/pdf/040_01_00.pdf

Capacity Factor (Details)

タイトルのみ変更

2030年の電源別発電コスト試算の結果概要

※数値は全て暫定値。

均等化発電原価(LCOE)は、標準的な発電所を立地条件等を考慮せずに新規に建設し所定期間運用した場合の「総発電コスト」の試算値。政策支援を前提に達成するべき性能や価格目標とも一致しない。

1．各電源のコスト面での特徴を踏まえ、どの電源に政策の力点を置くかといった、**2030年に向けたエネルギー政策の議論の参考材料**とする。

2．**2030年**に、**新たな発電設備を更地に建設・運転**した際の**kWh当たりのコスト**を、**一定の前提で機械的に試算**。（**既存の発電設備を運転するコストではない**）。

3．2030年のコストは、燃料費の見通し、設備の稼働年数・設備利用率、太陽光の導入量などの**試算の前提を変えれば、結果は変わる**。

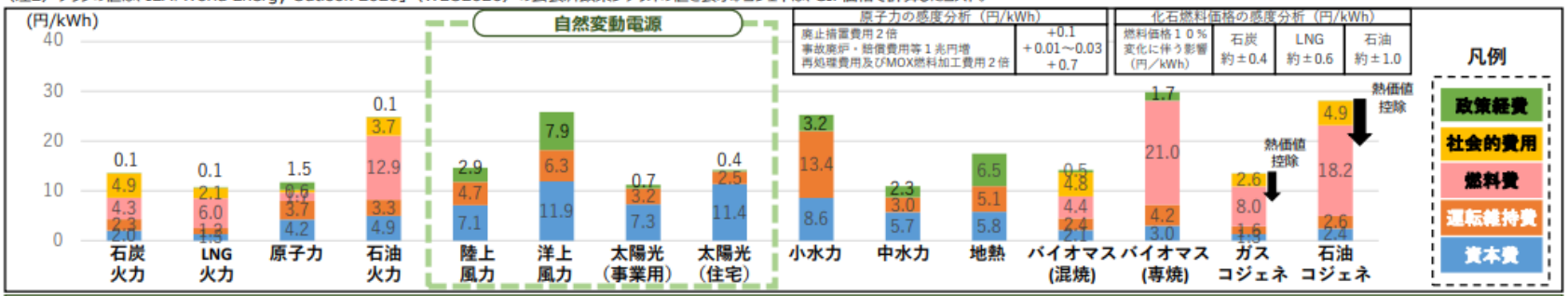
4．事業者が**現実に発電設備を建設**する際は、ここで示す**発電コストだけでなく**、**立地地点毎に異なる条件を勘案して総合的に判断**される。

5．**太陽光・風力（自然変動電源）の大量導入**により、**火力の効率低下や揚水の活用などに伴う費用（電源別限界コスト）が高まる**ため、これも考慮する必要がある。この費用について、今回は、系統制約等を考慮しない機械的な試算（参考①）に加え、**系統制約等を考慮したモデルによる分析**も実施し、**参考として整理**（参考②）。

電源	石炭火力	LNG火力	原子力	石油火力	陸上風力	洋上風力	太陽光（事業用）	太陽光（住宅）	小水力	中水力	地熱	バイオマス（混焼、5%）	バイオマス（専焼）	ガスコジェネ	石油コジェネ
発電コスト（円/kWh） ※（ ）は政策経費なしの値	13.6～22.4 (13.5～22.3)	10.7～14.3 (10.6～14.2)	11.7～ (10.2～)	24.9～27.5 (24.8～27.5)	9.9～17.2 (8.3～13.6)	26.1 (18.2)	8.2～11.8 (7.8～11.1)	8.7～14.9 (8.5～14.6)	25.3 (22.0)	10.9 (8.7)	17.4 (10.9)	14.1～22.6 (13.7～22.2)	29.8 (28.1)	9.5～10.8 (9.4～10.8)	21.5～25.6 (21.5～25.6)
設備利用率 稼働年数	70% 40年	70% 40年	70% 40年	30% 40年	25.4% 25年	33.2% 25年	17.2% 25年	13.8% 25年	60% 40年	60% 40年	83% 40年	70% 40年	87% 40年	72.3% 30年	36% 30年

（注1）表の値は、今回検証で扱った複数の試算値のうち、上限と下限を表示。将来の燃料価格、CO2対策費、太陽光・風力の導入拡大に伴う機器価格低下などをどう見込むかにより、幅を持った試算としている。例えば、太陽光の場合「2030年に、太陽光パネルの世界の価格水準が著しく低下し、かつ、太陽光パネルの国内価格が世界水準に追いつくほど急激に低下するケース」や「太陽光パネルが劣化して発電量が下がるケース」といった野心的な前提を置いた試算値を含む。

