



Ministry of Industry and Trade



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On behalf of:



Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

of the Federal Republic of Germany



Climate Protection through Sustainable Bioenergy Markets in Viet Nam (BEM)

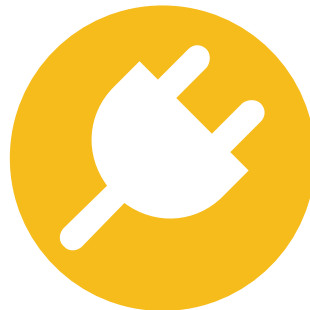
Tobias Cossen

MOIT/GIZ Energy Support Programme

Context

2009

Start of the German
development cooperation
with a focus on wind energy



July 2013

(G2G consultations)

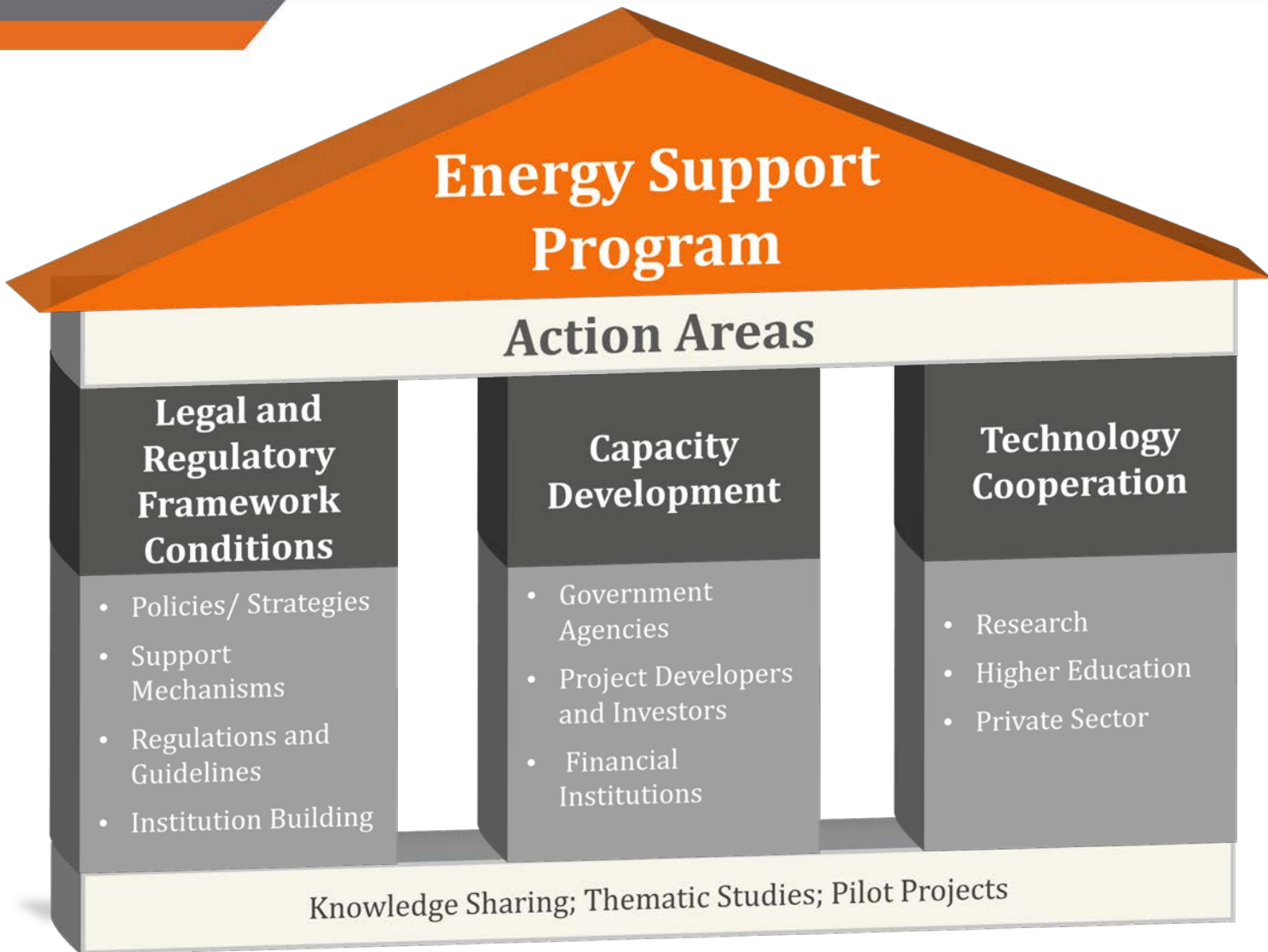
Energy becomes one of three
priority areas of Vietnamese-
German cooperation

Now

Mutually agreed strategic
areas of cooperation:
Renewable Energy and Energy
Efficiency



Approach of the Energy Support Programme (ESP)



ESP Cooperation Partners

Co- and parallel financing



Key national partners

- **Ministry of Industry and Trade**
 - Electricity & Renewable Energy Authority (EREA)
 - Department of Energy Efficiency and Sustainable Development (DEESD)
 - Electricity Regulatory Authority of Viet Nam (ERAV)
 - Viet Nam Electricity (EVN)
- **Vietnam Wind Power & Sugar Associations**
- **Research & Academic Institutions**
- **VIET, GreenID, etc.**

Key international partners



KFW



Energy Situation in Viet Nam

From 1990 to 2015

From 2015 onwards

Viet Nam's energy success story

- High electrification rate (98%)
- Installation of ca. 39 GW of power generation (40% hydro)
- All investments publically funded

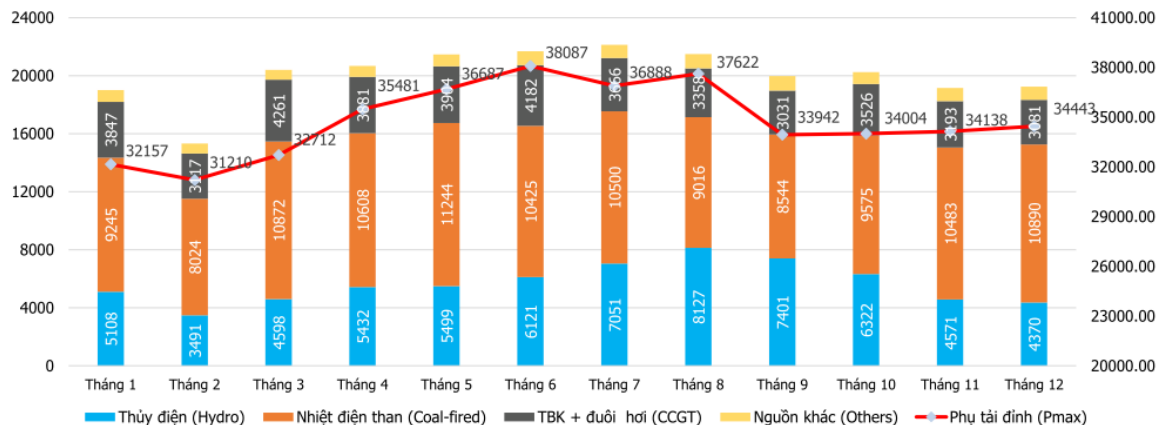
Viet Nam is still facing many challenges

- Persistent gap between economic and electricity growth rate
- Energy security and environmental/health concerns
- Public investments will not suffice to address future energy infrastructure requirements

Energy Situation in Viet Nam

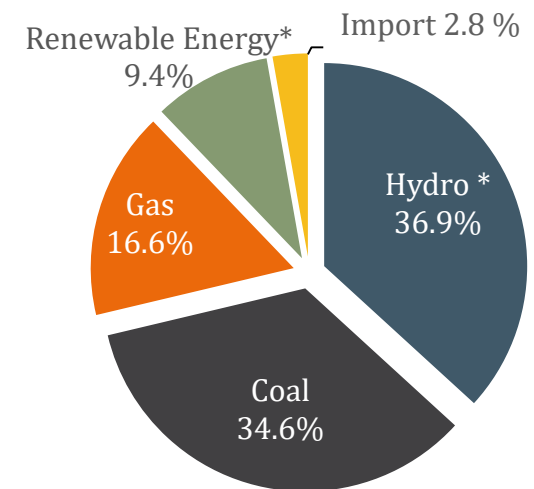
Installed Generation Capacity (Mid 2019)

SẢN LƯỢNG, TỶ TRỌNG HUY ĐỘNG NGUỒN VÀ CÔNG SUẤT ĐỈNH CÁC THÁNG TRONG NĂM
Power generation, production share and peak demand in 2019



240.81 TWh

Electricity Production (2019)

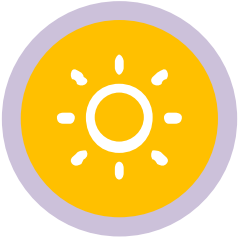






55 GW

* Including small hydro power

Data Source: EVN NLDC (2019)

Renewable energy – incentive support mechanism

Solar	Wind	Biomass	Small Hydropower	MSW
				
US¢ 7.09/kWh FiT for ground-mounted	US¢ 8.5/kWh FiT for onshore	US¢ 7.03/kWh FiT for combined heat and power projects	AVCT	US¢ 7.28/kWh FiT for Landfill
US¢ 7.69/kWh FiT for floating solar	US¢ 9.8/kWh FiT for offshore	US¢ 8.47/kWh FiT for non-combined heat and power projects		US¢ 10.05/kWh FiT for Incineration
US¢ 8.38/kWh FiT for solar rooftops system			By year, by season, by region	
20 years PPA	20 years PPA	20 years PPA	20 years PPA	20 years PPA

Note: FIT stands for **Feed-in tariff**, AVCT stands for **Avoided cost tariff**. The AVCT is calculated annually based on the production cost of the most expensive power plant in the power system.

Key policies and support mechanisms of biomass energy

Revised National Power Development Plan VII (Revised PDP VII) for the 2011-2020 period with a vision to 2030

- Next to capacity targets specified for wind and solar, the share of electricity **produced from biomass sources** is expected to reach approx. 1% in 2020, **1.2% in 2025 and 2.1% in 2030.**

- Further development of biomass power sources through applying **cogeneration** method in sugar mills and food processing plants as well as co-combustion of biomass and coal in coal-fired power plants, etc.

The next PDP, PDP 8, is currently being developed for the period of 2021-2030 with the vision to 2045.

The Viet Nam Renewable Energy Development Strategy (VREDS) up to 2030 with a vision to 2050

- **Gradually increase the rate of access to clean energy and electricity sources** by local people in rural, mountainous, remote and border areas as well as islands.

- **RE production targets** including big hydro power will contribute 38% of total electricity production in 2020 and 43% in 2050. Solar power will play a major role in the RE share (20% in 2050) as well as **bioenergy (8.1% in 2050)** and wind (5% in 2050).

Decision number 24/2014/QĐ-TTg by the Prime Minister

- Feed-in tariff (FIT) of 5.8 UScents/kWh applicable to **grid-connected biomass combined heat and power (CHP)** projects and an avoided cost tariff (AVCT) applicable to grid-connected biomass power projects.

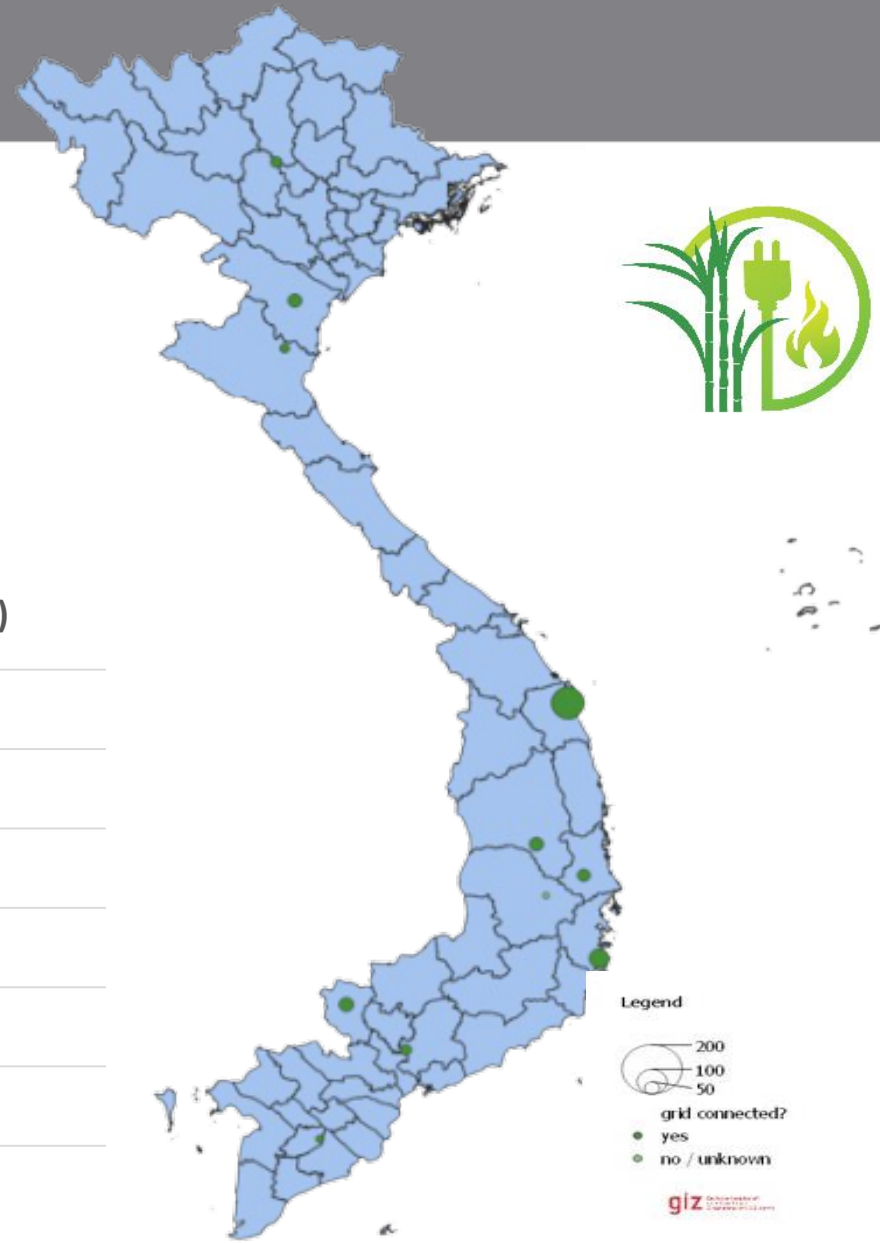
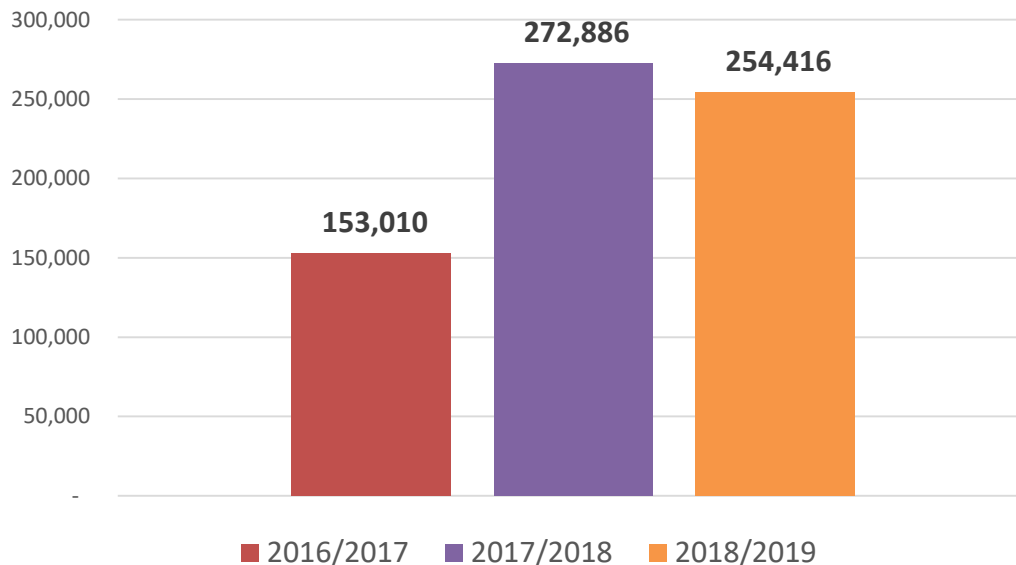
Decision No. 08/2020/QĐ-TTg by the Prime Minister

- FiT of 7.03 US cents/kWh applied for **co-generation heat power** project; while the FiT of 8.47 US cents/kWh applied for **other types of biomass** projects.

Bioenergy in Vietnam

- There are **11** bioenergy plants in operation with a **total installed capacity** of **391.1 MW**. Thereof, only **197 MW** is generation capacity (**grid connected**).

Electricity production to grid from sugar mills (MWh)



Barriers to biomass energy development in Viet Nam

- Insufficient knowledge on state-of-the-art technologies and respective technology transfer partnerships to catalyze market development.
- Capacity shortage of provincial governments for timely planning and licensing procedures.
- Investors' lack of access to information and qualified experts to evaluate bioenergy projects' full potential and feasibility.
- Inadequate capacity of financial institutions in evaluating biomass energy projects; lack of access to financing mechanisms.

Technological
barriers

Policy and
institutional
barriers

Database and
information-
sharing barriers

Economic and
financial barriers



BEM project structure and objectives

About BEM project



Objectives

The aim of BEM is to improve the preconditions for a **sustainable use of biomass for electricity and heat generation** in the country.



Time Frame

April 2019 – March 2023



Funding Agency

German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) through its International Climate Initiative (IKI)



Partners

- Line Agency: MOIT
- Responsible Department: EREA

Expected results of BEM



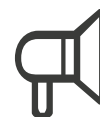
Legal and
Regulatory
Framework



Capacity
development



Facilitation of
**access to local
loan financing**



Technology
cooperation

1

Facilitate and support adjustment to the **regulatory framework on planning and licensing** of biomass energy projects, in particular on provincial level.

2

Provision of **capacity building to private sector companies** on the design and development of modern biomass energy investment projects.

3

Provision of technical support and instruments for the **appraisal and financing** of biomass energy investment project by local financing institutions, in particular local commercial banks.

4

Support and enhance **technology cooperation and networks** between Vietnamese and international enterprises, research and development institutions and universities on the use of biomass resources for electricity and heat generation.

Action area 1: Legal and regulatory framework

Support to the release of decision and circular for biomass and biogas FIT, integration of bioenergy in PDP8

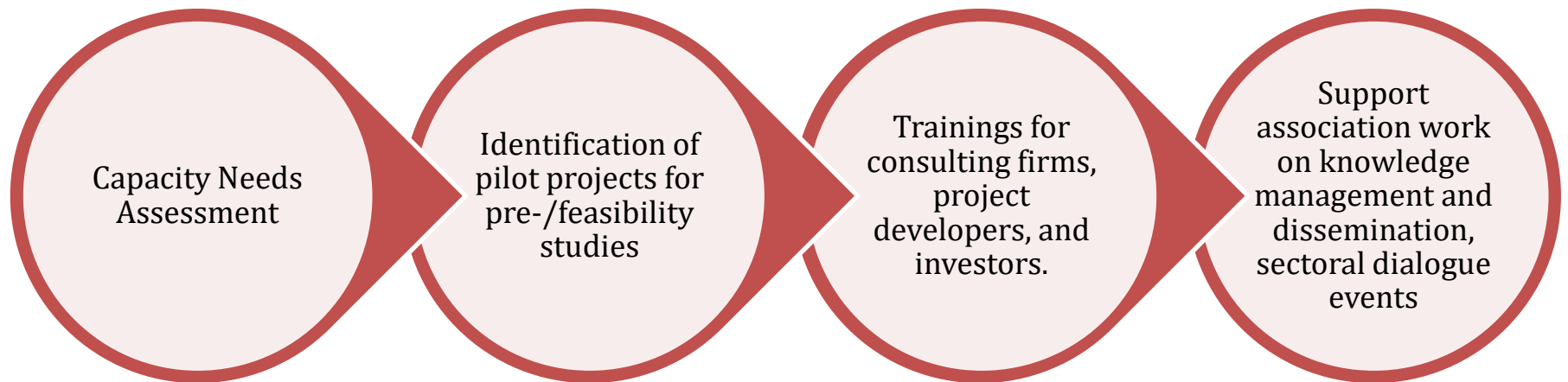
Training for provincial authorities on bioenergy planning.

