Ministry of Industry and Trade

Implemented by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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)

Bioenergy Technology CHP

GIZ in Viet Nam | MOIT/EREA

04/04/2022

Presentation outline

- Bioenergy resources in Viet Nam
- Biomass technology
- Biogas technology
- Outlook for Viet Nam

Typical bio-energy resources in Vietnam

- Agro-cultural residues
- Wood residues
- Organic waste/sludge

Biomass as solid fuel – on-site residues

Biomass processing residues:

Bagasse
Rice husk
Corn cobs
Coffee cherry pulp
Nut shells:
Peanut, Coconut, Palm kernel

Wood processing:
Off-cuts, saw dust, shavings, bark
3Mio tons export of Pellets

Biomass as solid fuel – harvesting residues

Biomass harvesting residues:

Palm fronts + trunks

Tree tops, branches, roots
Forrest pruning + thinning
Road, rail + power line pruning

Rice straw
Sugar cane leaves

Energy crops: C4 grass

Cost for:

- Harvesting
- Compacting
- Transport
- Labor
- Storage

Typical biomass applications in Vietnam

- Biomass CHP
- Biomass power plant
- Biomass co-firing

Biomass energy systems

	Power plant	Combined Heat & Power
Plant size:	10MWe +	1MWe +
Technology:	HP steam	HP or MP steam, ORC, Gasifier
Efficiency:	~30%	70 to 90%
Sales:	Power, ash	Power, ash, fertilizer, steam, heat, cooling, chilling
Investment:	USD25Mio +	USD5Mio +
Feed-stock:	100% buy-in	Mainly on-site residues
Limited by:	feed-stock supply and transport costs	Heat & Power demand of processing / clients plant.

Biomass power plants in Vietnam

List of Biomass power plant in Vietnam: only 10 in operation, others according to PDP8 draft (2021)

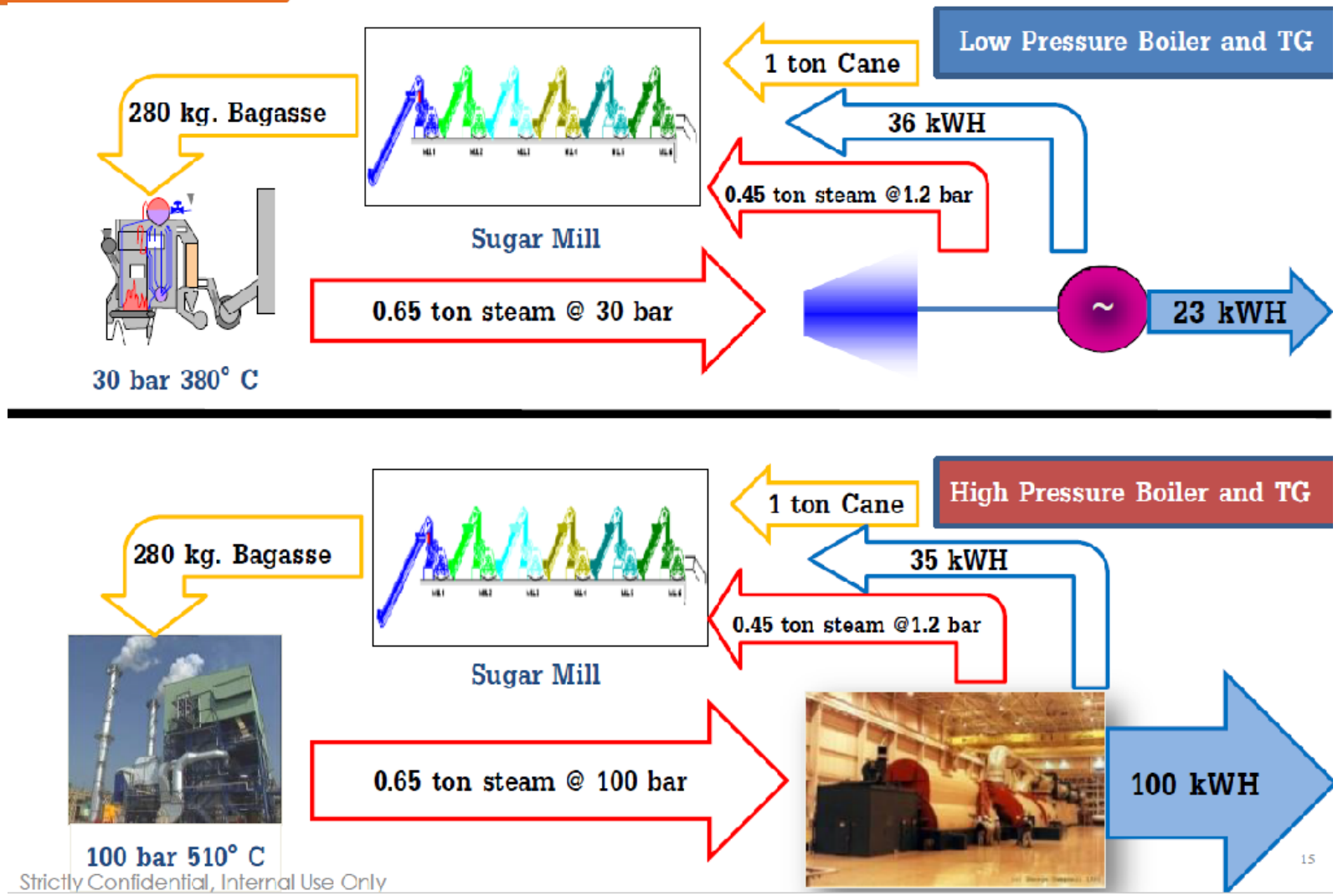
No.	Name	Capacity (MW)	Location	Operation year
1	KCP Phu Yen (phase 1)	30	Phu Yen	2017
2	Bagasse Tuyen Quang	25	Tuyen Quang	2019
3	Biomass An Khe	95	Gia Lai	2017
4	Khanh Hoa Sugar Factory	60	Khanh Hoa	Operated
5	Ninh Hoa Sugar Factory	30	Khanh Hoa	2010
6	Thanh Thanh Cong Sugar Factory	34,6	Gia Lai	2015
7	LASUCO Sugar Factory	35	Thanh Hoa	Operated
8	Nghe An Sugar Factory	10	Nghe An	Operated
9	Soc Trang Sugar Factory	12	Soc Trang	Operated
10	Thanh Thanh Cong Tay Ninh Sugar Factory	24	Tay Ninh	1997