（注2）グラフの値は、IEA「World Energy Outlook 2020」（WEO2020）の公表済政策シナリオの値を表示。コジェネは、CIF価格で計算したコスト。



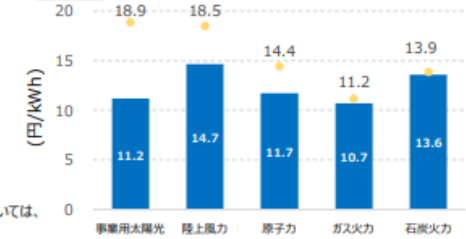
参考① 電源立地や系統制約を考慮しない機械的な試算（2015年の手法を踏襲）

「系統が日本全国で大幅に増強され、日本全体で電力需給が瞬時に調整される」前提を置いてもなお生じる追加費用（火力効率低下や揚水活用等の費用）追加費用として試算。

自然変動電源の導入量・割合※1※2	生じる追加費用
1450億kWh（15%）程度	年間8,470億円
1850億kWh（20%）程度	年間1兆1,580億円
2350億kWh（25%）程度	年間1兆4,780億円

※1 導入割合は総発電電力量が9300億-9400億kWhの場合
※2 検証時点では、洋上風力の時間変動実データが得られないため、洋上風力の追加費用の計算については、陸上風力の諸元を流用した。

参考② 電源立地や系統制約を考慮した、モデルによる分析・試算（委員による分析※2）



●2030年エネルギーミックスが達成された状態から、さらに各電源を微少追加した場合に、電力システム全体に追加で生じるコストを計算し、便宜的に、追加した電源で割り戻してkWh当たりのコスト（電源別限界コスト）を算出。