Contribute to establish the standard of biomass power plants.

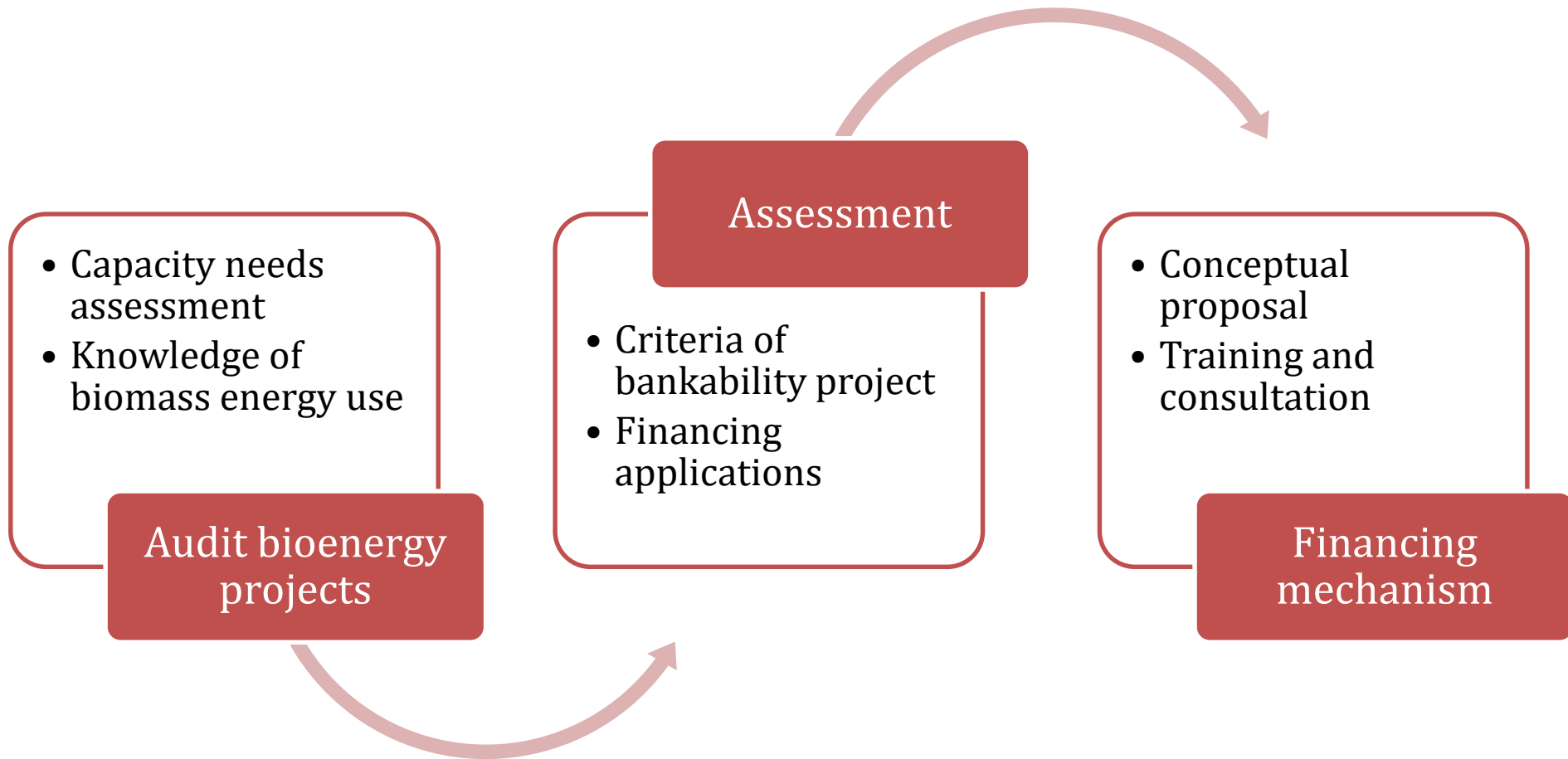
Development of an environmental impact assessment and approval instrument of bioenergy investment projects.

Facilitate the regulatory framework on planning and licensing of bioenergy projects.

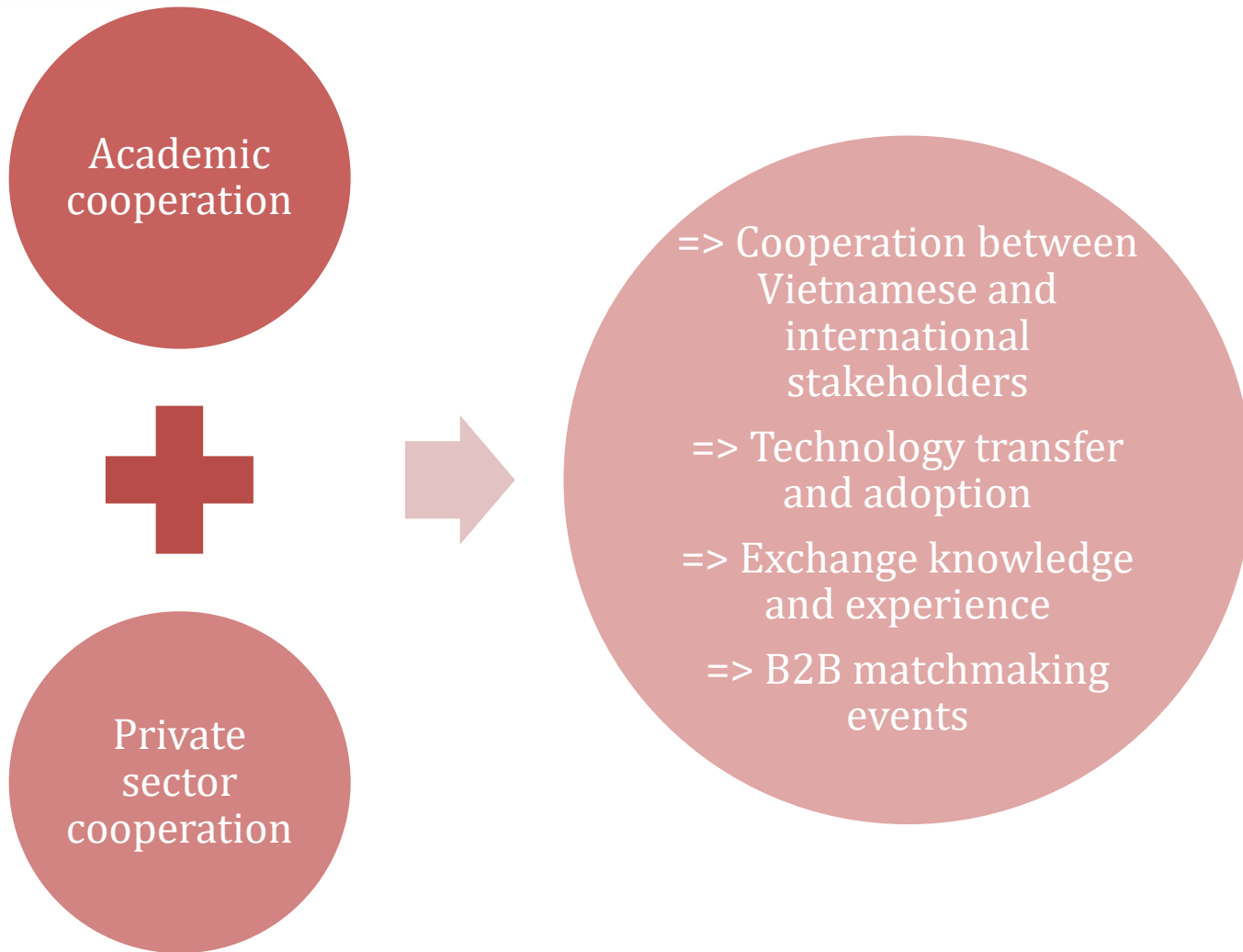
Action area 2: Capacity development



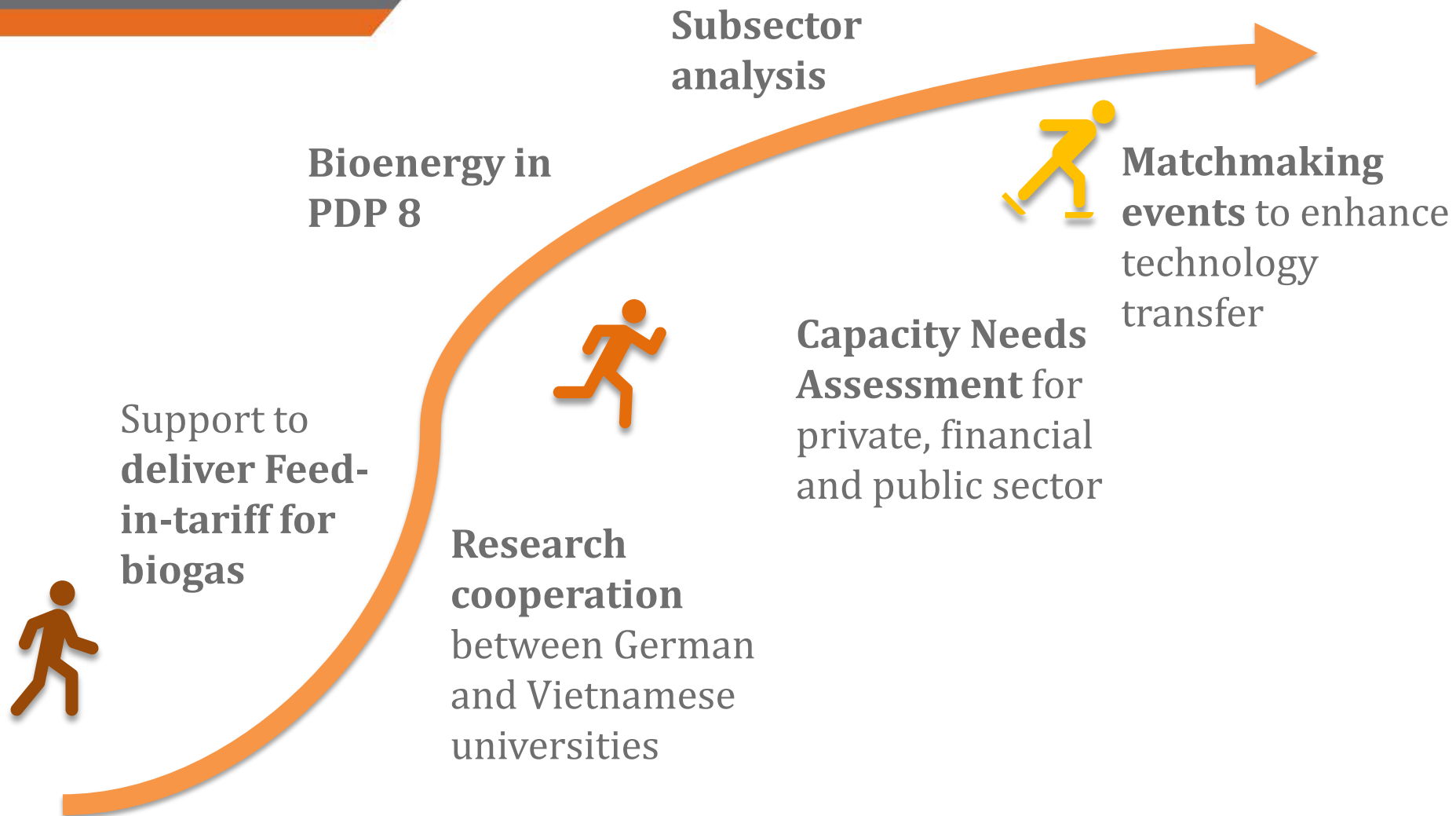
Action area 2: Financing of bioenergy project



Action area 3: Technology cooperation



Selected activities in 2020



An overview about the structural approach



Perspectives for stakeholders

We offer support to plan and implement bioenergy investment projects through:

- ✦ ...facilitating technology cooperation
- ✦ ...financing pre-/feasibility studies
- ✦ ...provide training and study tours to obtain knowledge and state-of-the-art technology
- ✦ ...working with business associations
- ✦ ...advising commercial banks on the development of criteria for assessing the bankability of these projects
- ✦ ...facilitating sector dialogues, matchmaking events
- ✦ ...organizing trainings and study trips for consulting firms, project developers, investors and financial institutions
- ✦ ...*and possibly more!*



Thank you!

Tobias Cossen

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Further information:

<http://gizenergy.org.vn/en/>

Vietnam Energy Partnership Group

<http://vepg.vn/>





Selected literatures on Bioenergy in Vietnam

Up-scaling result for bioenergy development under MOIT/GIZ Energy Support Programme




Legal and
regulatory
framework

- **Feed-in-Tariff** for Biomass power project
- National and Provincial Biomass **Energy Planning**
- Biomass Energy Project **Development Guidelines**



Capacity
development

- **Theoretical and on-the-job trainings** for local firms on bioenergy **project development**
- **Training** on bioenergy for **project investors & banks**



Technology
cooperation

- **Sub sector analysis** of the **sugar and timber** industries
- **Project pipeline development** via pre-feasibility studies

Reports and information

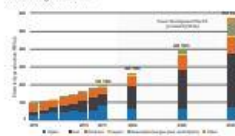
Biomass Energy Project Development Guidelines is a reference for project development in Vietnam which was introduced by the General Directorate of Energy – Ministry of Industry and with support from Renewable Energy and Energy Efficiency Project under the GIZ Energy Support Programme in Vietnam.



Climate Protection through Sustainable Bioenergy Markets in Viet Nam

The Energy Sector in Viet Nam

Viet Nam's fast-growing economy is the main driver for the rapidly increasing electricity demand throughout the country over the past years. Viet Nam's annual electricity production increased by more than twenty folds, from 64 TWh in 1990 to 146 TWh in 2017. The annual increase in this period was between 9-13%, almost twice as high as the GDP growth rate.



To facilitate this, the Vietnamese Government has promulgated key policies and support mechanisms on biomass energy development. According to the revised National Power Development Plan VII and the Renewable Energy Development Strategy, Viet Nam aims to increase its biomass energy share in power production substantially: 1% in 2020 to 2.1% in 2030 and to 4-1% in 2050. The Government issued already in 2015 the Circular 44/2015/TT-BCT to regulate the project development, methodology for an avoided cost tariff calculation and Standard Power Purchase Agreement for grid-connected biomass energy projects.

However, the installed capacity of biomass energy in Viet Nam is only 352 MW. Capacities for an increased use of biomass energy are still lacking as follows:

- Investors' lack of access to information and qualified experts to evaluate biomass energy projects' full potential and feasibility



Biomass Energy Project Development Guidelines

Technical Assistance for General Directorate of Energy
Ministry of Industry and Trade

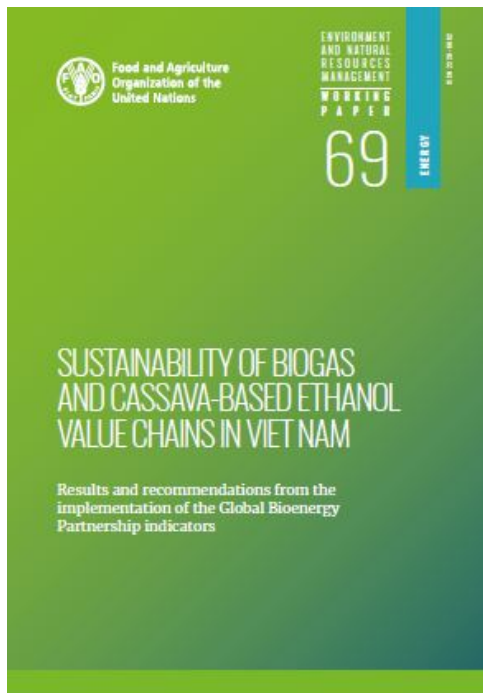
Climate Protection through Sustainable Bioenergy Markets in Viet Nam (BEM) Fact files is the product of the Climate Protection through Sustainable Bioenergy Markets in Viet Nam project (BEM).

Reports and information



Sweetening the Deal for Biomass Energy in Viet Nam's Sugar Industry is an insight brief builds on the results of the pre-feasibility studies conducted in 2017 by the Global Green Growth Institute and GIZ for five sugar mills.

**Sweetening the Deal for Biomass Energy
in Viet Nam's Sugar Industry**
Insight Brief 01/Viet Nam/November 2018



The Food and Agriculture Organization of the United Nations and Viet Nam Academy of Agricultural Sciences, on behalf of the Ministry of Agriculture and Rural Development, launched the report on Sustainability of Biogas and Cassava-based Ethanol Value Chains in Viet Nam

Biogas application in biodegradable organic waste treatment

June 2020

Kiều Phương – WATREC's Country Representative
0903 40 1970 – phuong.kieu@outlook.com



Circular Economy in waste management

- ◉ Reduction of landfilling
- ◉ Reuse and refining of materials
- ◉ Recycling of nutrients for soil
- ◉ Production of RE (from RDF and biogas)
- ◉ Safe and hygienic treatment of waste and leachate
- ◉ Reduction of emissions.



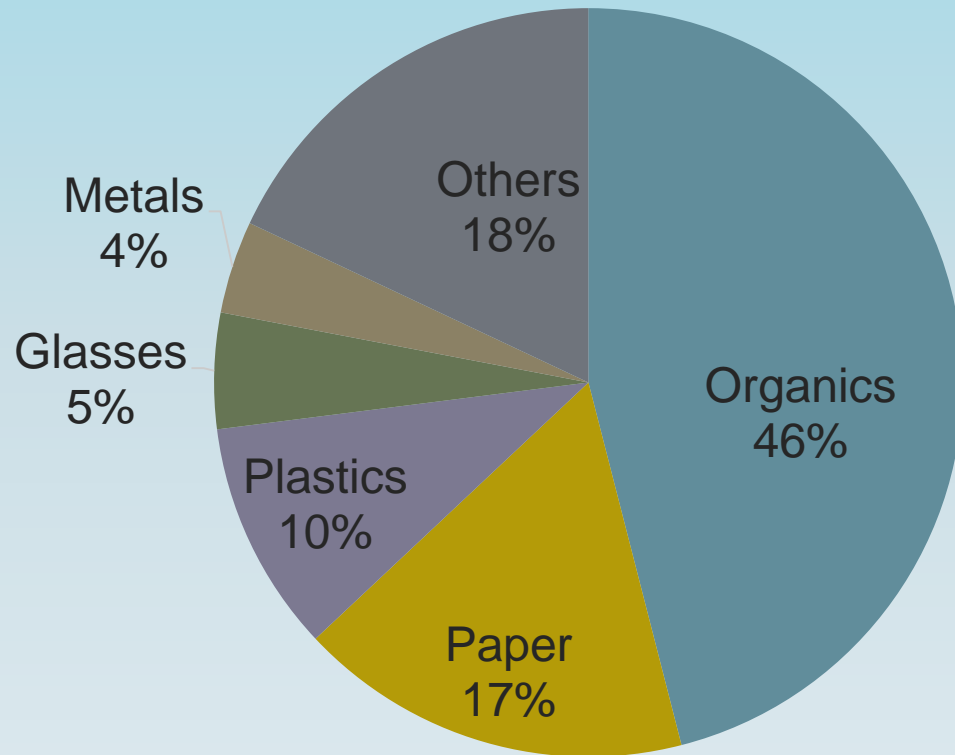
Domestic waste >< Income levels

Income	Organics	Paper	Plastics	Glasses	Metals	Other
Low	64	5	8	3	3	17
Average	59	9	12	3	2	15
> Average	54	14	11	5	3	13
High	28	31	11	7	6	17

Source: WB, Waste - Global Solid Waste Management, 2012

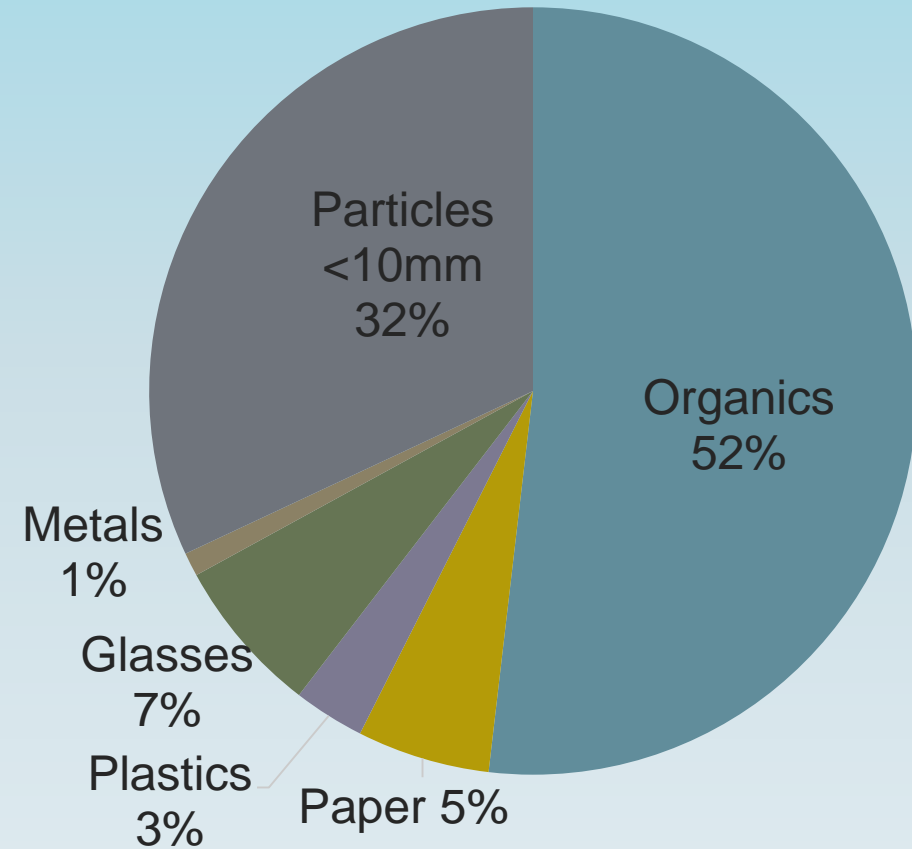
MSW Composition

Global



Source: Hoornweg & Bhada-Tata (2012)

Vietnam



Source: National Environmental Report 2016

Current status and future plan

- 200 mass incinerators and plants
- 35 composting plants
- No proved reliable technology; low energy recovery
- Low recycling, only 8% - 12%
- Serious pollution and lack of landfilling space.