Sugar industry

To exploit the technical potential of the factories and the biomass potential of agro-forestry residues

- Extension of the operational lifetime of the existing power generation systems (10 plants) by switching from bagasse-based cogeneration to off-season biomass power generation
- Modernization of power generation facilities (20 plants) from low-pressure boilers to high-pressure ones, and from single-fuel boilers to multi-fuel ones
- Establishment of biomass supply chains based on agro-forestry residues

Example CHP Sugar Mills

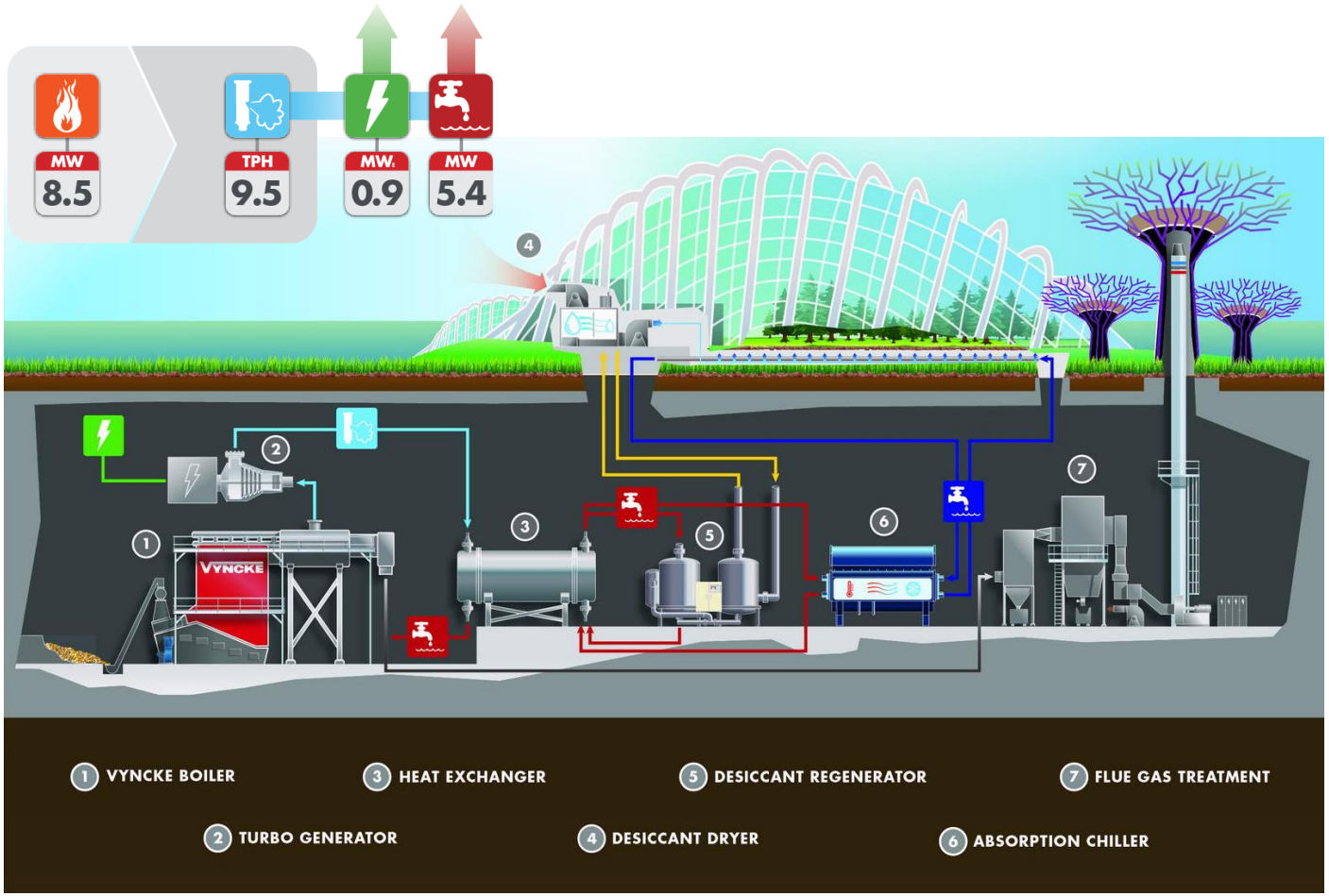


Source:

Example CHP Sugar Mills

30 MW Cogeneration Plant – M/s KCP Vietnam Industries, Vietnam

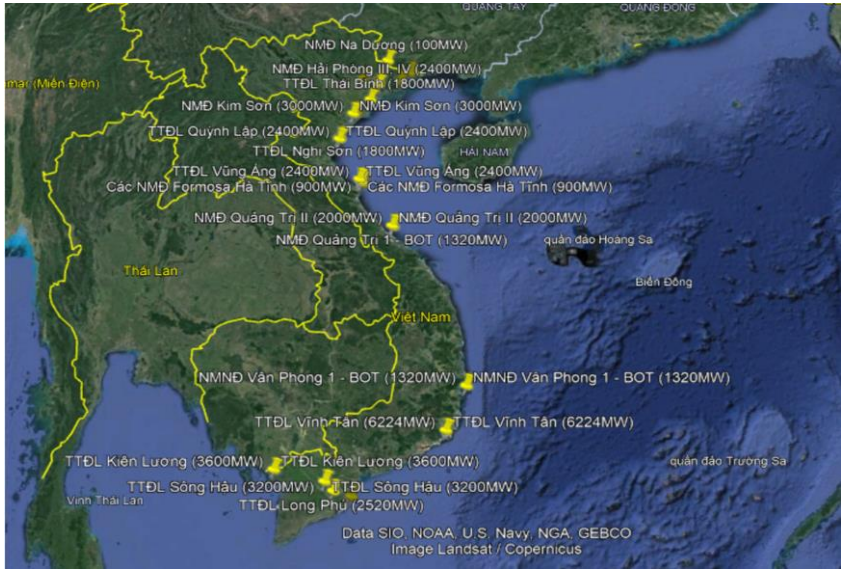
BIOMASS TO POWER & COOLING Tri-gen

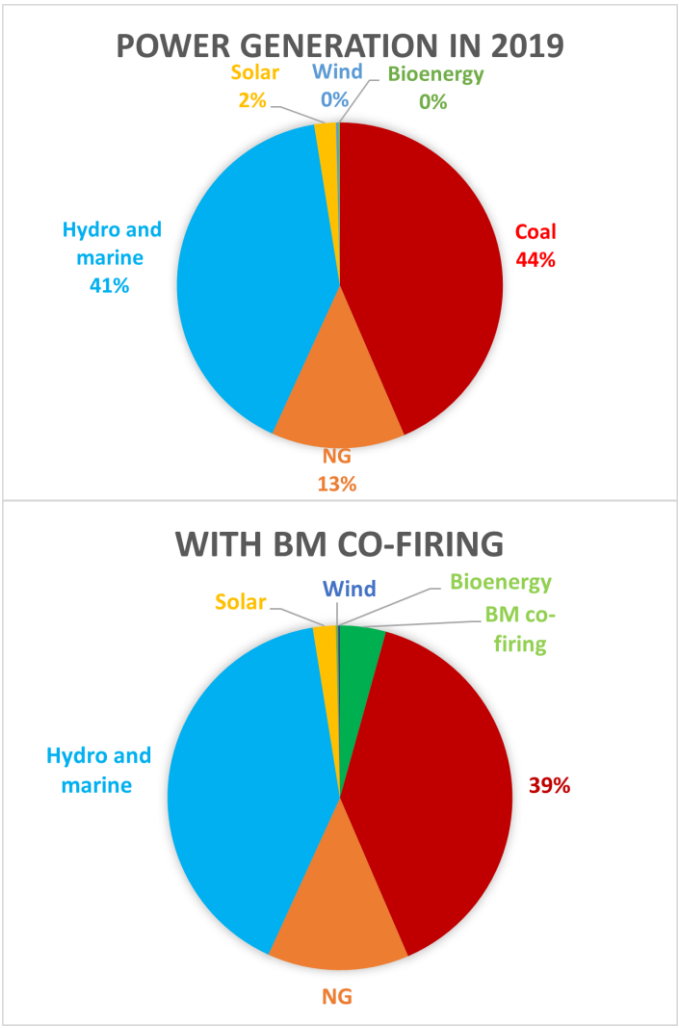


ecoWise

- Marina Bay, SINGAPORE
- Commissioned November 2011
- Installed below ground
- Power & cooling to

Co-firing of biomass in coal power plants





10% biomass mixed to coal is typical worldwide.

Vietnam had an installed capacity of around 21GW of coal-fired thermal power in 2021. Co-firing biomass would make around **2GW CO2 neutral.**