●どの電源を追加しても、電力システム全体にコストが生じる。これを、どう抑制していくのか、誰がどう負担するのかを議論していくことが重要。

青　棒：発電コスト（上の積上げ棒グラフの値と同じ）

黄色ドット：電源別限界コスト

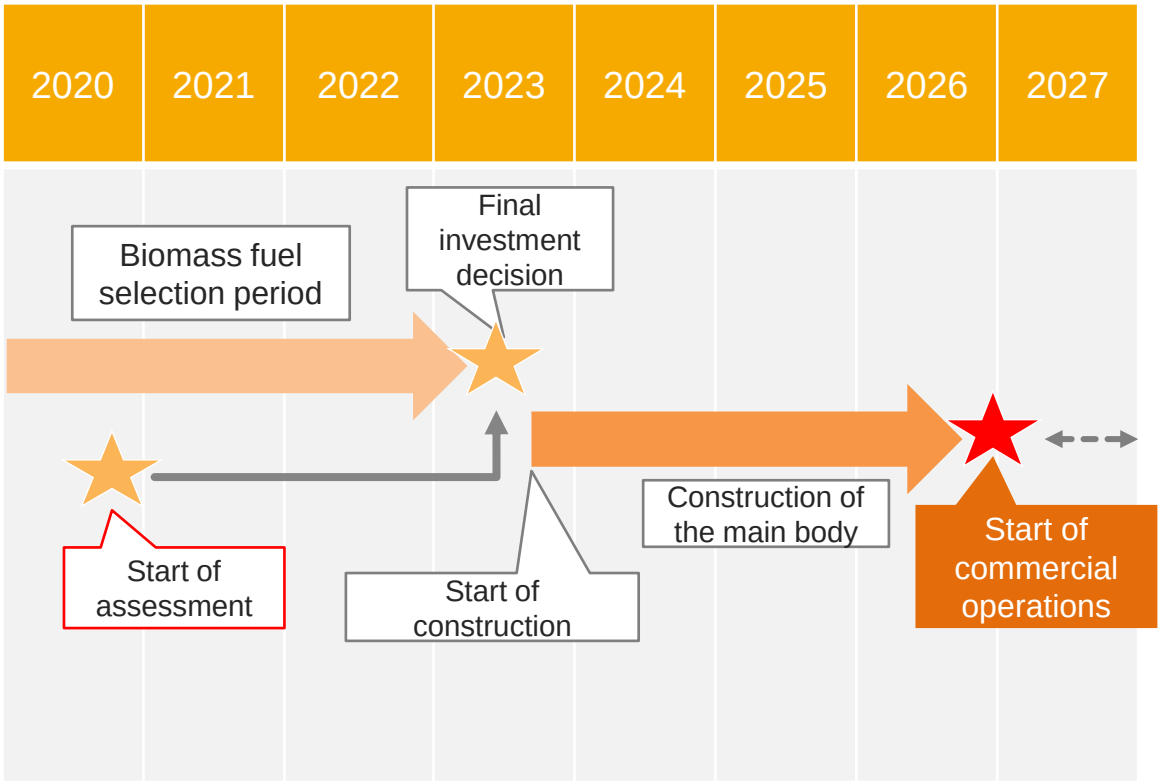
※2　第８回発電コスト検証WGにおける委員発表資料より引用。

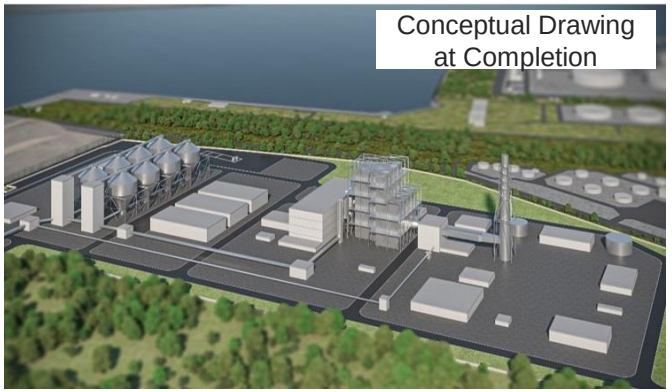
Reference: https://www.enecho.meti.go.jp/committee/council/basic_policy_subcommittee/mitoshi/cost_wg/2021/data/08_05.pdf

Realization of the World's Largest Level Non-FIT Mega Biomass Power Plant Construction

- This power plant is the world's largest level with an output of 300 MW, and aims to achieve high efficiency.
- It is under development at Niigata Higashi Kou (East Port), Niigata Prefecture. Administrative procedures for the first step of the environmental assessment (environmental consideration statement) have been completed.
- Grid connection agreement was signed in August 2021.

Current Timeline





Power Output	300MW (the world's largest level)
Planned Construction Site	Suburbs of Higashi-Kou, Seiro Town, Niigata Prefecture
Power Generation Method	Ultra-supercritical pressure re-combustion method
Estimated Annual Power Generation	About 2,000GWh
Amount of Fuel Usage	About 1.2 million tons annually
CO2 Reduction Amount	About 1 million tons annually

Hydrogen Power Generation Demonstration Project

1st : Japan's first commercial hydrogen power generation

- April 2022: Japan's first commercial hydrogen power plant started operations in Fujiyoshida City, Yamanashi Prefecture

- Accumulation of knowledge in three fields, "hydrogen production," "power generation using hydrogen," and "sales of hydrogen-derived electric power”

Name of Power Plant	erex Fujiyoshida Hydrogen Power Plant
Construction Site	Fujiyoshida City, Yamanashi Prefecture
Power Generation Output	320kW
Site Area	About 225㎡
Start of Operation	April 6, 2022
Fuel	Hydrogen 100%（297Nm³/h)

Exterior view of Fujiyoshida Hydrogen Power Plant

2nd : Large-scale hydrogen demonstration center [tentative name]

- Construction of a large-scale hydrogen demonstration facility based on the knowledge gained from the PJ in Fujiyoshida City, Yamanashi Prefecture is under consideration.

- erex Group aims to further reduce the price of hydrogen by increasing the scale, and at the same time is considering the creation of hydrogen demand (mobility, hydrogen power generation, etc.) in parallel.

- erex Group is also currently considering construction on remote islands where it is difficult to introduce solar, wind, and other energy sources.

Cambodia Hydropower Generation Project

- The start of operation was revised to 2025. The project is in progress, such as resettlement of residents having been completed


Preparation Work (Road)