Goals

- Waste are considered resources
- Source separation into 5 waste types
- 2022: Landfilling rate <20%*.

Vietnam MSW – Features and Solution

⦿ Features

- Mixed and wet
- Rich in organics
- Low caloric values
- High impurity and poor recyclability

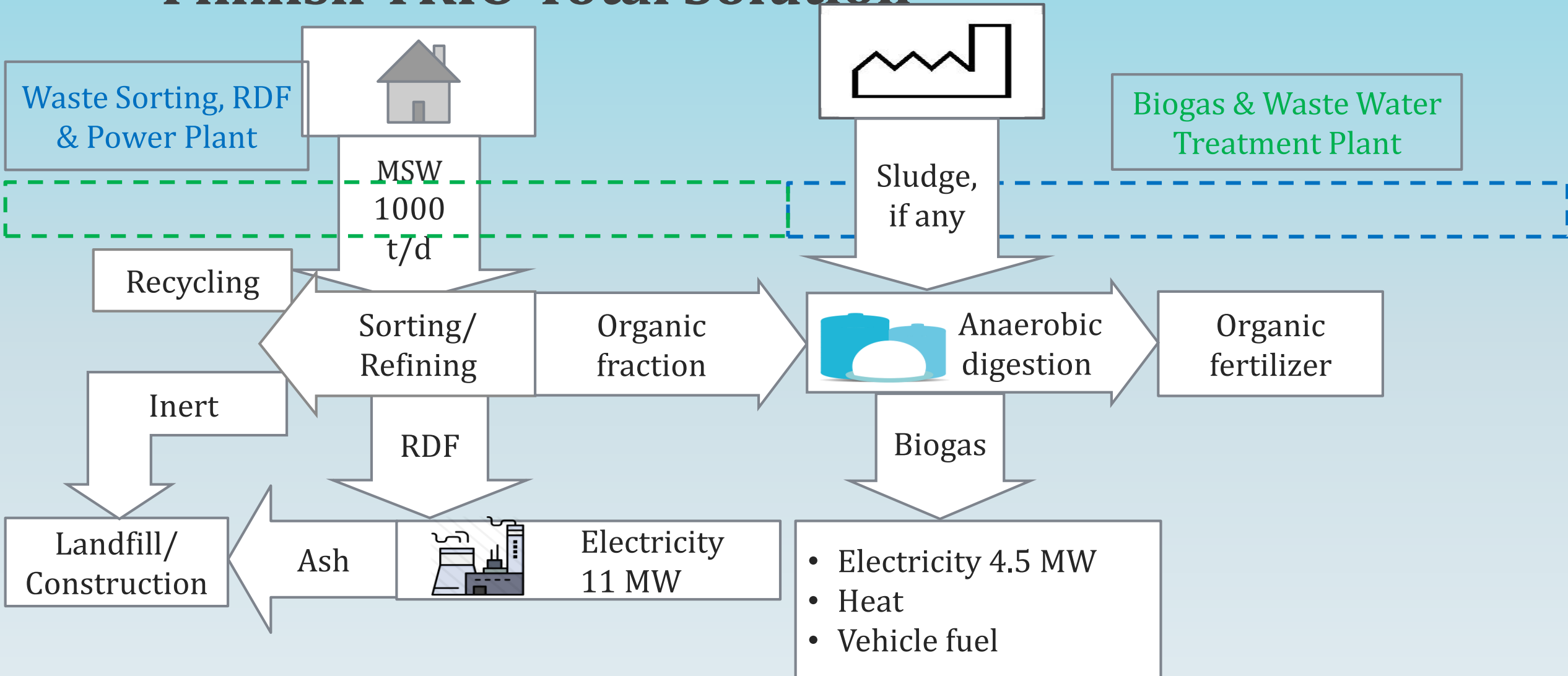
➡ Europe: Plants may locate far apart

➡ Việt Nam: Plants form a waste treatment complex under an investor.

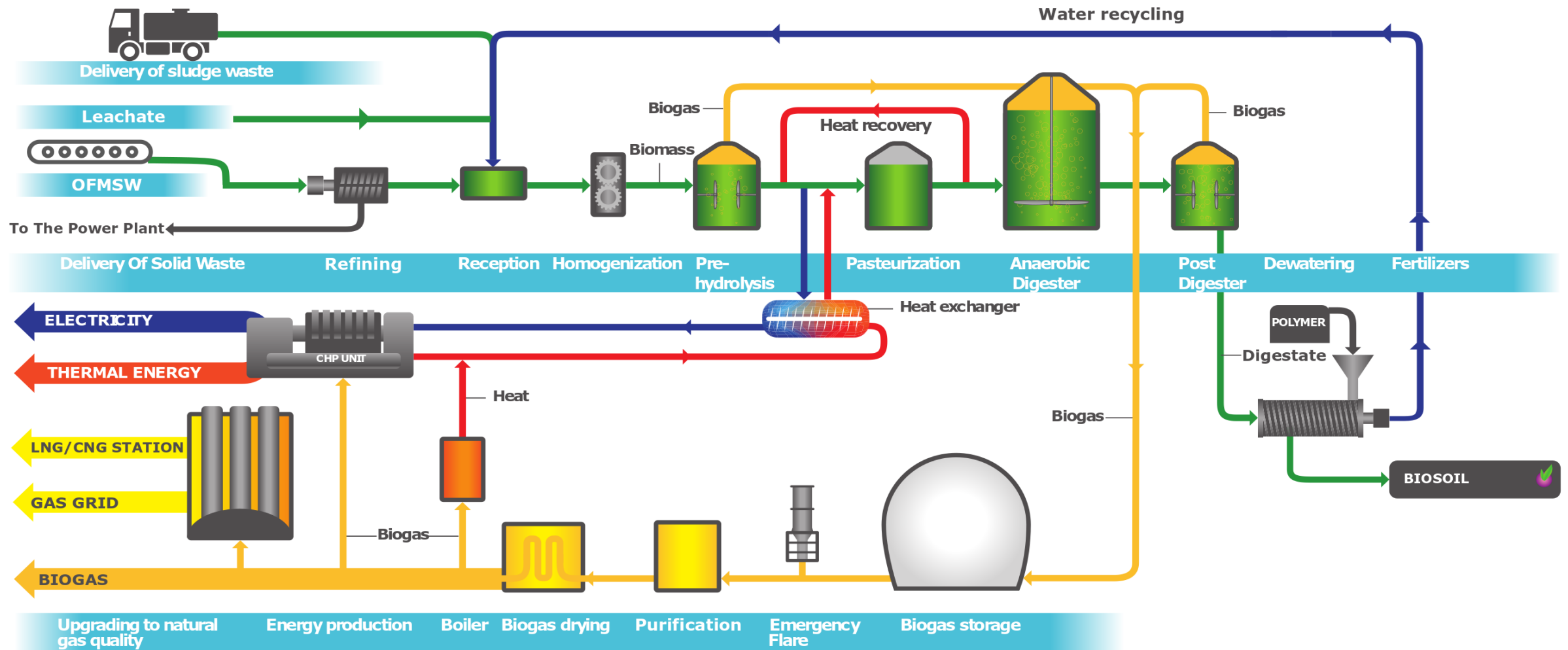
⦿ Solution

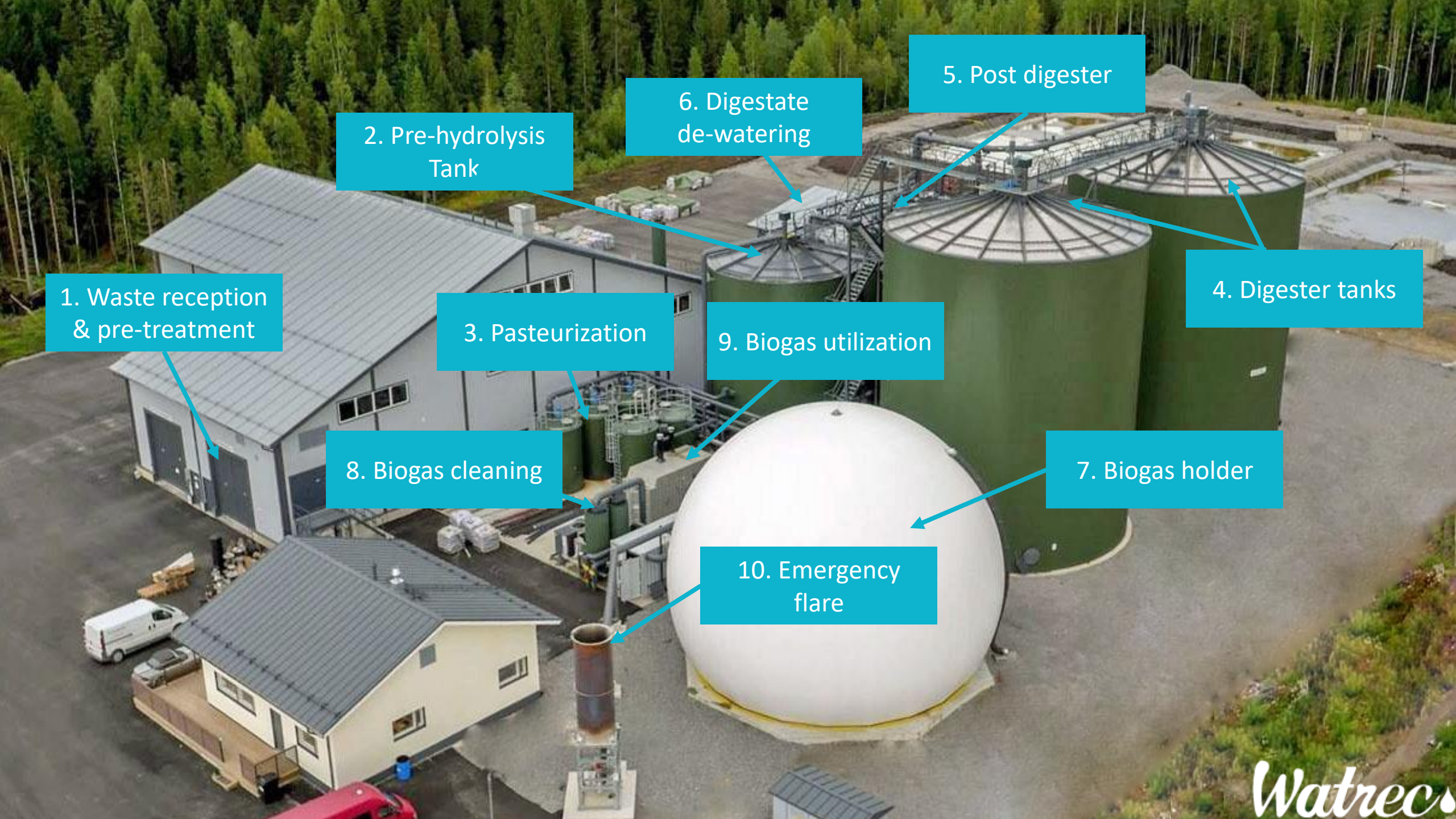
- Sorting waste on-site
- Producing RDF for higher efficiency
- AD for OFMSW + combustion for inorganics
- Recycling metals and nutrients

Finnish TRIO Total Solution



Watrec biogas process





1. Waste reception
& pre-treatment

2. Pre-hydrolysis
Tank

3. Pasteurization

8. Biogas cleaning

6. Digestate
de-watering

5. Post digester

4. Digester tanks

9. Biogas utilization

7. Biogas holder

10. Emergency
flare

Why is biogas technology needed?

- ◉ (OFMSW) is abundant
- ◉ Increase sorted combustible particles' CVs
- ◉ Maximize energy recovery from waste
- ◉ Integrate waste water & leachate treatment
- ◉ Combine septic tank & organic sludge treatment
- ◉ Make the most of recyclability
- ◉ Bring sustainable economic & environmental benefits.



Difference in incoming waste's quality?



Watrec biogas advantages

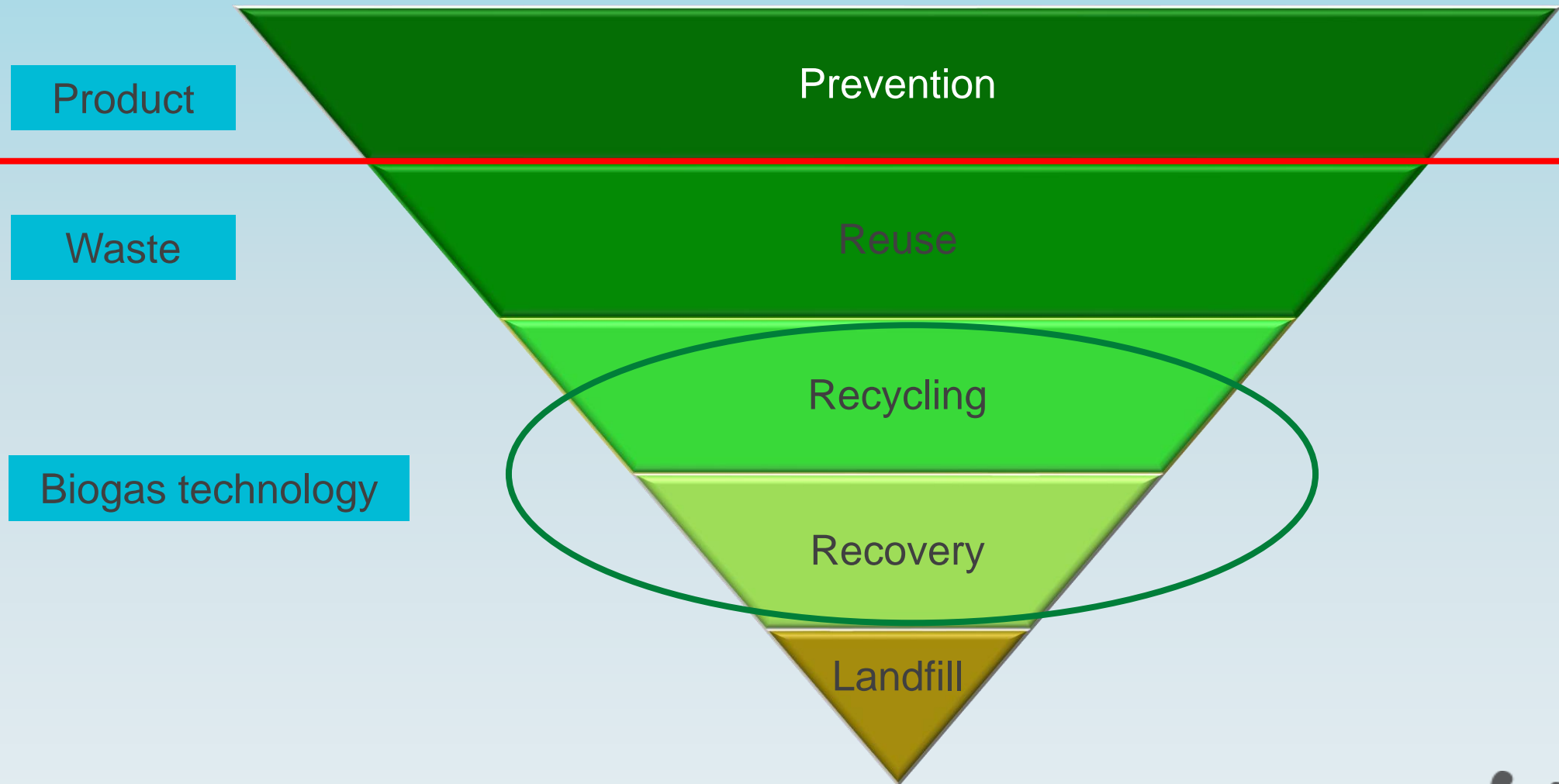
- ◉ Flexible reception (both liquid and solid)
- ◉ High biogas yield
- ◉ Safe and quality organic fertilizer
- ◉ Efficient odor and waste water handling
- ◉ Expandability
- ◉ Automatic and closed process
- ◉ Higher localization.