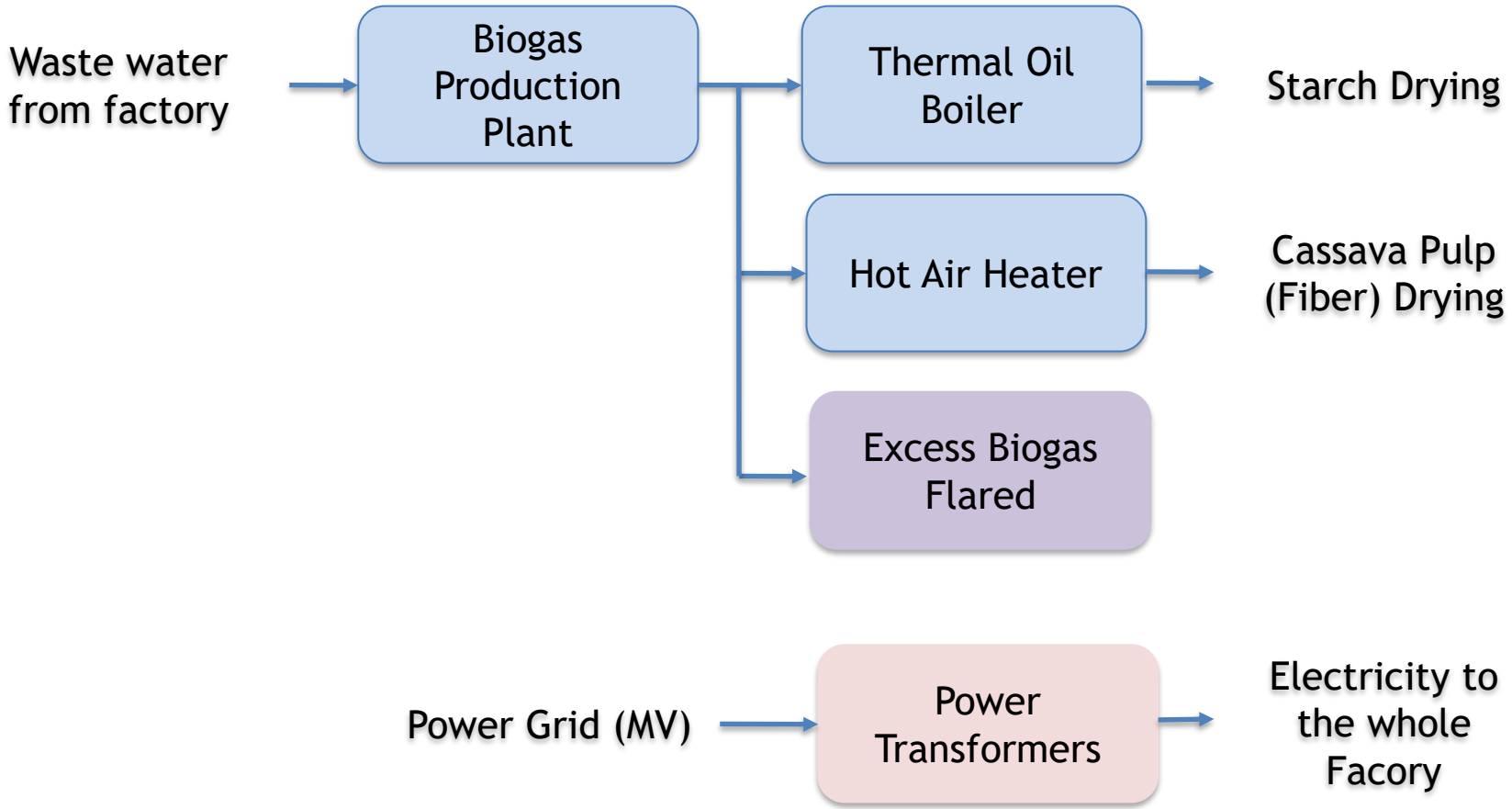
Typical biogas applications in Vietnam

- Treatment of cassava wastewater
- Treatment of piggery effluent
- Treatment of organic waste/sludge

Treatment of Cassava wastewater

- **Substrate storage, preparation and feeding**
  - **Storage in lagoons/tanks, almost no preparation necessary, simple feeding by pumps**
- **Digestion and gas storage**
  - **Lagoon digesters, single membrane gas storage**
- **Biogas utilization**
  - **Direct utilization in burner, biogas generator, gas flare**
- **Treatment and application of digestate**
  - **Facultative and aerobic activated sludge treatment for discharge into waterbodies**
- **Control system**
  - **Simple control of basic parameters**

Existing Energy Supply System



Existing Biogas Production Plant

- 2 biogas digesters (HPDE covered lagoon type)
- 60,000 m3 each
- 43 days hydraulic retention time (HRT)
- CODin: 17,740 mg/l
- COD removal efficiency: 96.5%
- Biogas yield: 0.45 Nm^3/kg COD removal

Proposed Project

- To utilize excess biogas for electricity generation in the biogas-fired genset(s)
- Electricity generated will be used to supply the electricity demand of the tapioca starch factory (captive power generation project)

Treatment of piggery effluent

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- **Biogas utilization**
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Case study from India

Sugar cane pressmud to bottled bio-CNG

Substrate: Pressmud (Cane juice filter cake) stored in silage clamps for OFF-season. Cost of press mud approx. 8 €/ton.

3 digesters (heated, insulated and mixed) with around 11,000 m^3 treatment volume

Biogas production: approx. 18,000 m^3/d

Biogas upgrading (CO_2 removal) from 55% CH_4 in raw Biogas to 96.5% CH_4 by water scrubbing

Bio-CNG production: approx. 7,000 kg/d

Gas compression to 250 bar, filling into steel cascades

Solid-liquid separation of digestate and composting of solids to produce approx. 25 t/d solid fertilizer

Outlook for Vietnam

- Success criteria
- Potentials
- Progress

Successful business models

Successful bio-energy projects worldwide had these in common:

- Access to equity and credit at reasonable rates. (risk assessment by creditors)
- Secured biomass supply.
- Sufficient regulatory support. (Approval process, grid connection)
- Sufficient financial support (FiT, CO2 tax, RECs)
- Low hanging fruits like CHP and co-firing

Thank you