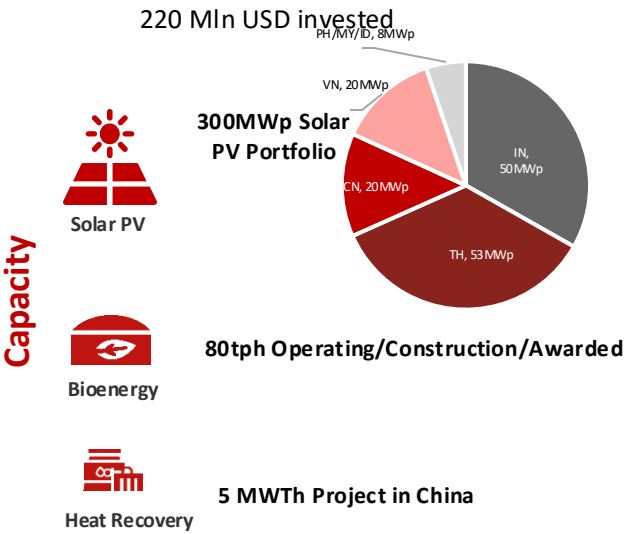
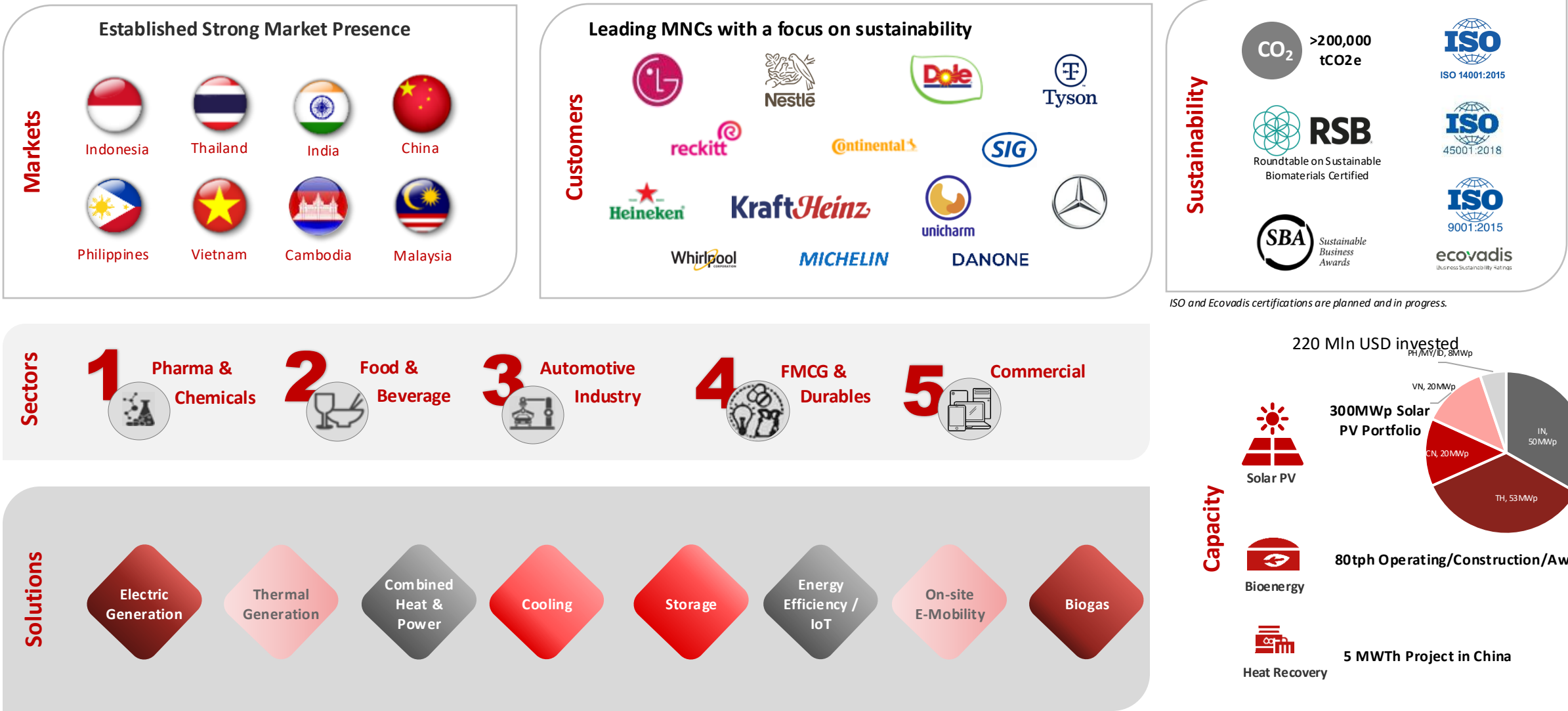




**Bioenergy
Flexibility in Energy Systems**

Introduction to BECIS

BECIS aims to be a global leader and a trusted partner providing energy solutions that enable our customers to achieve their sustainability goals



Energy as a Service (EaaS)

BECIS combines distributed energy solutions with in-depth expertise to bring our customers Energy as a Service.