Challenges for biogas technology in Việt Nam

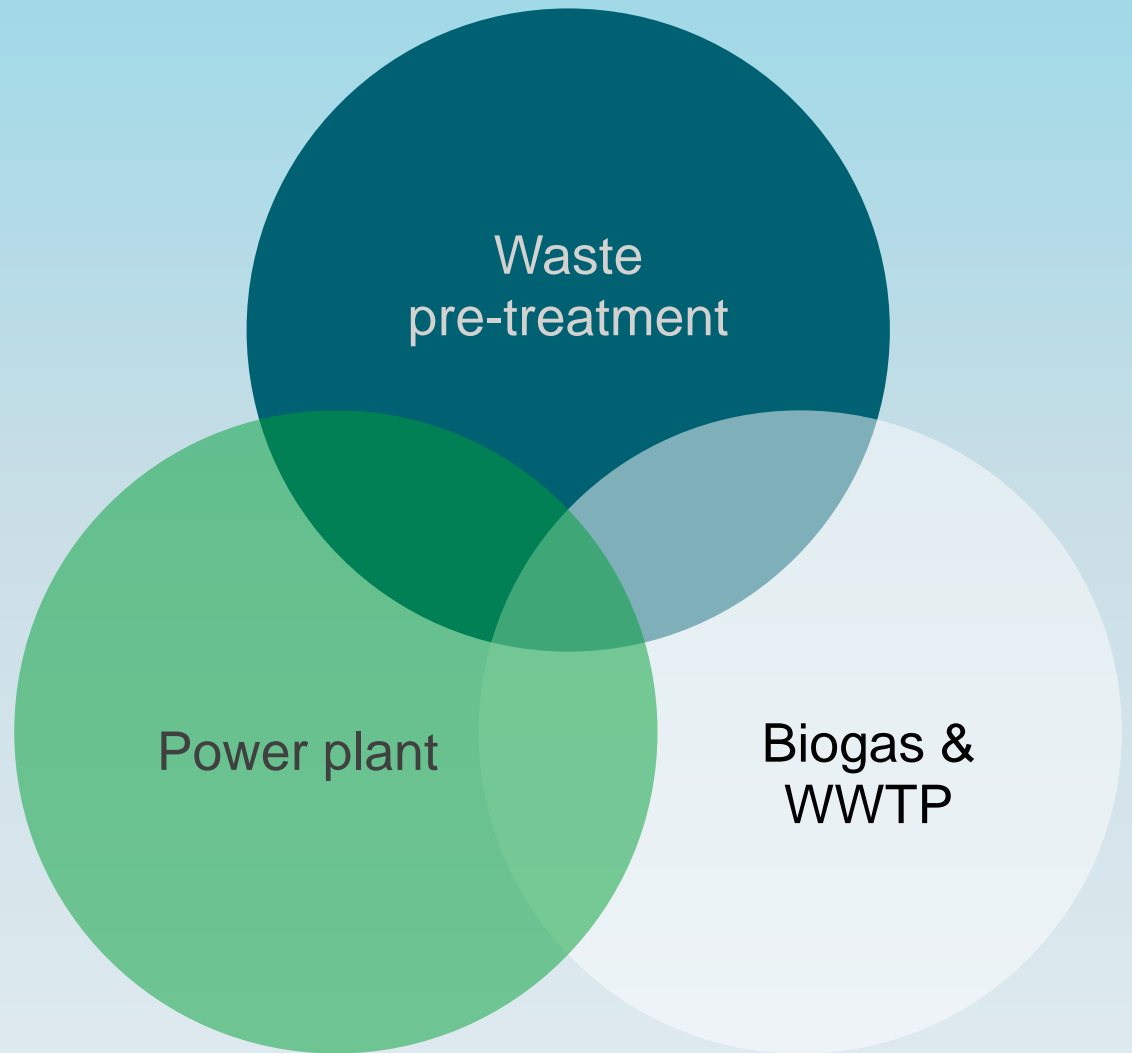
- ◉ No feed-in tariff available for biogas power
- ◉ Need to combine with Sorting, Combustion and other Recycling facilities
- ◉ Higher waste water treatment cost than in Europe
- ◉ Power production may be the most feasible option
- ◉ Profused but scattered resources
- ◉ Not much known yet in MSW handling
- ◉ Often compared or mixed up with traditional low cost biogas/ AD method.

EU – Waste management hierarchy

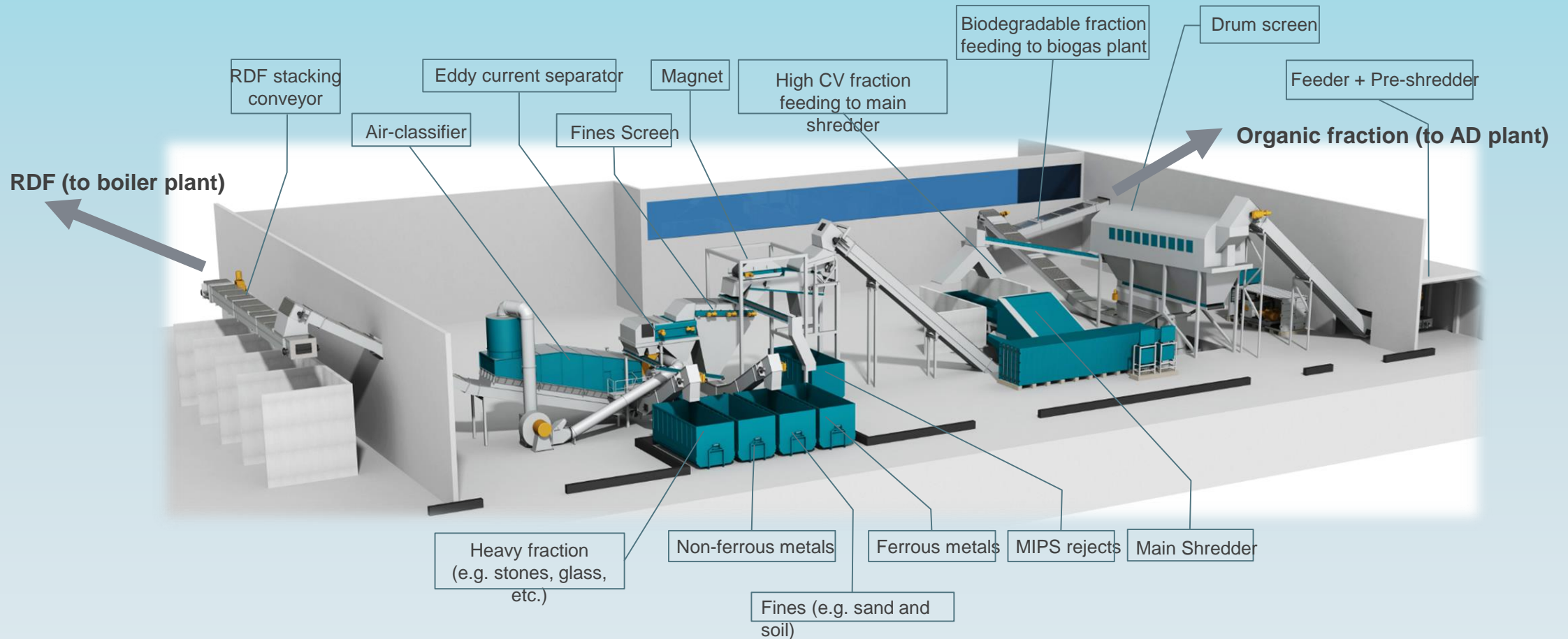


TRIO outstanding features

- ◉ Low rejects – High recycling
- ◉ Low emission and ash volumes
- ◉ Flexible reception of waste streams
- ◉ Maximized electricity production
- ◉ Lower Opex with integrated processes
- ◉ 25-30 lifetime – Reasonable Capex
- ◉ Proven technologies – Compact footprint
- ◉ Solution for present and future waste management.



Waste sorting and RDF production



CFB world-class efficiency

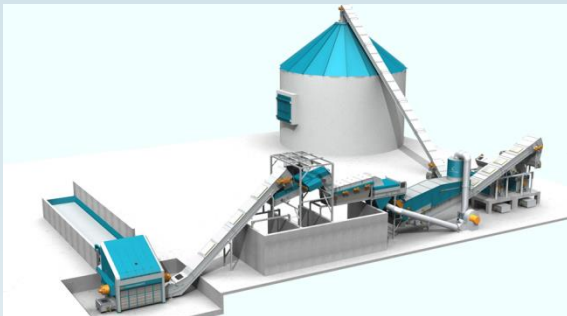


Full automation & high availability:

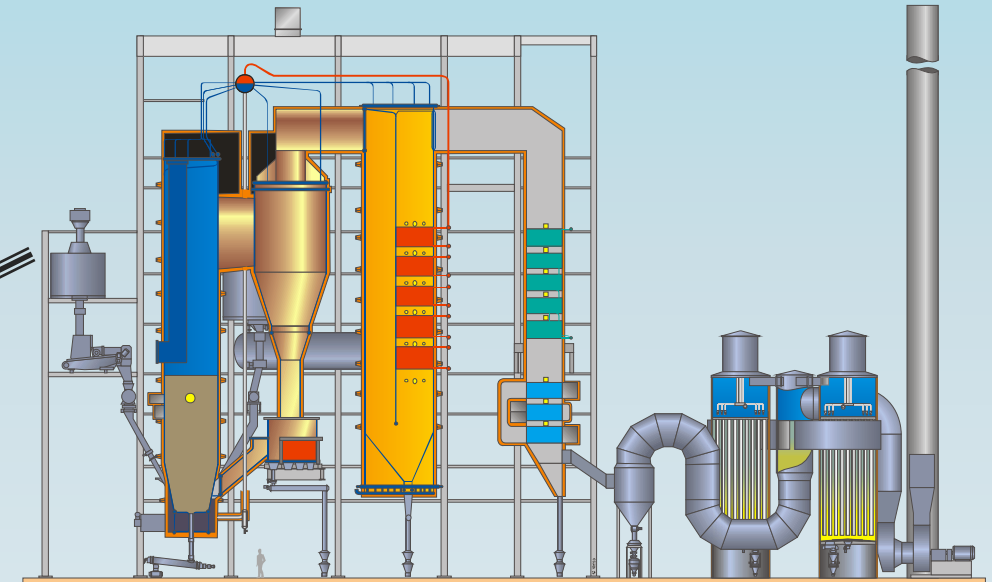
- Fuel feeding
- Emission control
- Power/heat production
- Remote service

Excellent fuel flexibility:

- RDF, REF, SRF
- Industrial wastes, tyres etc.
- Sludges
- Wood fuels, pellets agricultural wastes
- Coal, coal wastes



RDF



High power production:

- Corrosive resistant superheating (510 C, 75 bar)
- 14% more power compared to conventional plants

Low emissions:

- No SCR needed
- Reduced absorbent need due to chemical reactions in fluid bed

1 solution – 3 technologies

- ◉ BMH Technology (www.bmh.fi)
 - TYRANNOSAURUS® Waste to Fuel turning solid waste into RDF/SRF
 - >200 references globally
- ◉ Watrec (www.watrec.com)
 - AD process producing biogas and biosoil from organic waste
 - 8 biogas plants in efficient operation in Finland
- ◉ Valmet (www.valmet.com)
 - World leader in SRF firing boilers and power plants
 - >30 references worldwide.



Example, 1000 t/d MSW

- About 55% organics
- LHV as received 5 MJ/kg, moisture 65%
- Power net sales 15.5 MWe or 123 000 MWh/a
- Biosoil 120 000 t/a (value up to 30 €/t depending on local fertilizer demand)
- Opex 4.5 M€/a
- Capex 75 M€ (excl'd. site clearance, earthworks, road and power connections, etc.)
- Option to accept liquid waste (sludge from wastewater treatment, industry, septic tanks etc.)
- Option to increase the power net sales to app. 19 MWe.

TRIO Solution





VIỆN NĂNG LƯỢNG
INSTITUTE OF ENERGY



BIOENERGY IN VIETNAM

PAST - PRESENT - FUTURE

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Website: <http://www.ievn.com.vn>
Email: btt@ievn.com.vn

Hanoi,, 2020





CONTENT

1: Exploitation status

2: Development potential

3: Opportunities and challenges



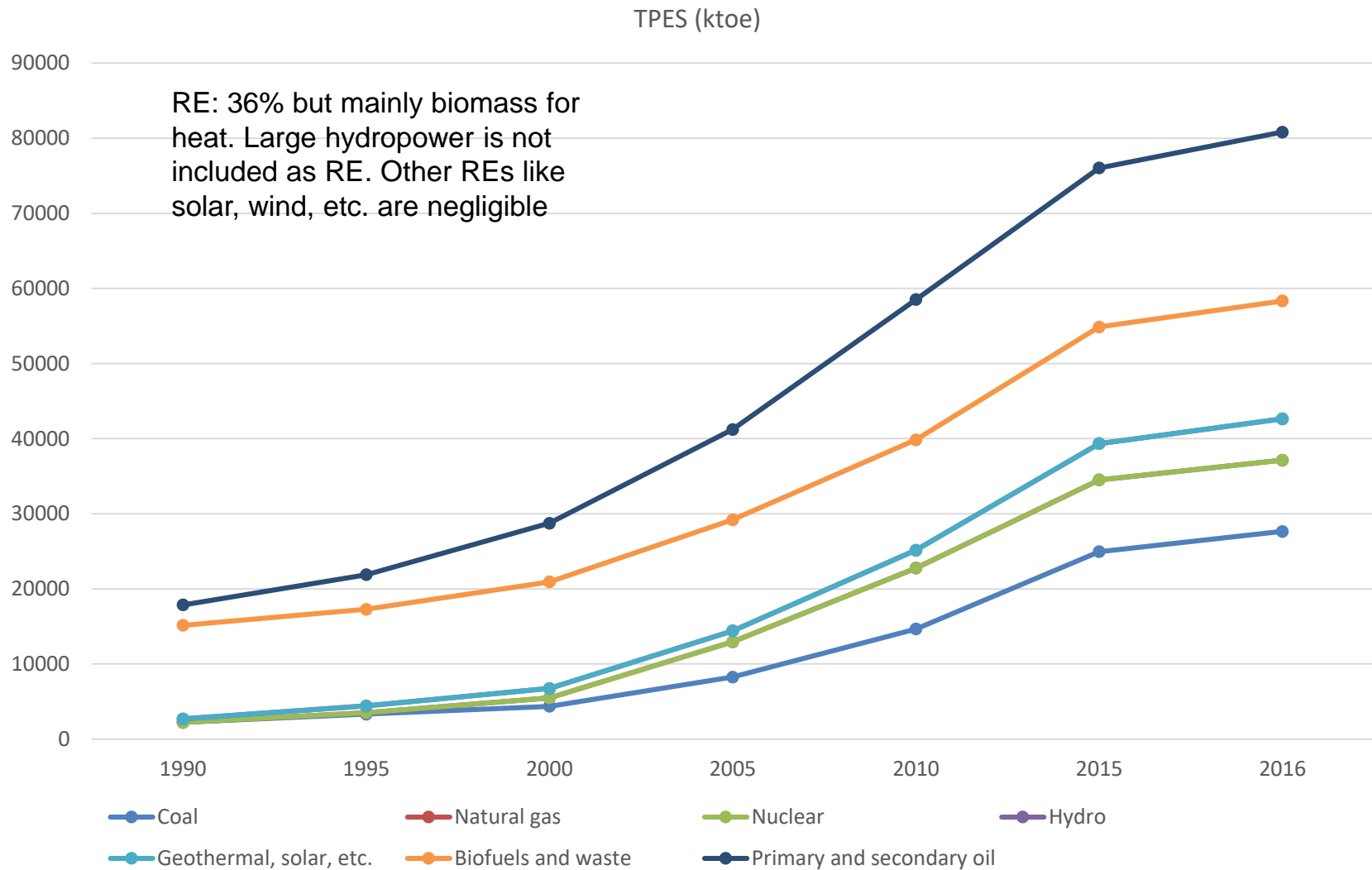
CONTENT

1: Exploitation status

2: Development potential

3: Opportunities and challenges

Primary Energy Supply in Vietnam





BIOMASS

Main types of biomass



Agricultural waste

- Rice husk and straw
- Corn waste
- Coffee waste
- Coconut shell
- Sugarcane waste (bagasse, tree-tops, leaves)
- Peanut waste
- Cashew skin
- Cassava root
- Others



Energy crops

- Energy crops (fast growth and high heating value)
- Fountain grass
- Others



Forest waste

- Fuelwood and wood fuel
- Bamboo
- Others (activated charcoal)



Others

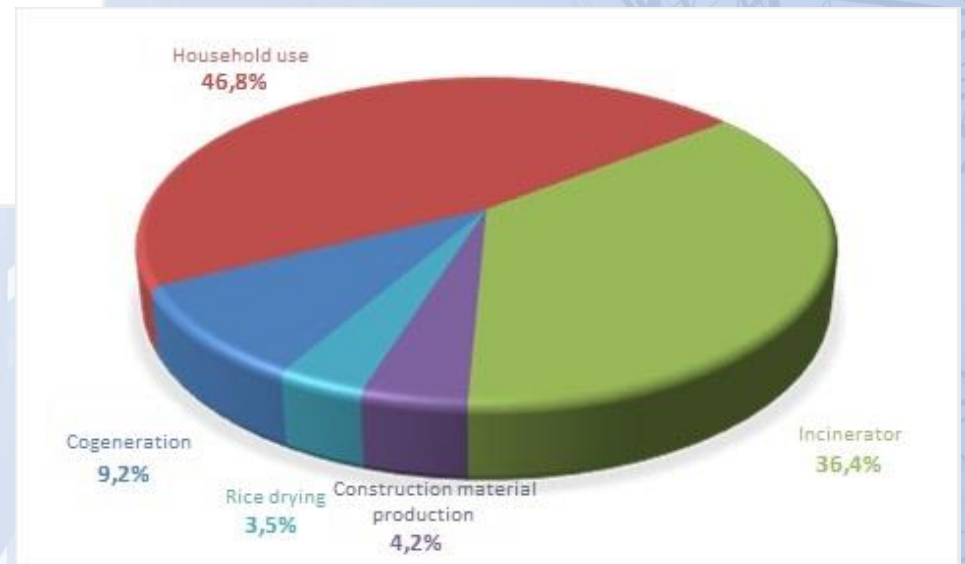
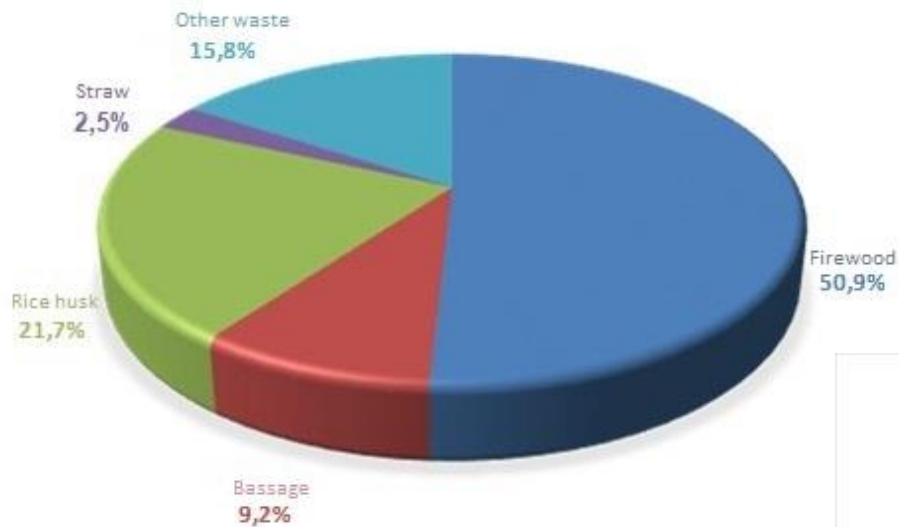
- Garden plants and indoor plants
- Timber
- Wood processing residues (shavings, sawdust)
- Scattered trees, etc.