Dam Construction Field Office

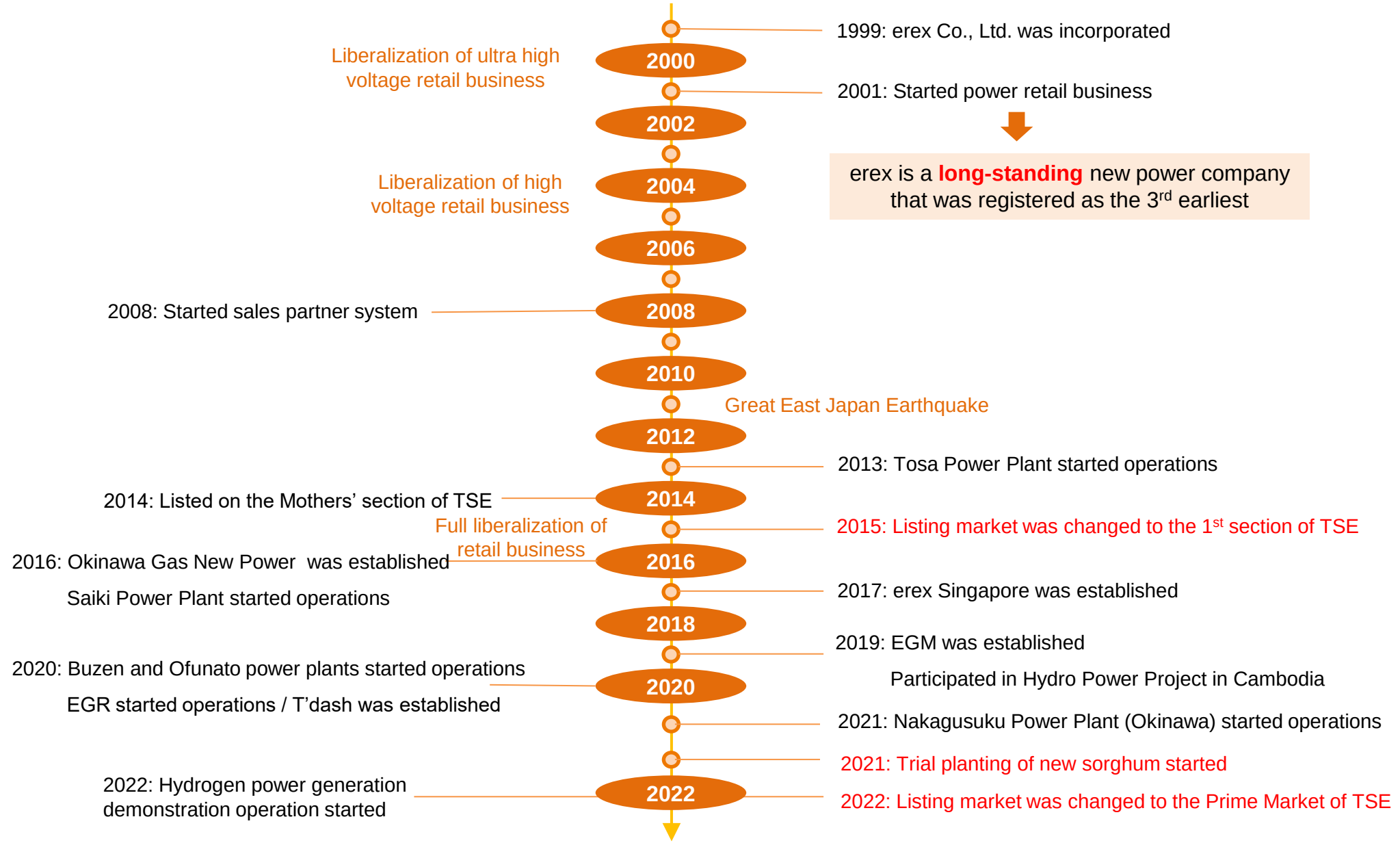

Resettlement Residence

Company Profile

Company Profile of erex Group

Company Name	erex Co., Ltd.
Headquarter	14F, Kyobashi EDOGRAND, 2-2-1 Kyobashi, Chuo-Ward, Tokyo 104-0031, Japan
Incorporation	December 8th, 1999
Capital Stock	11.2 Billion Japanese Yen (as of March 2022)
Stock Exchange	Prime Market of Tokyo Stock Exchange (Securities Code: 9517)
Sales Subsidiaries	Evergreen Marketing Co., Ltd. (EGM) Evergreen Retailing Co., Ltd. (EGR) Okinawa Gas New Power Co., Ltd. (OGNP) T'dash LLC (T'dash) e-sell Co., Ltd.
Power Generation Subsidiaries	Tosa Power Plant Saiki Power Plant Buzen Biomass Power Plant Ofunato Power Plant ※ Equity-Method Affiliated Company Nakagusuku Biomass Power Plant
Other Group Subsidiaries	Saiki Biomass Center erex Singapore Pte. Ltd.