Distributed Energy Solutions

Decarbonization & Energy Audits

On-Site Solar

Solar-Battery Hybrids

Biomass Energy

Energy Analytics

Services	Solar PV	Biomass / Biogas	Heat Pump	Chiller / Refrigeration	Air Compressors	E-Boiler	Energy Analytics	Storage	Absorption chiller
Electricity	✓	✓ (CHP)						✓	
Steam		✓				✓			
Hot Water		✓	✓			✓		✓	
Cooled air / chilled Water		✓ (CCHP)		✓					✓
Heat Recovery			✓					✓	
Compressed Air					✓				
Energy Efficiency							✓		

Expertise & Capabilities

Investment

Design & Engineering

Construction

Asset Performance

Sustainability & Decarbonisation

Readily available capital to eliminate or minimize customer CAPEX spend.

Engineered solutions with a focus on safety, longevity, and reliability.

Expert project management – reduces complexity for our customers.

On-going monitoring and maintenance ensuring reliable and safe delivery of energy & services.

Continuous expansion of solution offerings, allows customer to push further on sustainability objectives.

WE PROVIDE OUR CUSTOMERS WITH SOLUTIONS TO
REDUCE CO₂ EMISSIONS BY REPLACING FOSSIL
FUELS WITH SUSTAINABLE AND RENEWABLE
SOURCES. OUR CUSTOMERS CAN FOCUS ON THEIR
CORE BUSINESS WHILE WE PROVIDE SUSTAINABLE
ENERGY WITH **LONG TERM ENERGY SUPPLY
AGREEMENTS.**