Biomass energy consumption by type and use, 2016

Unit: MWh

Use	Type of Biomass					Total
	Firewood	Bagasse	Rice husk	Straw	Other waste	
Power generation						
Cogeneration	184,228	9,081,352	-	-	-	9,265,580
Heat generation						
Household use	30,663,746	232,759	2,706,914	2,490,908	11,170,863	47,265,190
Incinerator	18,722,031	-	13,264,416	-	4,773,180	36,759,627
Construction material production	1,790,213	-	2,419,040	-	-	4,209,253
Rice drying	-	-	3,487,005	-	-	3,487,005
Total	51,360,218	9,314,111	21,877,375	2,490,908	15,944,043	100,986,655

Biomass energy consumption type, 2016



Biomass energy consumption by use, 2016

The share of biomass power in the national grid, 2019

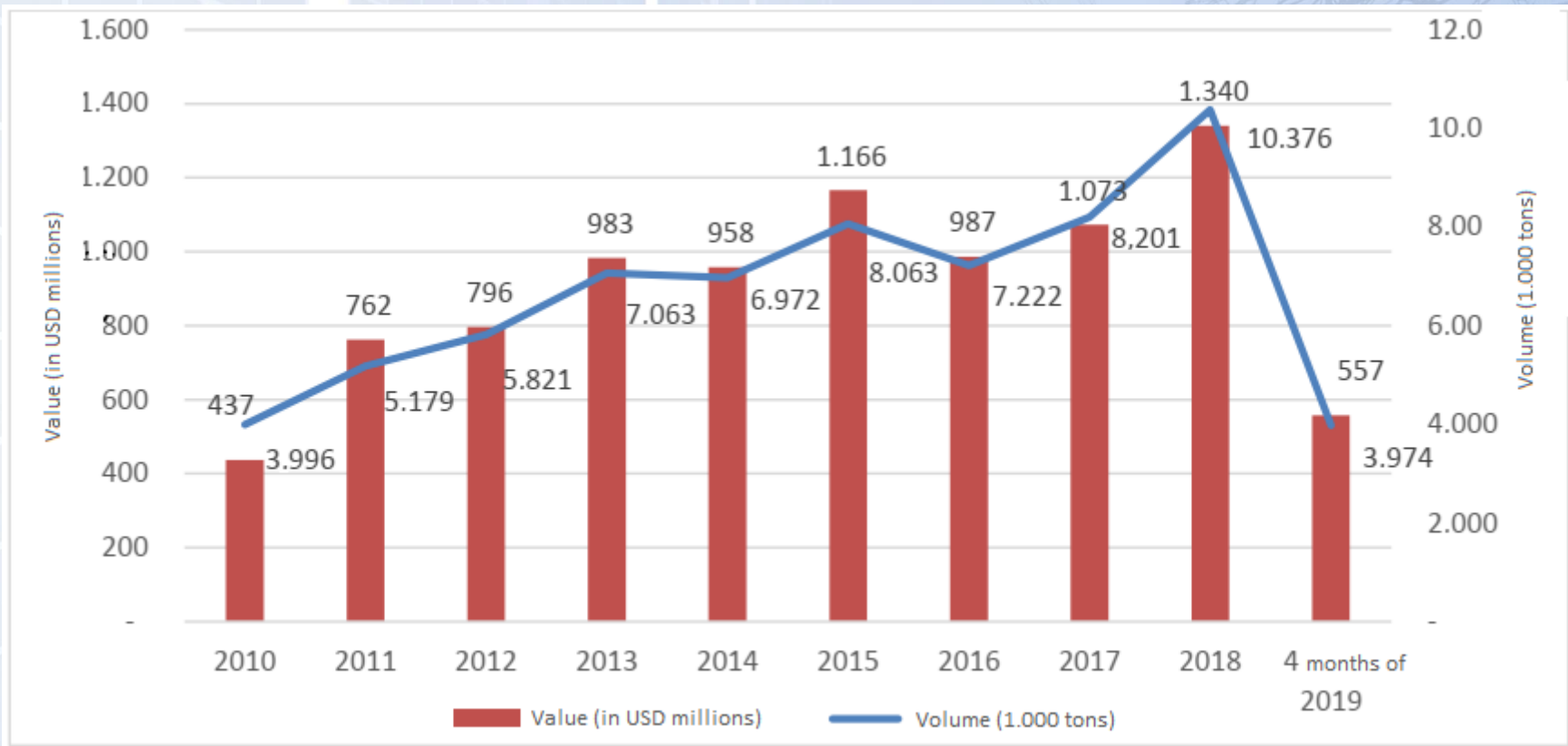
	Installed capacity (MW)	Commercial power (MWh)
Nationwide (*)	55,367	240,101,000
Biomass power (**)	522.27	346,999
Sugar refinery	499.77	346,999
Paper & pulp mill	22.5	0
The share of biomass power	0.94%	0.14%

Source:

(*): (EVNNLDC, 2020)

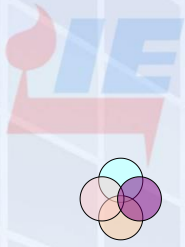
(**): Results of surveys and estimates, Institute of Energy research team, 2020

Woodchip Export



Vietnam's woodchip export volume

Source: General Department of Vietnam Customs, 2013 - 2019



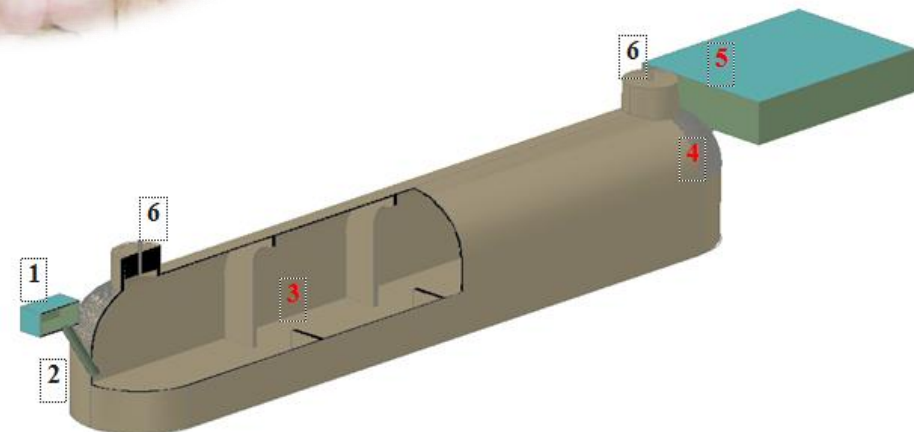
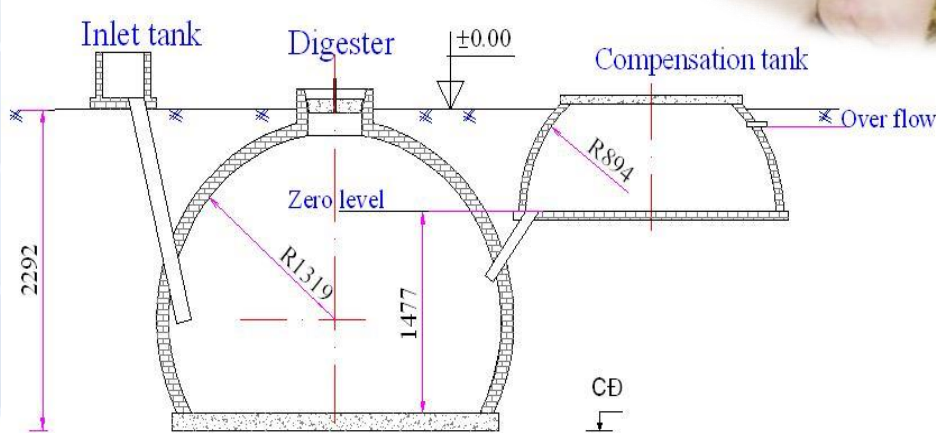
Biogas

Animal husbandry:

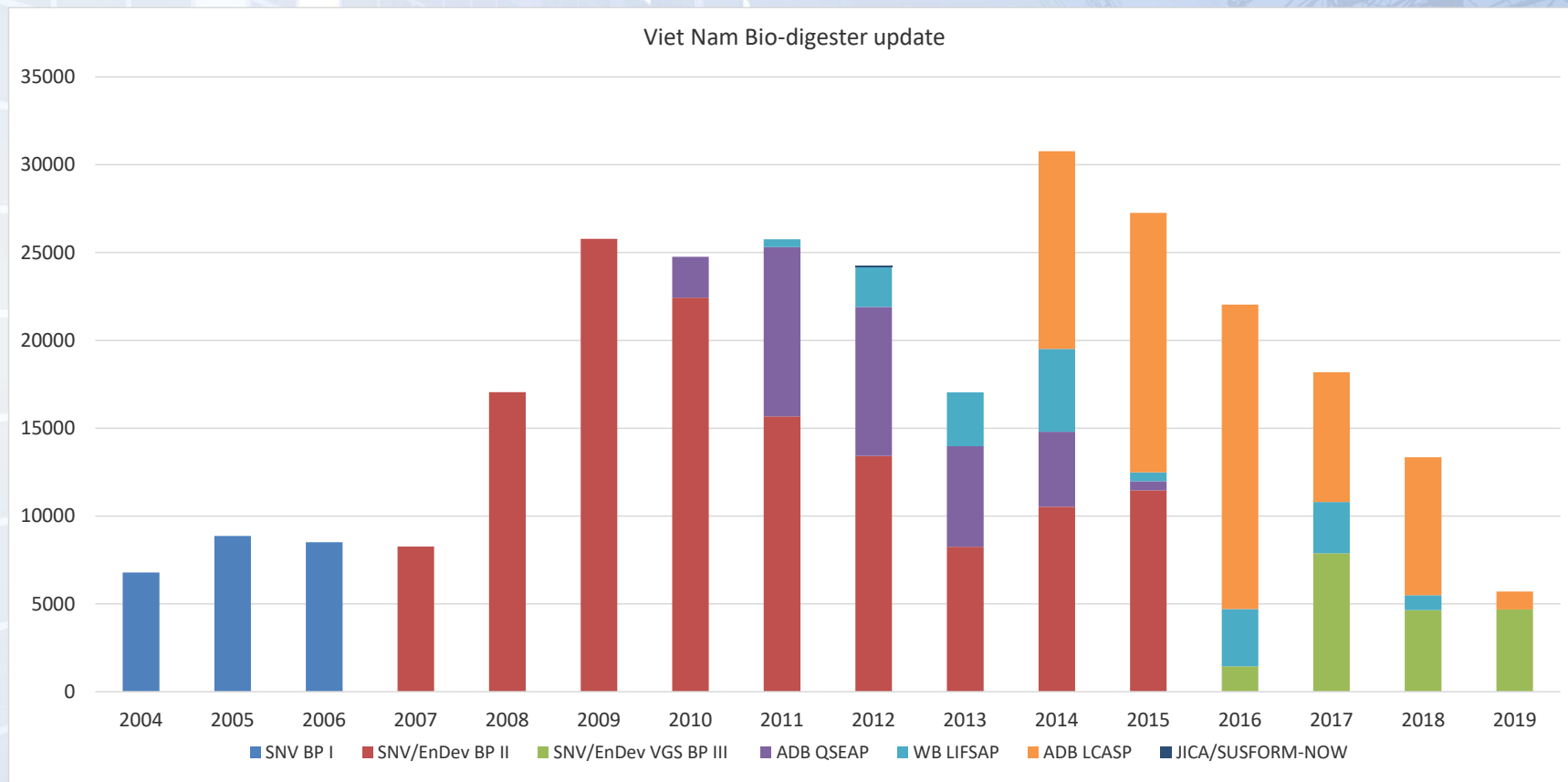
- Household level
- Farm level

Technology:

- Brick tank
- HDPE tarpaulin
- Composite, etc.



The number of bio-digesters at the household level



Source: SNV, 2020

Monday, June 8, 2020



EXPLOITATION STATUS

Source: SNV, 2020

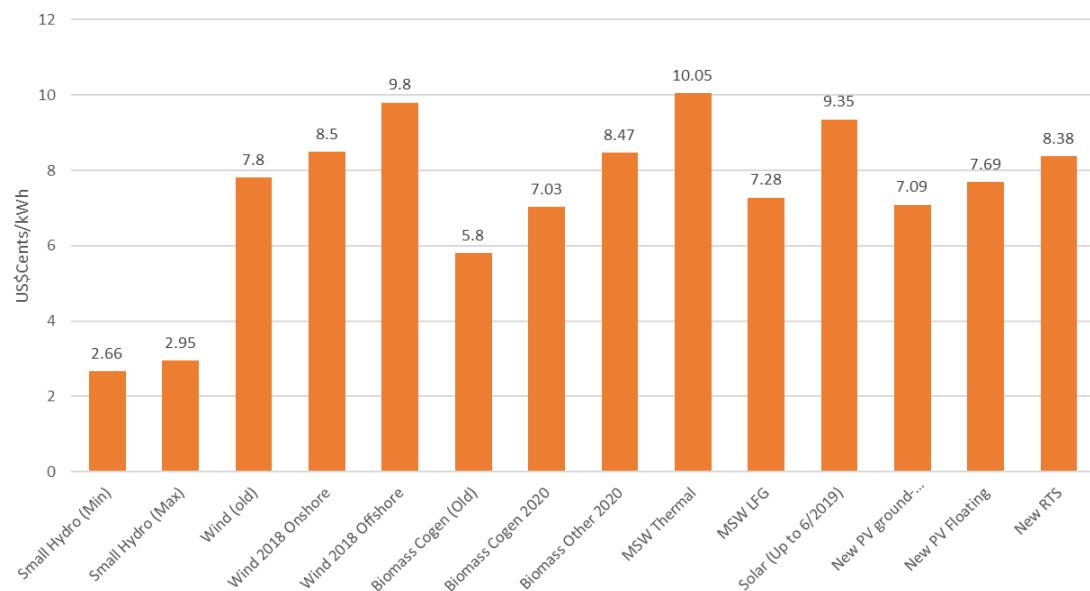


Power generation from biogas at household level

Incentives for bioenergy projects

Type of RE	Technology	Capacity limit	Tariff (VAT excluded) per Decision 08/QĐ-TTg
Biomass	Cogeneration	None	• 7,03 USc/kWh
	Other biomass	None	• 8,47 USc/kWh
Biogas	Decision unavailable		

Tariff for RE technologies in Vietnam





CONTENT

1: Exploitation status

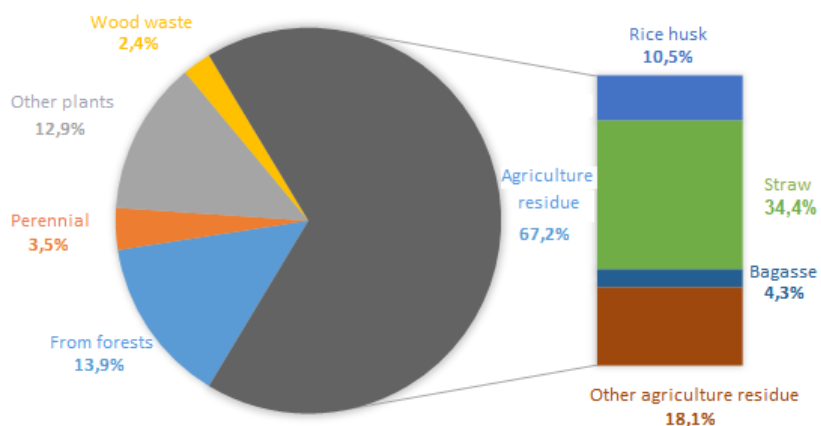
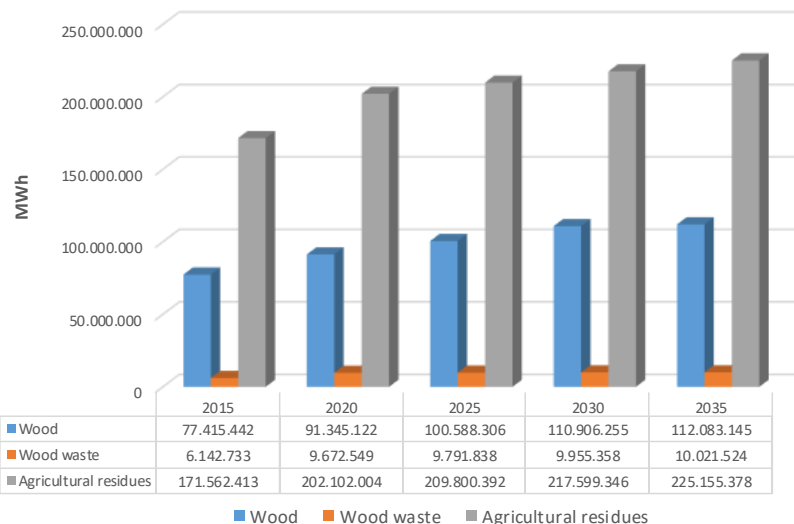
2: Development potential

3: Opportunities and challenges



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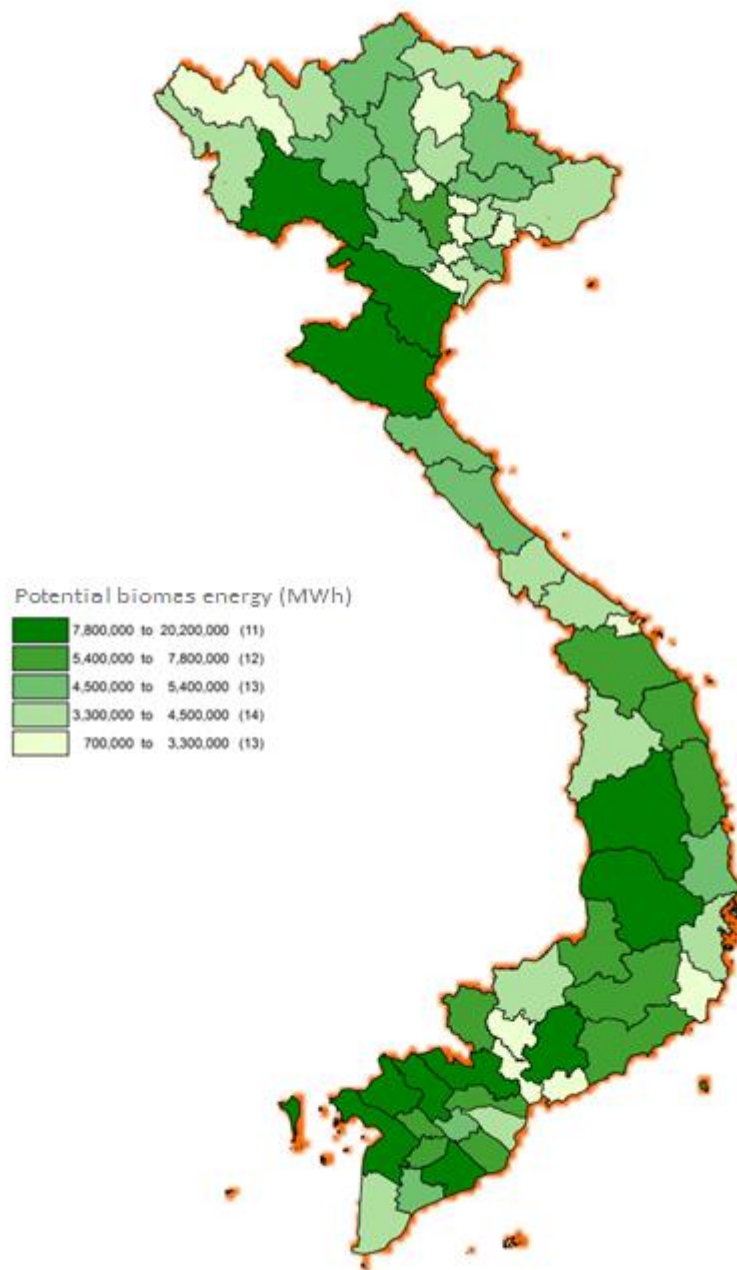
BIOMASS



Technical potential of biomass energy

Monday, June 8, 2020

DEVELOPMENT POTENTIAL



Potential for power generation from biomass

Biomass power plant	2020	2025	2030	2035
Rice husk	360	365	367	370
Wood-Firewood (*)	2,563	2,900	3,286	3,360
Bassage	470	470	470	470
Straw	1,295	1,305	1,314	1,324
Woodfuel (**)	1,300	1,300	1,300	1,300
Others (***)	360	360	360	360
Total	6,348	6,700	7,097	7,184

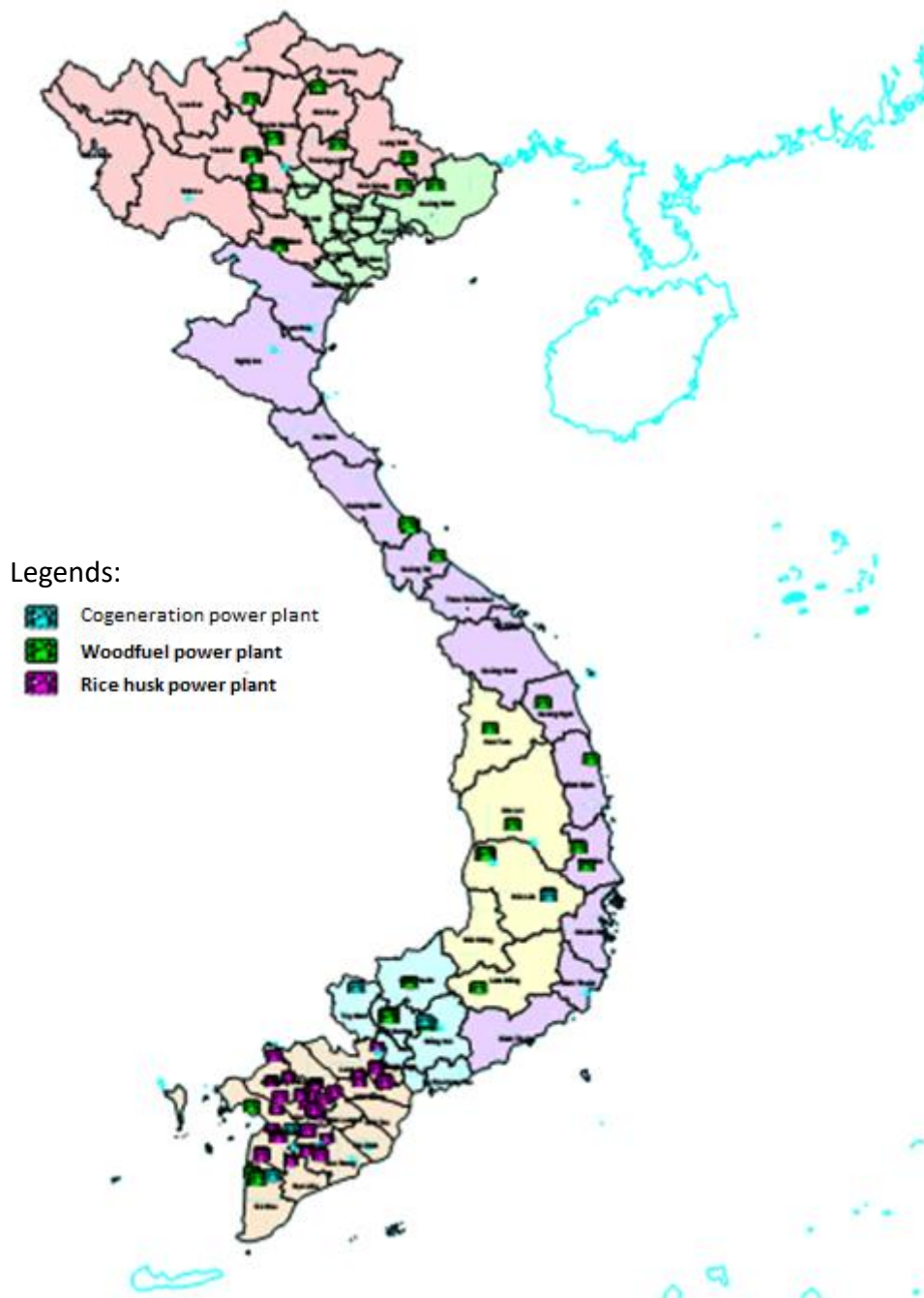
Notes:

(*) Wood/firewood-fired power plants run on sustainable sources of wood from trimming forest trees, industrial perennials, fruit trees, and their waste (from processing (sawdust, woodchips, etc.) and exploitation (branches, tree tops, stumps, etc.)).