History of erex Group: Achievements (Trust) and Knowledge Cultivated in the Last 20 Years



erex is a **long-standing** new power company that was registered as the 3rd earliest

erex Group's Business

① Fuel Business

- Procurement through trading houses & In-house procurement
- A business base has been established in Singapore / Sales to 3rd Parties
- **Development of new fuels such as new sorghum**

② Power Generation Business

- Tosa/Saiki/Ofunato/Buzen/Okinawa (operating)
- Mega Bio (under assessment) / Sakaide (Preparing to start construction
- Vietnam Bio/Cambodia Hydropower (Preparation work)
- **Biomass co-firing and single-fuel-firing of coal-fired power plants**

③ Trading Business

- Procurement from PPA sources and JEPX
- Contribution to earnings from power trading
- Transactions of environmental value, etc.

④ Retail Business

EverGreen
T'dashY
沖縄ガスニューパワー
eshell

⑤ R & D Business

- **Development of new fuels overseas**
- **Development of technologies for biomass co-firing and single-fuel-firing of coal-fired power plants**
- **Hydrogen power generation project**

Realization of a De-Carbonized Society

Power Generation Business

- Nakagusuku Biomass Power Plant started its commercial operations on July 20, 2021. 5 biomass power plants are currently in operation

Buzen Power Plant (FIT)

Start of Operation: Jan 2020
Location: Buzen City, Fukuoka
Fuel: PKS, Wood Pellet
Method: Biomass Power
Output: 75,000kW (rated)

Niigata Power Plant (Non-FIT)

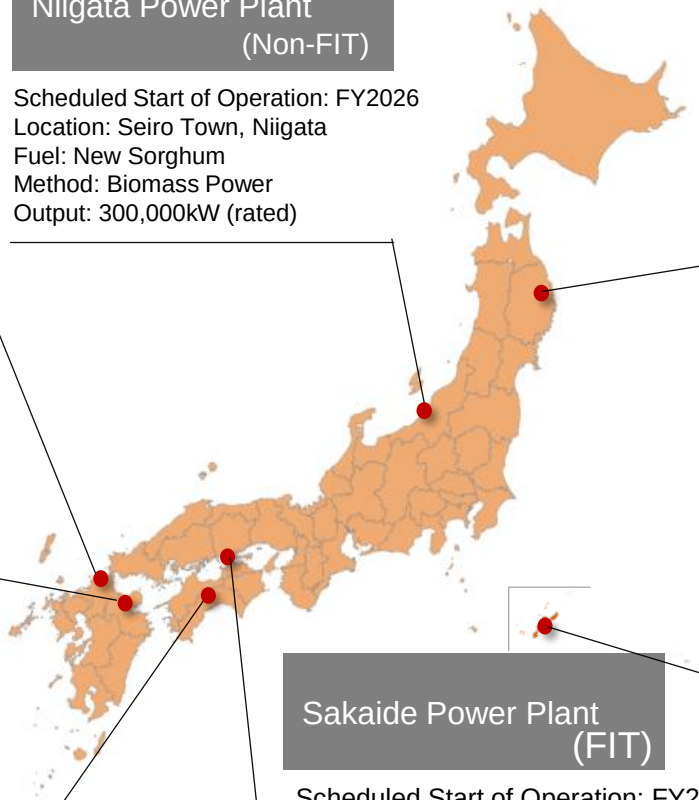
Scheduled Start of Operation: FY2026
Location: Seiro Town, Niigata
Fuel: New Sorghum
Method: Biomass Power
Output: 300,000kW (rated)

Ofunato Power Plant (FIT)

Start of Operation: Jan 2020
Location: Ofunato City, Iwate
Fuel: PKS
Method: Biomass Power
Output: 75,000kW (rated)

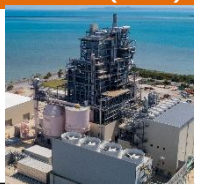
Saiki Power Plant (FIT)

Start of Operation: Nov 2016
Location: Saiki City, Oita
Fuel: PKS
Method: Biomass Power
Output: 50,000kW (rated)



Nakagusuku Power Plant (FIT)

Start of Operation: Jul 2021
Location: Uruma City, Okinawa
Fuel: PKS, Wood Pellet
Method: Biomass Power
Output: 49,000kW (rated)



Tosa Power Plant (FIT)

Start of Operation: Jun 2013
Location: Kochi City, Kochi
Fuel: PKS
Method: Biomass Power
Output: 20,000kW (rated)

Sakaide Power Plant (FIT)

Scheduled Start of Operation: FY2025
Location: Sakaide City, Kagawa
Fuel: PKS, Wood Pellet
Method: Biomass Power
Output: 75,000kW (rated)

ENERGY RESOURCE EXCHANGE