(**) Woodfuel-fired power plants run on wood from planted forests - a supply of raw material for exported woodchip production.

(***) Others include those running on agricultural residues such as corncob and cashew skin, or a combination of multiple types of biomass

PIPELINED BIOMASS POWER PLANTS BY 2030





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BIOGAS

DEVELOPMENT POTENTIAL

Consider the possibility of power generation from biogas from:

- ▣ Animal husbandry and aquaculture: waste, etc.
- ▣ Agricultural product processing factories: waste from cassava processing factories, dairy processing plants, etc.
- ▣ Treatment of domestic solid waste using the anaerobic degradation technology, biogas production for power generation



CONTENT

1: Exploitation status

2: Development potential

3: Opportunities and challenges



Opportunities

- ▣ Bioenergy has a huge potential for power generation
- ▣ Vietnam's energy and power demand is huge
- ▣ The significance of RE in general and bioenergy in particular has been recognized by the Government:
 - Strategy for RE development in Vietnam by 2030 with a vision to 2050 approved by the Government (Decision 2068/QĐ-TTg dated November 25th, 2015)
 - Climate change adaptation strategy: biomass and biogas considered one of many solutions to reduce greenhouse gas emission.
 - Green growth strategy: promoting green energy/industry and low-carbon technologies (from waste to energy)
 - Incentives issued for biomass power generation projects; incentives proposed for biogas power generation projects.



Challenges

- ▣ Difficulty in controlling the fuel supply into power plants:
 - ▣ Unstable and unsustainable fuel supply
 - ▣ Seasonal changes in fuel pricing
- ▣ High CAPEX - one of the biggest obstacles
- ▣ Small-scale and distributed projects (except sugar refineries)
- ▣ Unattractive power purchase incentives
- ▣ Lack of development experience, and skilled engineers and workers for bioenergy projects
- ▣ Lack of information and unreliable databases
- ▣ Land fund for the development of bioenergy projects (land for fuel supply, etc.)



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THANK YOU!

Renewable Energy Center,
Institute of Energy, Ministry of Industry and Trade
Email: RE_center@ievn.com.vn



INDOCHINE IMEX., JSC

Outstanding technologies

Shared benefits



INTRODUCTION TO DDG



PART 1 – INTRODUCTION TO DDG



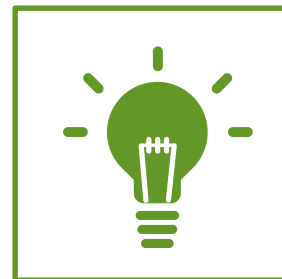
INDOCHINE IMPORT - EXPORT INDUSTRY INVESTMENT JSC (DDG)

- ❖ Date of establishment: June 2010
- ❖ Charter capital: VND120 billion.
- ❖ Staff headcount: 250 employees, of which technical experts and engineers account for 30%.
- ❖ Experience: 20 years of experience in energy and environmental management.

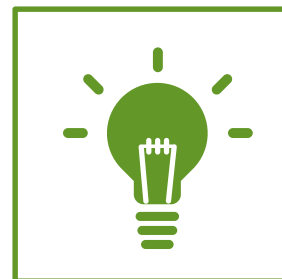
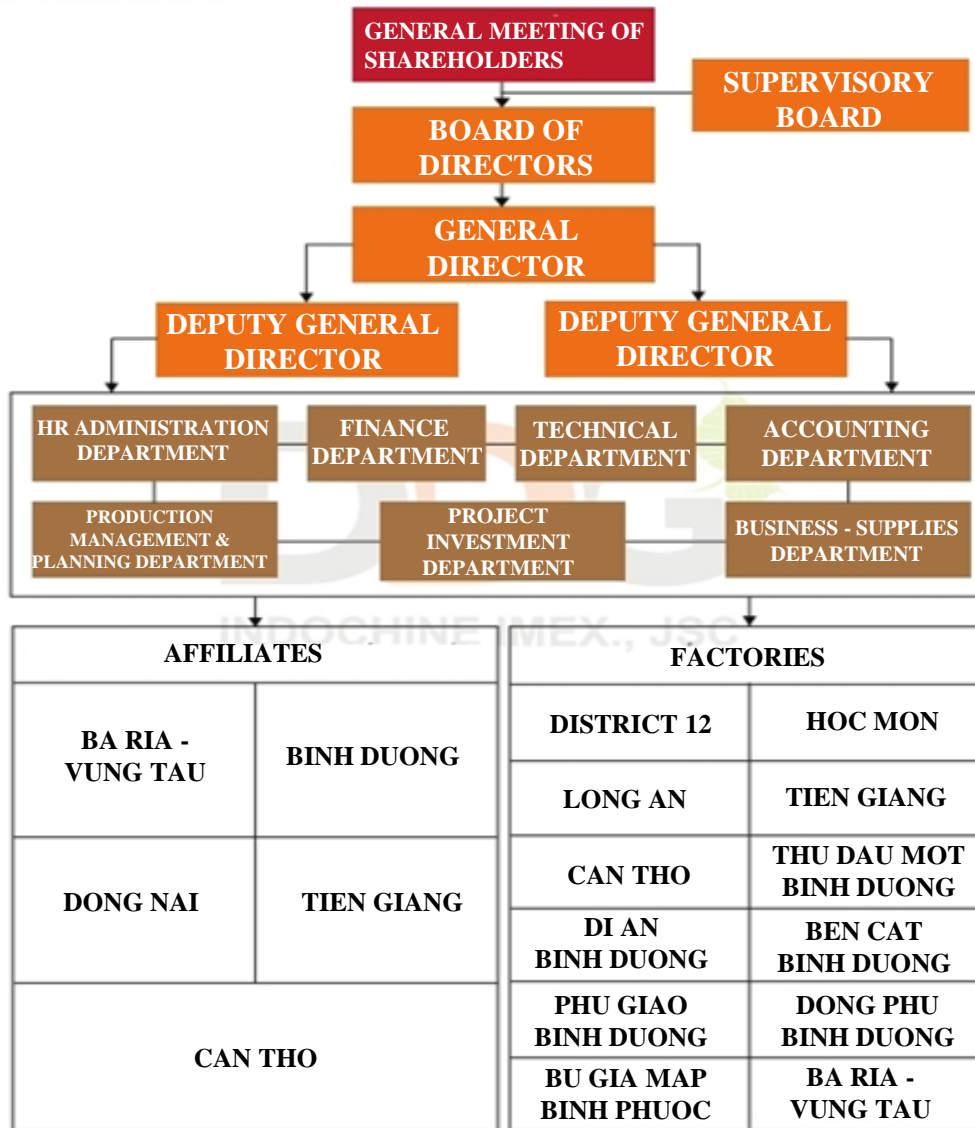


➤ Business motto:

Outstanding technologies - Shared benefits



ORGANIZATIONAL STRUCTURE



FIELDS OF OPERATION



❖ Investing in systems related to energy and environment

❖ Investing in plants that generate and supply steam, thermal energy, and power for customers in need

❖ Investing in projects that develop renewable energy sources in combination with agricultural production

❖ Providing energy-saving solutions, preparing technical plans for fuel transformation, etc.

❖ Investing in projects combining steam and thermal energy - power

❖ Generating power from waste

❖ Producing pellets from biomass and solid waste

❖ Investing in food drying, agricultural product drying, etc.



CERTIFICATES OF TECHNOLOGY



Gold Cups of Techmart Vietnam



Exclusive Certificate of Utility Solution Patent
granted by the Ministry of Science and Technology



- ❖ DDG manages its operations in accordance with ISO 9001:2015 and ISO 14001:2015 and applies the 5S standard to the production process.



Certificate

This is to certify that

INDOCHINE IMPORT - EXPORT INDUSTRY INVESTMENT JSC

162B Dien Bien Phu Street, Ward 6, District 3, Ho Chi Minh City, Vietnam

Has been assessed by ABS Certification Body and found to comply the requirements of

ISO 9001 : 2015

Quality management system

for the following activities

INVESTMENT, SUPPLY AND MANAGEMENT OF THERMAL SYSTEM



Certificate

This is to certify that

**INDOCHINE IMPORT - EXPORT INDUSTRY INVESTMENT
JOINT STOCK COMPANY**

162B Dien Bien Phu Street, Ward 6, District 3, Ho Chi Minh City, Vietnam

Has been assessed by ABS Certification Body and found to comply the requirements of

ISO 14001 : 2015

Environment management system

for the following activities

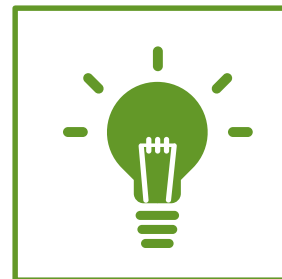
INVESTMENT, SUPPLY AND MANAGEMENT OF THERMAL SYSTEM.



PART 2 – OPPORTUNITIES AND CHALLENGES IN BIOMASS BOILER MARKET

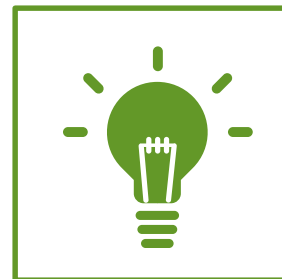


- ❖ Steam is utilized in the following industries:
 - + Food
 - + Paper Manufacturing
 - + Rubber Manufacturing
 - + Textile and Dyeing
 - + Feed Manufacturing
 - + Other industries: Steel, Ceramic Tile, Cement, etc. Manufacturing
- Steam utilization for production is in great demand.
- Each industry has different stringent technical requirements for steam supply systems and steam quality.
- Environmental standards between industries also vary.





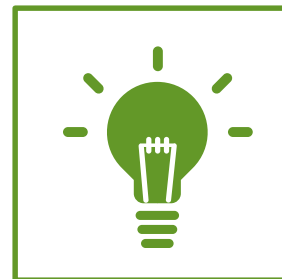
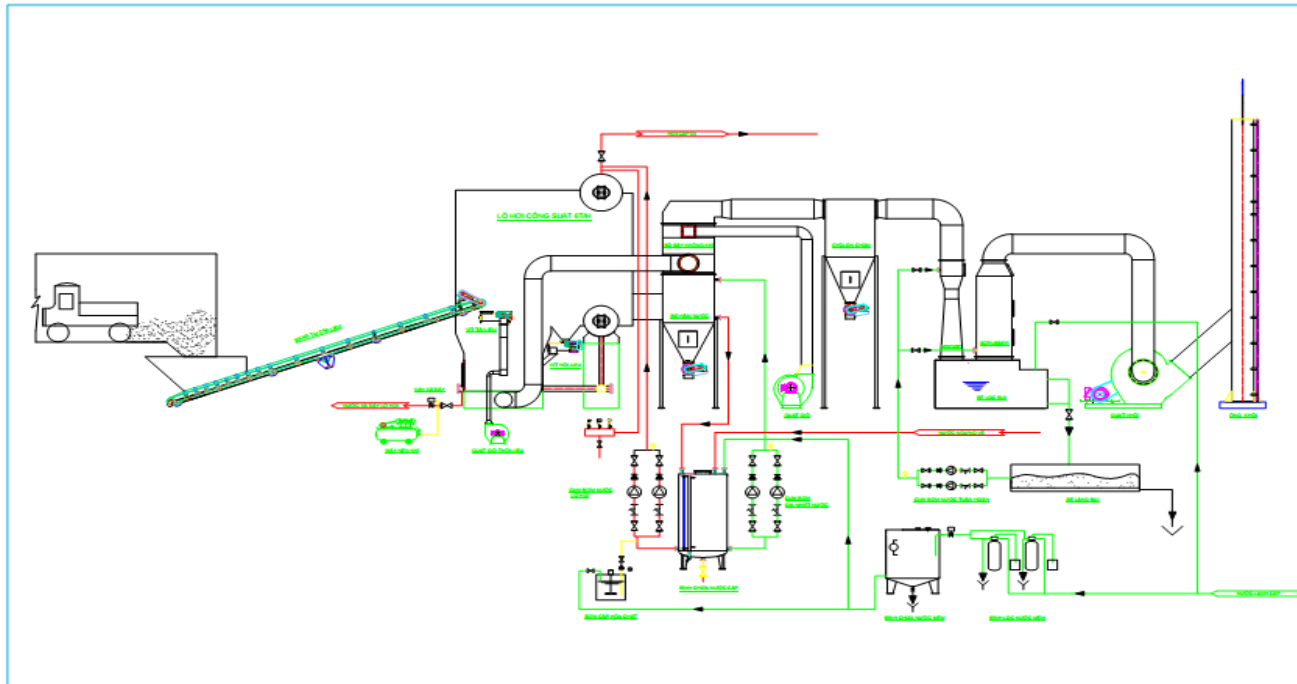
- ❖ Current types of steam boiler and fuel in use:
 - + Diesel-oil (DO) boiler: 20%
 - + Fuel-oil (FO) boiler: 25%
 - + Coal-fired boiler: 20%
 - + Biomass boiler: 20%
 - + Gas boiler: 5% (Popular in ceramic tile or pharmaceutical industry, etc.)
 - + Wood-fired boiler, etc.: 10%





❖ Challenges in biomass boiler market:

- The market for developing biomass boilers in place of DO, FO, and coal-fired boilers is still very large.
- Biomass boilers are encouraged to be used (because they use renewable fuels produced from agricultural wastes, which helps reduce CO2 emissions).





❖ Regarding biomass fuel:

- Before 2015: Biomass fuel is at very low price
- From 2016 until now: the price volatility of biomass has always been increased (an increase of 100%)
- Decrease in supply - depending on specific regions.
- The unit price varies with the season

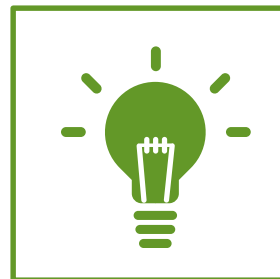


Husk

Shavings

Sawdust

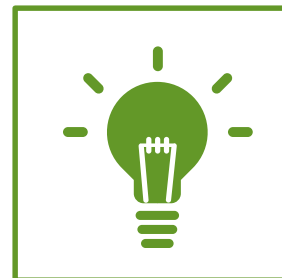
Wood pulp





❖ Opportunities in biomass boiler market:

- + Some industries require transformation: food industry (beer, soft drinks, milk, etc.)
- + The cost of biomass fuel is still competitive when compared to the cost of DO, FO, and gas, which is lower from 15% to 25%.
- + Biomass boilers with high-efficiency energy-saving devices + specialized equipment for smoke and exhaust treatment ➔ To be selected.
 - + Handling ash and slag easily and efficiently (can be reused for other purposes).
 - + Lower investment costs of biomass boiler system + available replacement equipment.





PART 3 – OUTSTANDING PROJECTS

NOTABLE CUSTOMERS



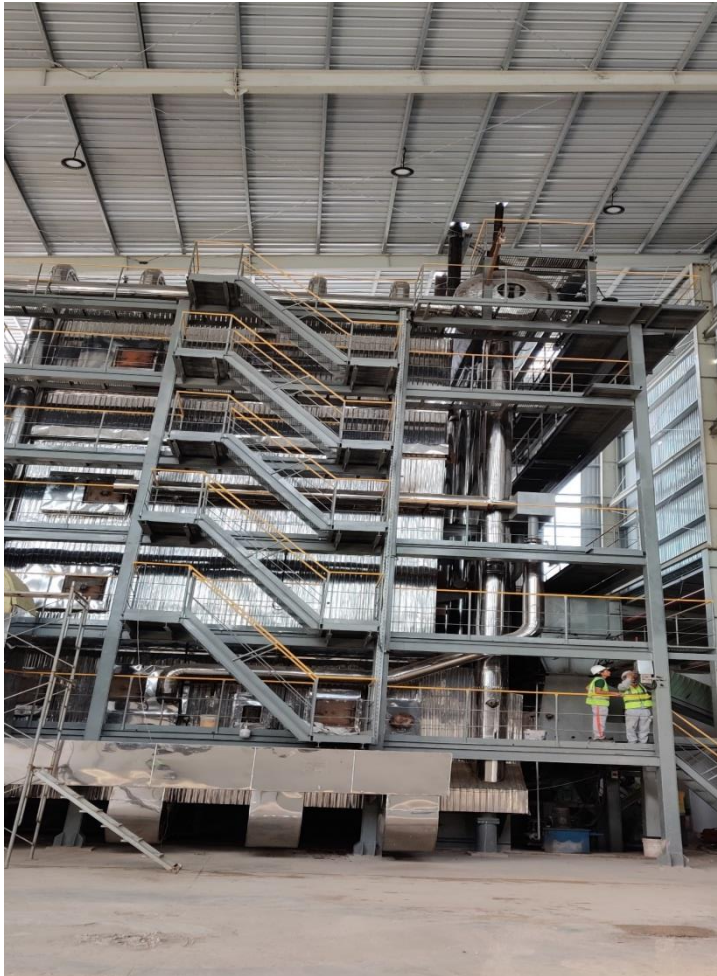
- ❖ HEINEKEN Vietnam Brewery - Tien Giang Limited Company
- ❖ CNG Vietnam JSC (Mei Sheng Textiles Vietnam Co., Ltd)
- ❖ Ton Dong A Corporation
- ❖ Yuen Foong Yu Paper Enterprise Co., Ltd (Vietnam)
- ❖ Saigon Agriculture Corporation (Sagrifeed)
- ❖ Saigon–Vientiane Import Export Company (Savimex Corporation)
- ❖ Suntory PepsiCo Vietnam Beverage – Can Tho Plant
- ❖ Phuoc Hoa Rubber JSC
- ❖ Mai Vinh Rubber Co., Ltd
- ❖ Linh Huong Manufacturing & Trading Co., Ltd
- ❖ Nhat Nam Rubber Manufacturing & Trading Co., Ltd
- ❖ Southern Industry Agriculture Investment Co., Ltd
- ❖ Bien Hoa Packaging JSC
- ❖ Dong Tien - Long An Paper JSC
- ❖ Binh Duong Water - Environment JSC (BIWASE)
- ❖ HEINEKEN Vietnam Brewery - Vung Tau JSC
- ❖ etc.





Project on steam supply for HEINEKEN Vietnam Brewery - Tien Giang Limited Company

OUTSTANDING PROJECTS



Project on thermal power generation from
industrial waste incinerators –
Binh Duong Water - Environment JSC
(BIWASE)

Investment project on steam and power supply
and brewer's grain drying –
HEINEKEN Vietnam Brewery - Vung Tau JSC



Project on thermal energy supply –
Phuoc Hoa Rubber JSC



Project on thermal energy supply –
Linh Huong Production Trading Co., Ltd



Project on thermal energy supply –
Mai Vinh Rubber Trading Services
Production Co., Ltd



Project on steam supply –
Yuen Foong Yu Paper Enterprise (Vietnam)
Co., Ltd in Long An Province

OUTSTANDING PROJECTS



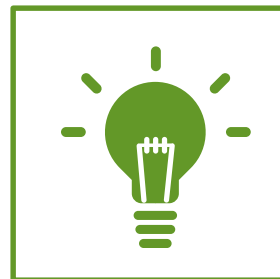
Project on steam supply –
Dong Tien - Long An Paper JSC



Project on steam supply –
Suntory PepsiCo Vietnam Beverage - Can Tho
Plant

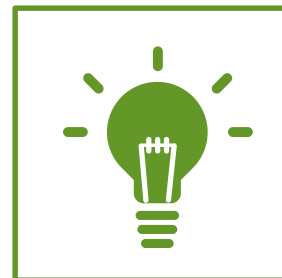
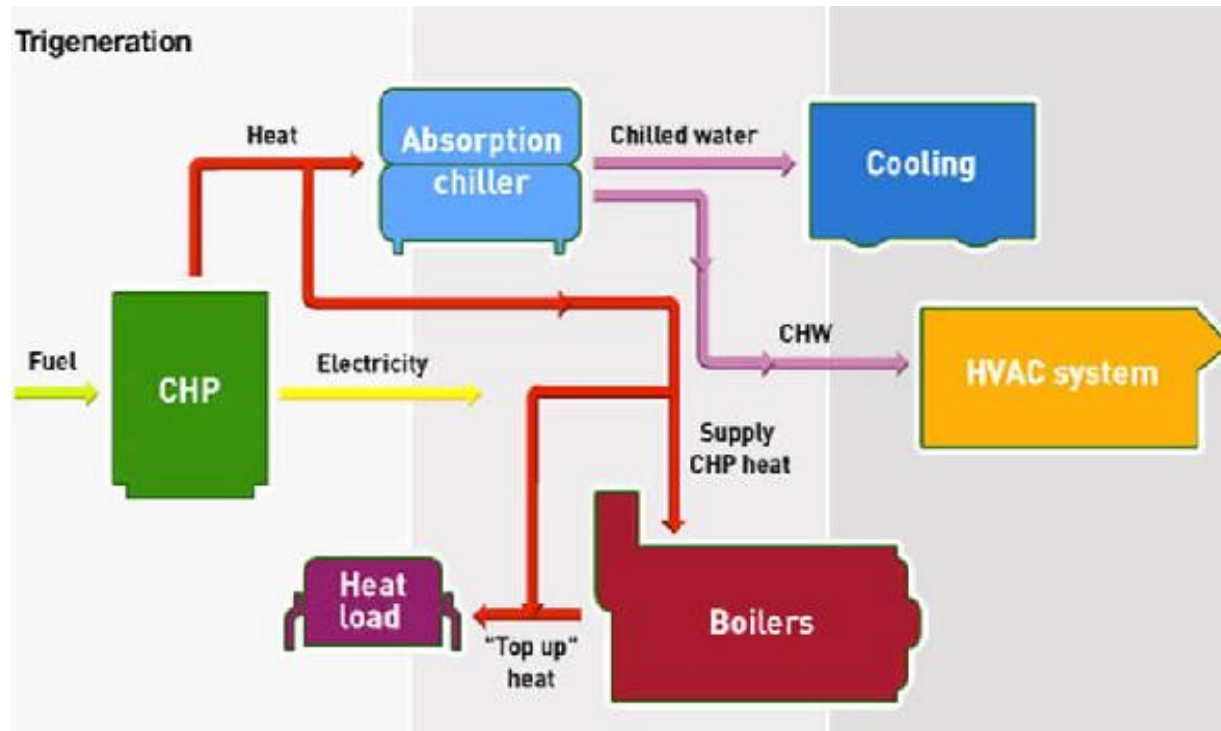


- ❖ Develop projects on biomass boilers to replace DO, FO, and gas boilers, and projects on steam supply



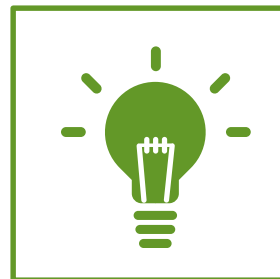


- ❖ Combine biomass boilers and grid-connected turbines.



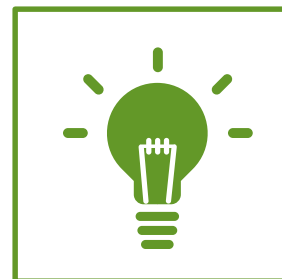


- ❖ Utilize heat from burning waste to generate on-grid electricity.





- ❖ Power generation from biomass gasification.
- ❖ Specialized drying system for agricultural products (Image: A brewer's grain drying system)
- ❖ Recovery products from boiler exhaust system.



COMMON UTILIZATION OF BIOMASS ENERGY IN INDUSTRIAL SECTOR IN VIETNAM



Mr. Ma Khai Hien

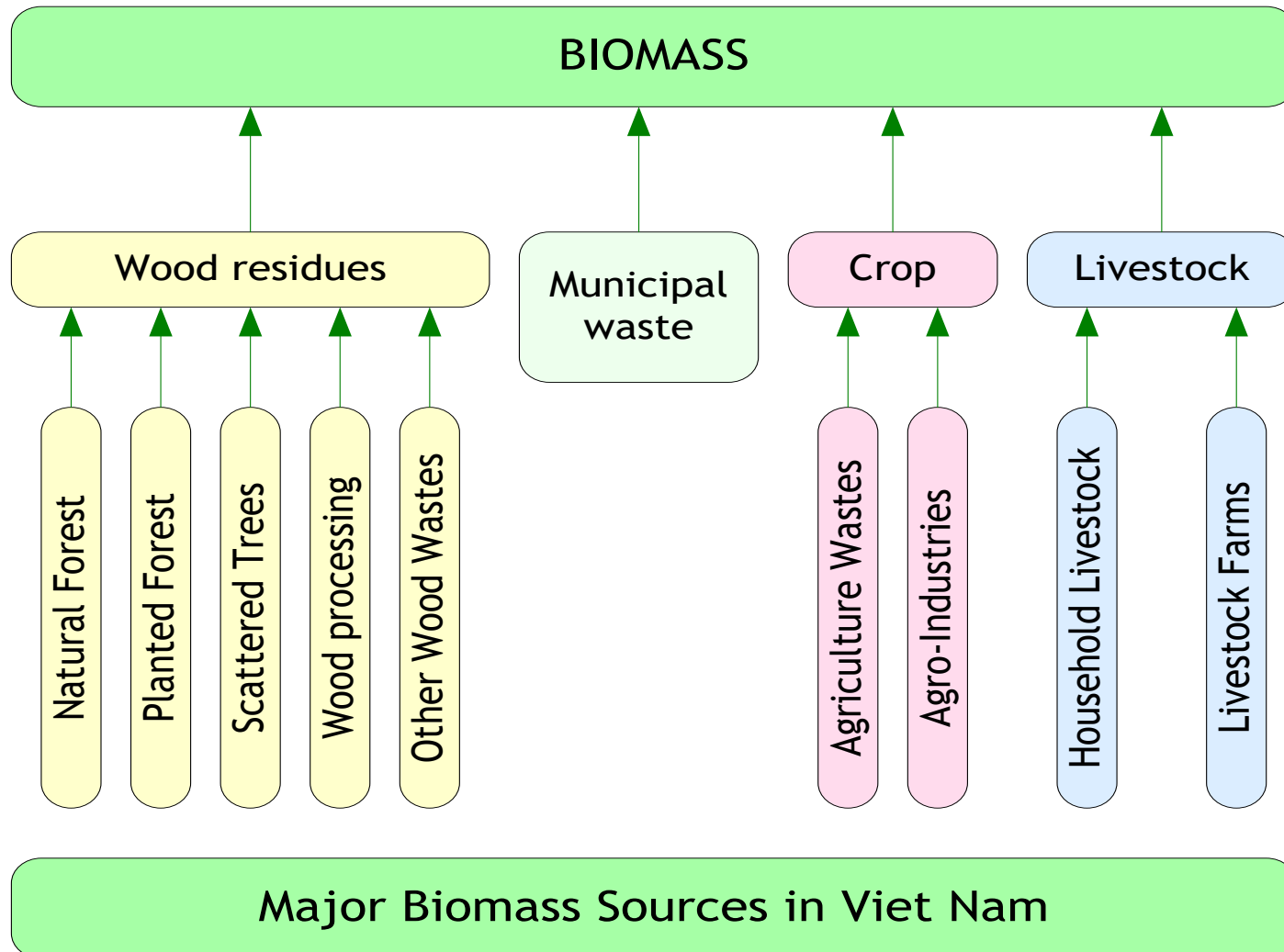
Energy Conservation Research and Development Center

www.enerteam.org

CONTENT

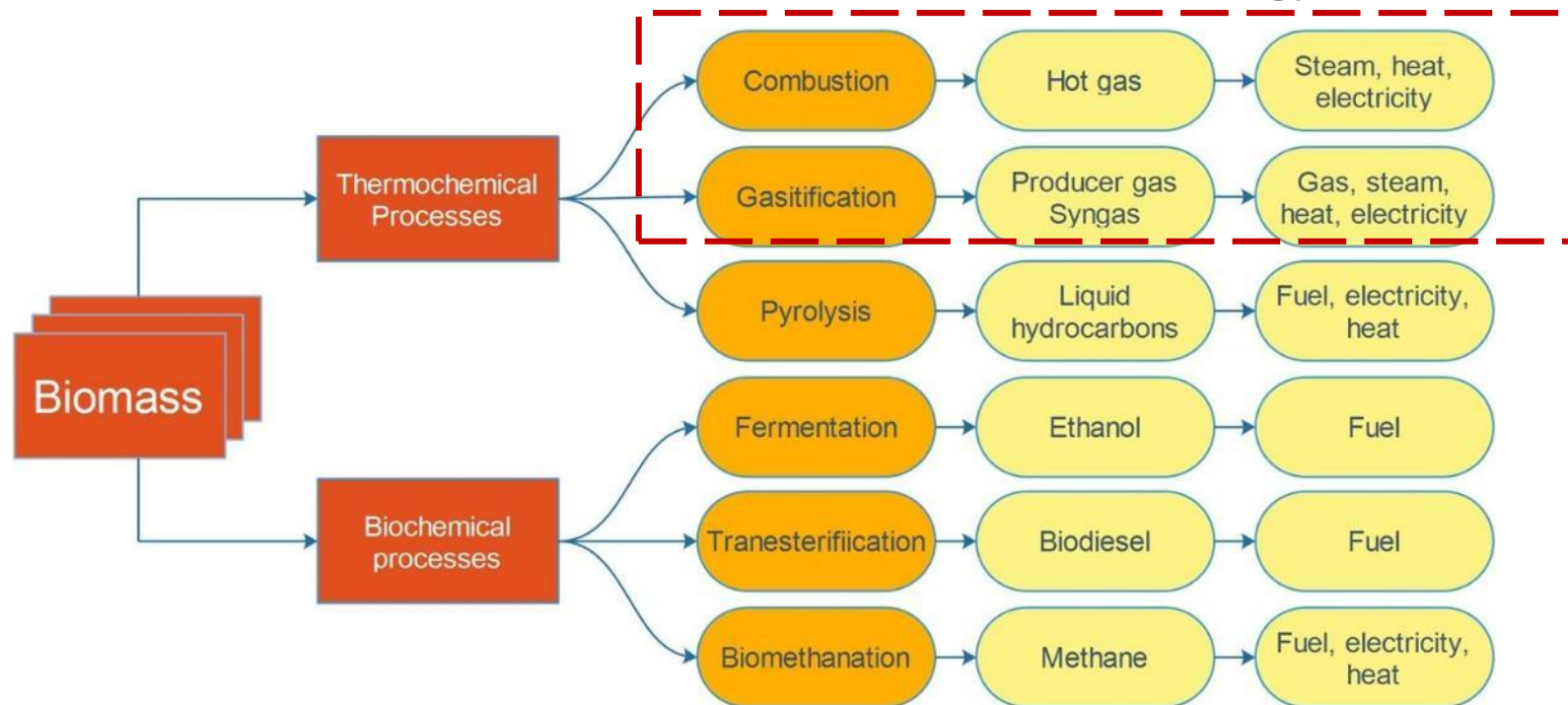
- Overview of biomass sources in Viet Nam
- Utilization of biomass energy
 - Case study: Feasibility study of Combined Heat and Power (CHP) project using sugar cane bagasse and other biomass in sugar mills
 - Case study: Utilization of biomass energy in industrial sector.
- Utilization of biomass in gasification technology

MAIN BIOMASS SOURCES



CURRENT APPLICATION OF BIOMASS ENERGY IN VIET NAM

Conversion process from biomass to energy



There are two common approaches to convert biomass to energy, which are:

- Thermochemical processes which are applicable for dry biomass such as bagasse, woody biomass, rice husk, rice straw, etc.
- Biochemical processes which are application for wet biomass such as livestock waste, waste water, etc.

CURRENT APPLICATION OF BIOMASS ENERGY IN VIET NAM

- The biomass sources used are diverse but the proportion decreases. However, the share is still significant, equivalent to about 15.5 million TOE.

From the summary of biomass resources for energy production (MWh), 2016 (IE)

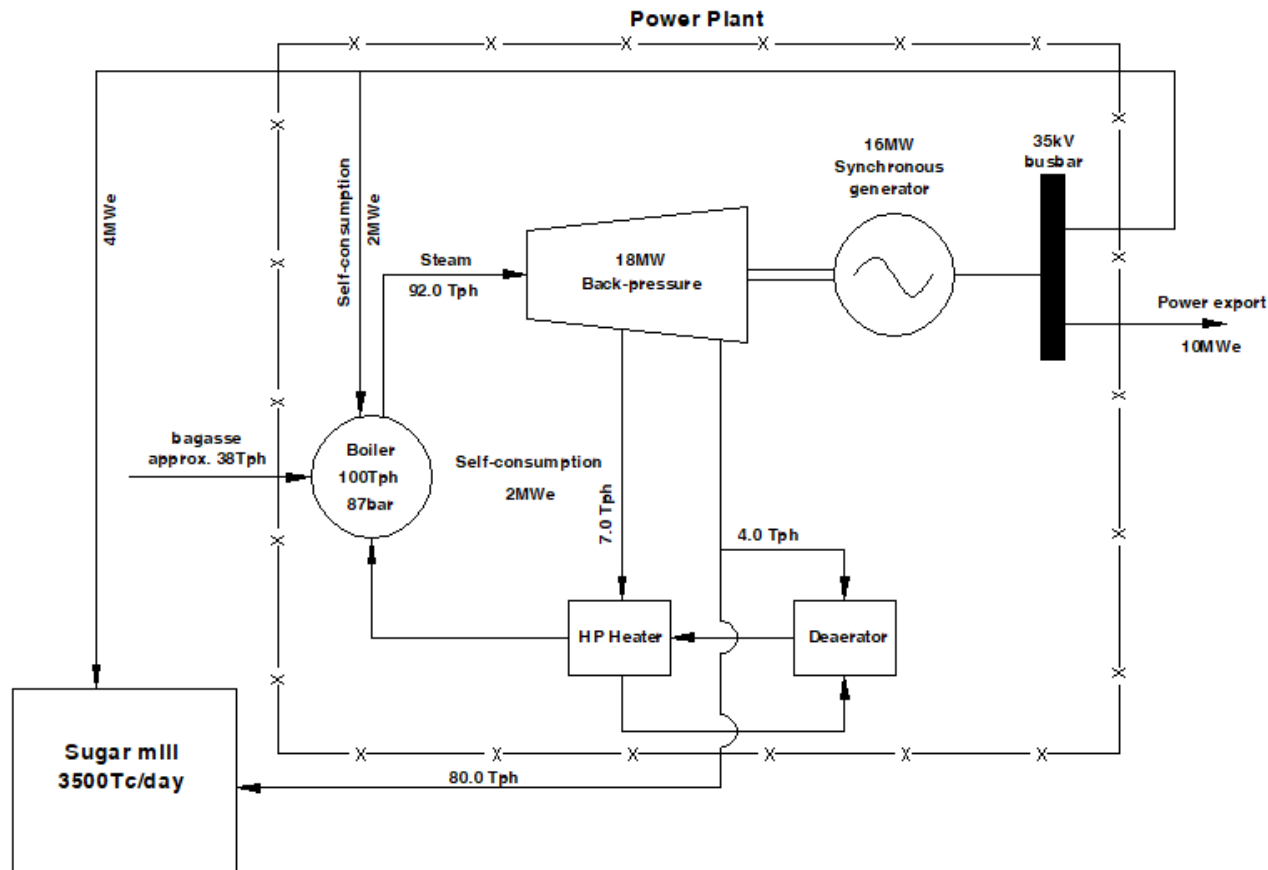
Purpose of use	Type of bagasse					Total
	Wood	Bagasse	Husk	Straw	Other type of waste	
Electricity production						
Cogeneration	184.228	9.081.352	-	-	-	9.265.580
Heat production						
Household cooking	30.663.746	232.759	2.706.914	2.490.908	11.170.863	47.265.190
Boiler	18.722.031	-	13.264.416			36.759.627
Production of building materials	1.790.213	-	2.419.040			4.209.253
Dry rice	-	-	3.487.005			3.487.005
Total	51.360.218	9.314.111	21.877.375	2.490.908	15.944.043	100.986.655

Regulatory framework supporting biomass energy

- Decision No. **24/2014/QĐ-TTg** dated 24, March 2014 by the Prime Minister on the supporting mechanism for biomass power projects in Vietnam.
- Circular No. **44/2015/TT-BCT** dated 9, December 2015 by MOIT on the procedure of project developing, avoided cost tariff, and standardized power purchase agreement for biomass power projects.
- Avoided cost tariff applied for biomass power projects by MOIT: decision No. **942/QĐ-BCT** dated 11, March 2016.

- Decision No. **08/2020/QĐ-TTg** dated 5, March 2020 by the Prime Minister on amending and supplementing several articles of the Prime Minister's Decision No. 24/2014/QĐ-TTg dated 24 March 2014 on support mechanisms for the development of biomass power projects in Viet Nam

Generating electricity using bagasse from sugar mills



*Combined heat and power
process in sugar mills*

This operating mode is recommended to use a multi-fuel boiler with an unlimited mixing ratio. The boiler can be used with 100% replacement biomass and a condensing turbine. The CHP plant is only operated during the sugarcane crushing season (133 days). steam extracted to process sugar at 2.5 bar (manometer).

CASE STUDY

Pre-feasibility study of the cogeneration project (CHP) using sugarcane bagasse and alternative biomass at some sugar mills

Research Objectives

- Increase the efficiency of current bagasse use. The amount of electricity produced is not only sufficient for the production of sugar but also contributes to the supply of electricity to the national grid.
- The project will bring a new source of revenue to the companies thanks to the sale of electricity, thereby improving its competitiveness.

PRODUCTION AND ENERGY DEMAND

No.	Parameter	Unit	2013 - 2014	2014 - 2015	2015 - 2016	Target 2020
1	Amount of pressed sugarcane	Ton	519.199	585.081	455.374	
2	Number of operating hours	Hour	4.371	4.951	3.978	
3	Average pressing capacity	TMN	2.850	2.835	2.746	3.500
4	Amount of bagasse	Ton	159.054	170.031	136.044	
5	Percentage of bagasse	%	30,63	29,06	29,88	
6	Moisture of bagasse	%	51,21	50,16	49,64	
7	Total steam outout	Ton	367.468	396.486	305.346	
8	Total electricity production	kWh	15.098.730	18.294.436	14.830.444	
9	Percentage of steam/sugar cane	Ton of steam/ton of sugar cane	0,708	0,678	0,671	0,550-0,600
10	Ratio of power/sugar cane	kWh/ton of sugar cane	36,9	37,5	40,6	35,0

OPTION 1- ONLY CHP: BY THYSSENKRUPP

- Using biomass boiler with 100% bagasse fuel and back pressure turbine.
- 1 boiler: 100 tons of steam per hour.
- 87 kg/cm²; 510°C
- 1 turbine 18 MWeI
- Operating in the sugarcane season - 180 days

OPTION 2: 2 BOILERS, 2 TURBINE- BY THYSSENKRUPP

Using multi-fuel boiler with a combination of bagasse and other biomass but the mixing rate is limited.

1 back pressure turbine and 1 condensing and extraction turbine.

- 2 boilers – 50 tons of steam per hour per one, 87 kg/cm²; 510°C
- 2 turbines - 9 MWeI each.

Operating in the sugarcane season - 180 days

In off season, only operating:

- 1 boiler with the capacity of 30.4 tons of steam/hour
- 1 condensing turbine at 7 MWeI

Operating time in off sugarcane season - 120 days

OPTION 3: 1 BOILER, 1 TURBINE – BY LAWI

Using a multi-fuel boiler with
100% other biomass
Use only 1 condense and
extraction turbine
1 turbine 100 tons of
steam/hour; 95 bar (a); 515°C
turbine 15 MWeI

Operating in the sugarcane
season - 180 days

In the off season, the boiler will
be operated to produce 59 tons
of steam/hour; 93 bar (a);
500°C, capacity 15 MWeI

Operating in the off season -
155 days

OPTION 4: TK + VYNKE, 2 BOILERS -2 TURBINE: REFERENCE FROM THYSSENKR VYNKE PROPOSAL

- 2 boilers with 50 tons of steam/hour; 87 kg/cm²; 510°C
- 2 turbine, each with the capacity of 9 MWe
- This option is similar to the option 2, but replacing 1 single fuel boiler of Thyssenkrupp by multi-fuel boiler of Vyncke, allowing the 100% other biomass. In addition, both turbines are condense and extraction type.
- Operating in the sugarcane season – 180 days
- Operating in the off season – 120 days

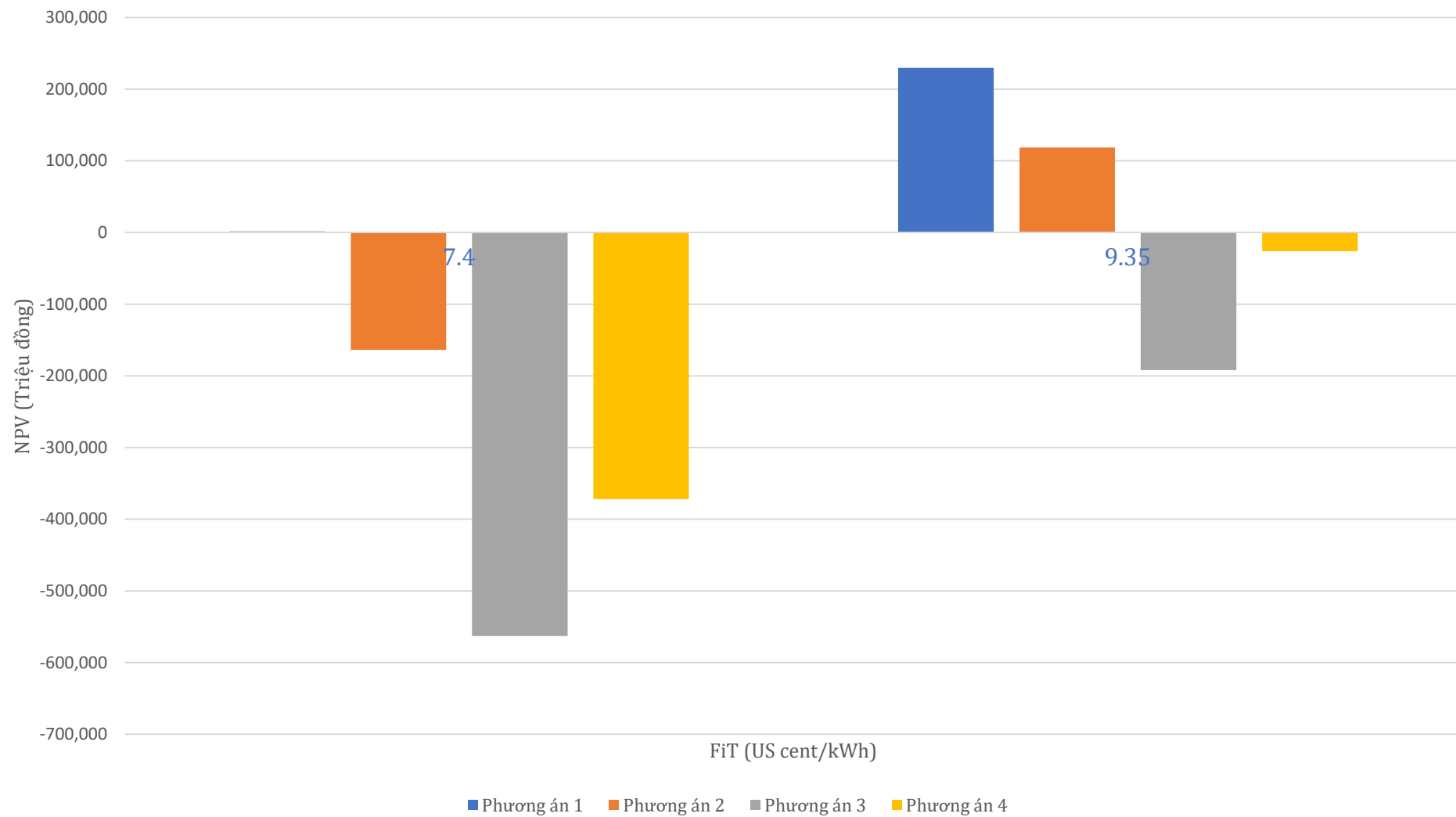
EXPECTED ELECTRICITY OUTPUT

Indicator	Parameters	Option 1	Option 2	Option 3	Option 4
On-grid electricity	MWh/year	69.224	85.816	107.995	102.840
Electricity for self consumption	MWh/year	18.270	18.270	18.270	18.270
Surplus electricity	MWh/year	50.954	67.546	89.725	84.570
Self consumption of CHP component	MWh/year	7.690	10.826	13.852	13.962
Total electricity output	MWh/year	76.914	96.642	121.846	116.802

ESTIMATED BIOMASS FUEL

Parameters	Unit	Option 1	Option 2	Option 3	Option 4
Bagasse	Ton/year	188.244	186.317	188.244	186.317
Rice husk	Ton/year	0	28.314	34.174	32.617
Wood chip	Ton/year	0	-	33.100	26.657
Total amount of other biomass	Ton/year	0	28.314	67.274	59.274

NPV ANALYSIS



ASSESSMENT

- Option 1 – SPV or not SPV/CHP – the most suitable option for sugar mills consideration
- Option 2 is the potential option for off season.
- Sensitivity of energy efficiency and/or electricity output is higher compared to other parameters.
- The fluctuation of the price of other biomass fuel affects to the productivity.
- The need to find appropriate financial support will help improve the financial efficiency of the project.

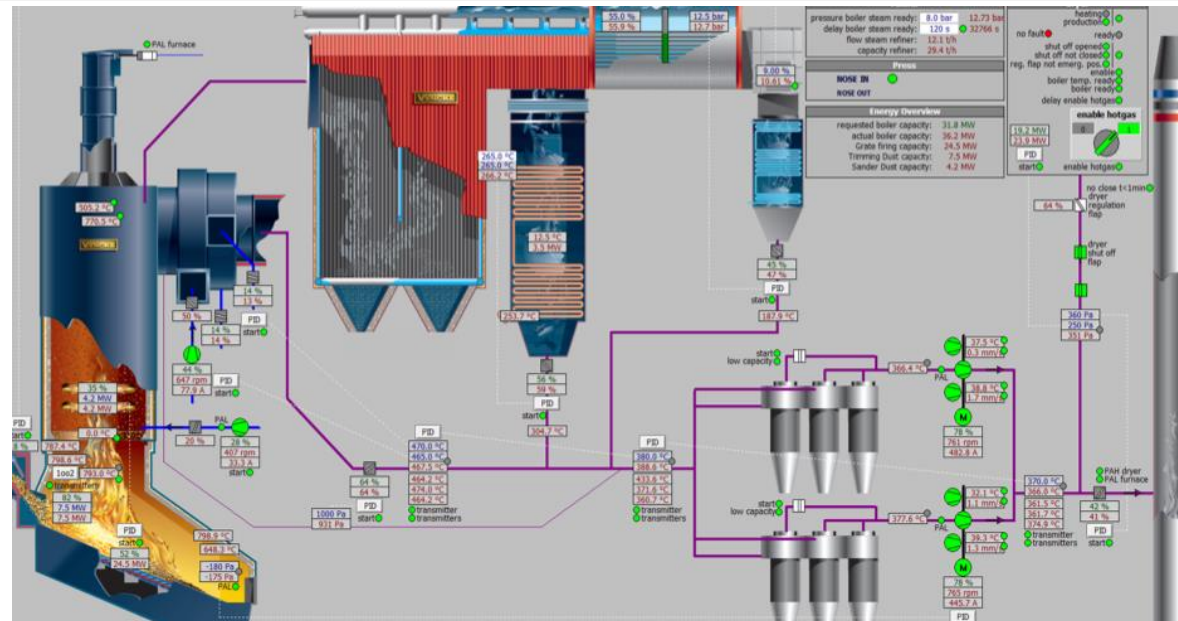
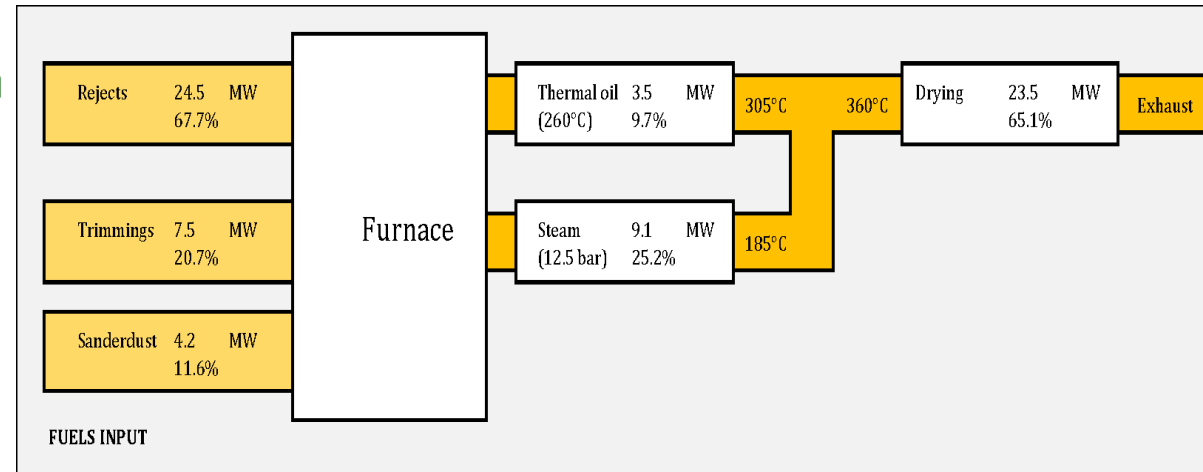
Biomass energy application in industrial boilers



UTILIZATION OF BIOMASS TO PRODUCE HEAT IN WOOD PROCESSING (MDF)

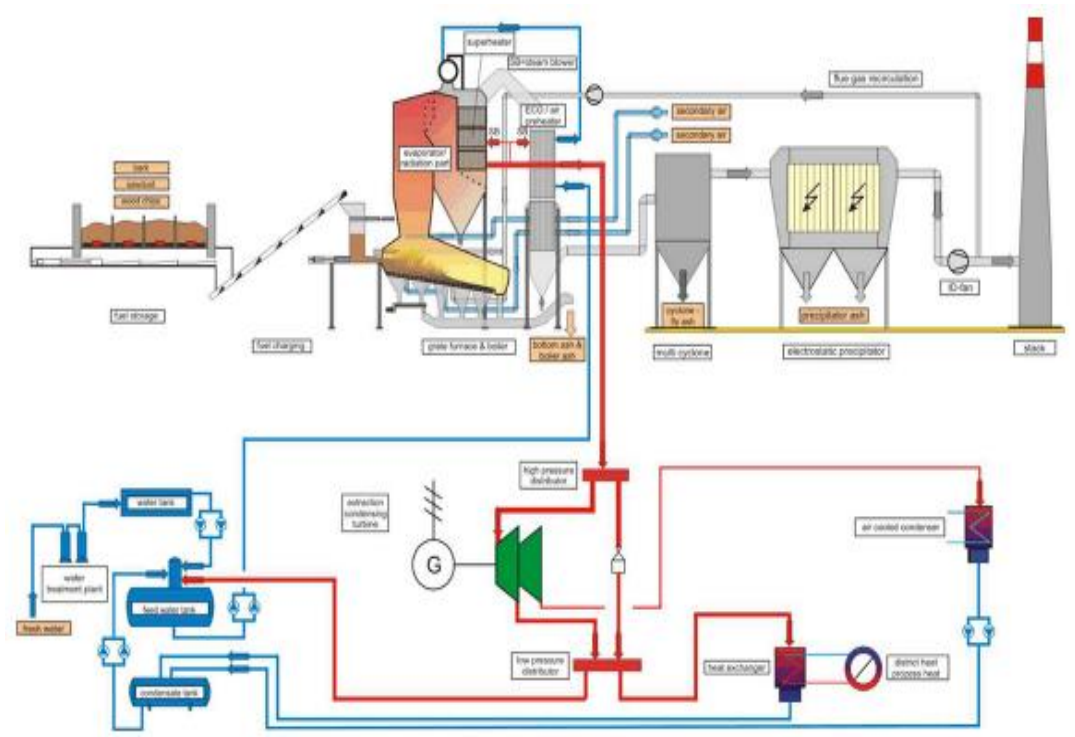
Thermal energy is generated from biomass waste from woody biomass provided in the main production process:

1. Thermal oil for heating
2. Steam drying process
3. Hot exhaust fumes



Potential of electricity generation - heat from biomass source of wood factory

- However, the available biomass has not been fully utilized to operate the cogeneration system (CHP – Combine Heat and Power):



CONVERTING DO OIL TO BIOMASS BOILERS

- Using biomass boiler (wood pellet, husk pellet, husk, etc.) instead of oil – coal boiler.

	DO OIL	WOOD PELLET
Heating value of combustion fuel	9800 kcal/liter	4000 – 4600 kcal/kg.
Fuel consumption	Max 75 liters/ton of steam	Max 200 kg/ton of steam
Theory calculation based on the demand to produce 1 ton of steam per hour at 5 bar pressure	1 ton of steam/hour	1 ton of steam/hour
Unit price for combustion fuel	21.100VND/ kg	2.400VND/ kg
Combustion fuel cost for producing 1 ton of steam	<i>Max 1,5million VND/ton of stream</i>	480.000VND/ton of steam



CONVERTING COAL TO BIOMASS BOILER IN TEXTILER INDUSTRY

Hải Dương: Converting coal to wood pellet boiler



Parameter	Unit	Coal	Biomass
Percentage of fuel consumption	Ton of fuel/1.000 SP	76,5	126,1
CO ₂ Emission	CO ₂ Ton/1.000 SP	246,4	0,2
Fuel price	USD/ton of fuel	186,8	106,4
Power price	USD/1.000 SP	14.290	13.418
Cost savings	USD/1.000 SP		873
	%		6,1%



CONVERTING SUITABLE FUEL FOR F.O/DO OIL

- b. Using a biomass fuel boiler (rice husks, firewood) to replace DO / F.O oil fired boiler. Currently, there are full-packaged steam suppliers at lower cost than F.O. oil.

No.	Detail	Self-steam production from F.O	Purchasing steam	Unit
1	Price for 1 ton of steam	1.200.000	600.000	VND
2	Price saving/1 ton of steam	600.000		VND/ton of steam
3	Percentage of price saving	50%		
4	Amount of CO ₂ reduction	333,6		Kg CO ₂ /ton of steam



CONVERTING COAL TO BIOMASS BOILER BEVERAGE INDUSTRY

Viet Nam: Converting DO oil boiler to using the to buy steam from the fluidized bed boiler using rice husks



Parameter	Unit	Diesel Oil	Crushed husk
Percentage of fuel consumption	Unit/ton of steam	75,6 (lit)	167,6 (kg)
CO ₂ Emission/ton of steam	Kg CO ₂ /ton of steam	224,9	0,3
Steam price	USD/ton of steam	55	36,5
Percentage of saving	-		33,9%
Steam consumption in 2018	ton of steam/year	93.716	
Saving	USD/year		1.751.365
Emission reduction	Ton of CO ₂ /year		6.700

Applicable gasification of biomass resources in industry

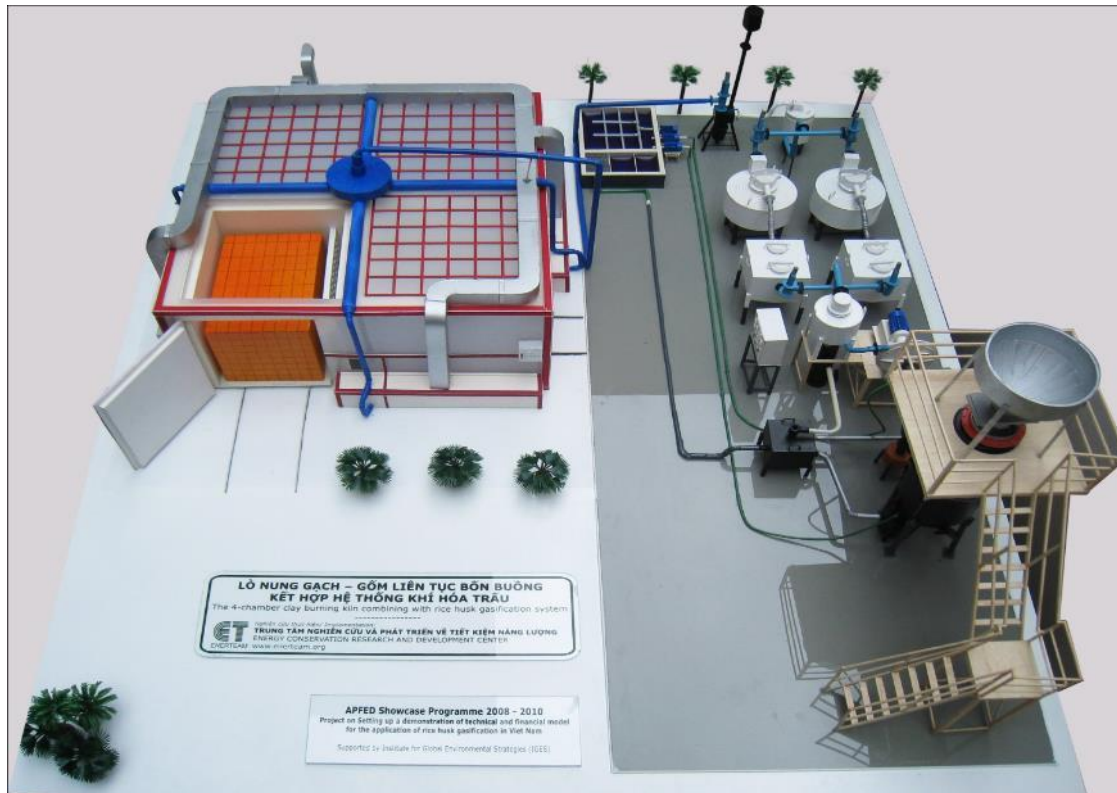


AVAILABLE BIOMASS RESOURCES FOR GASTIFICATION APPLICATION

- Husk
- Wood chips
- Cocoa pods
- Sawdust
- ...



EXAMPLE CASE: COMBINATION OF 4-CHAMBER HUSK GASTIFICATION SYSTEM



PROJECT RESULTS

- Increase in production activities
- Increase in product quality, form a beautiful and uniform ceramic color, with hardly no waste product during firing
- Save energy, due to the energy efficiency of rice husk gasification – which is better than direct rice husk combustion
- Avoid using fossil fuels
- Improve the surrounding production environment,
- Increase value added to the biomass (rice husk), which is an agricultural residue, therefore bring more benefits to the local agriculture.



THANK YOU

ENERGY CONSERVATION RESEARCH AND DEVELOPMENT CENTER

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