**WE BUILD, OWN
& OPERATE**



ELECTRICITY



COOLING



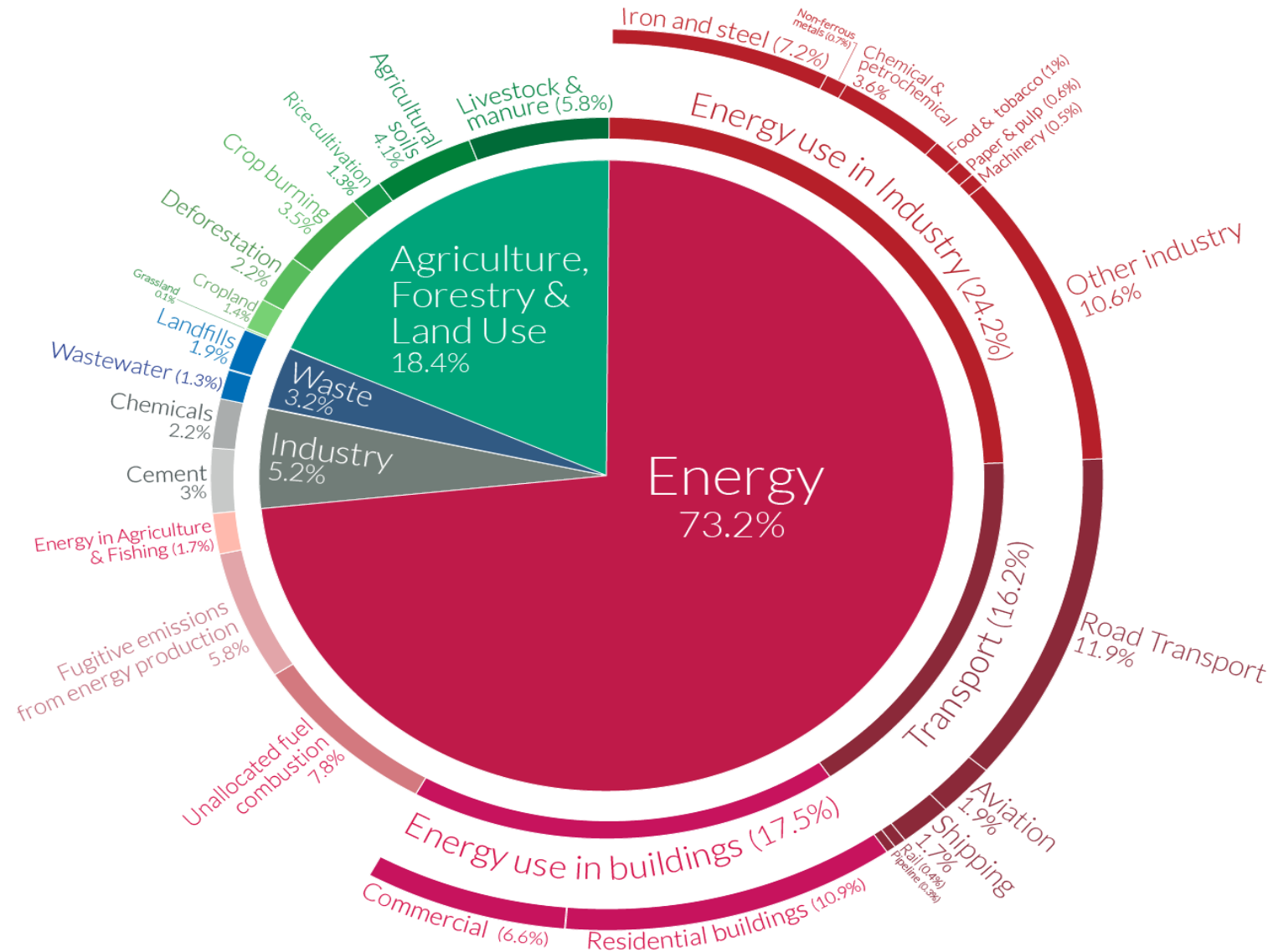
HEATING



Global greenhouse gas emissions by sector

Our World
in Data

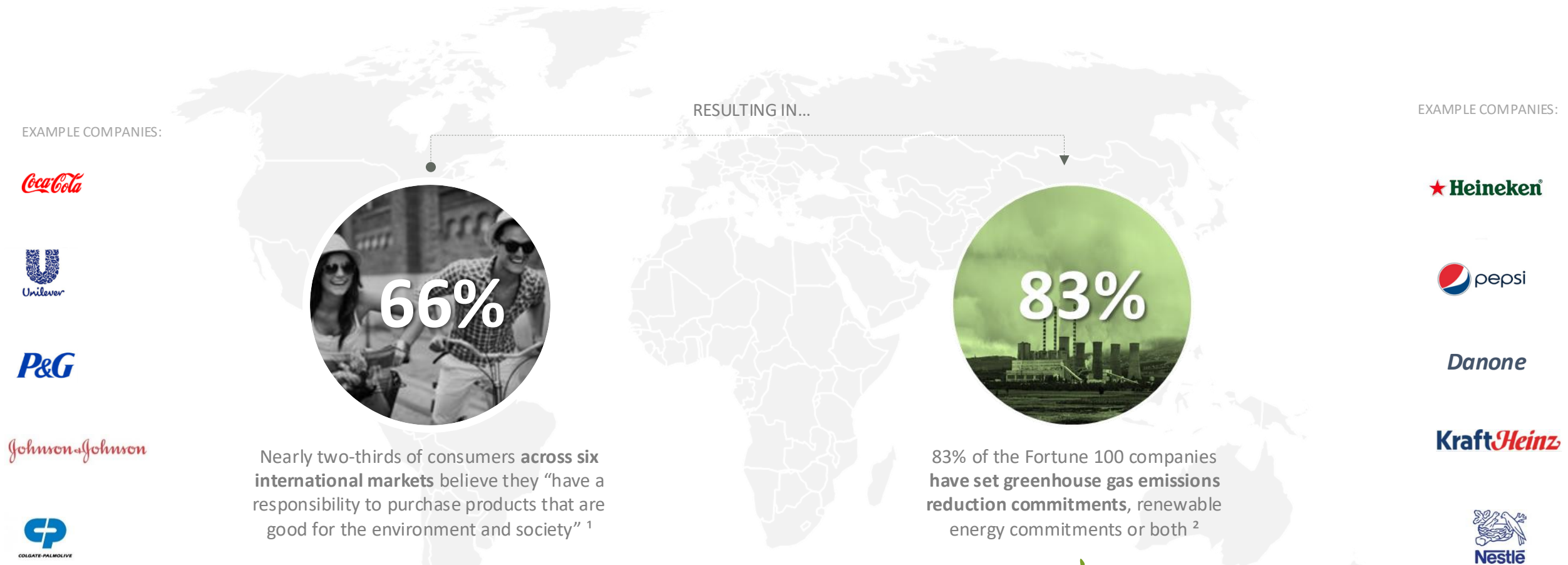
This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO₂eq.



Industry (**24%** of 2021 greenhouse gas emissions) – Greenhouse gas emissions from industry primarily come from **burning fossil fuels** for energy, as well as greenhouse gas emissions from certain chemical reactions necessary to produce goods from raw materials



Multinational corporations are increasingly turning to renewable energy



2020 study estimated economic losses due to climate change could be between **127 and 616 trillion dollars** extra until 2100 with current commitments, compared to 1.5 °C or well below 2 °C compatible action.

¹ Harvard Business Review, 2016

² Clearpath, 2015

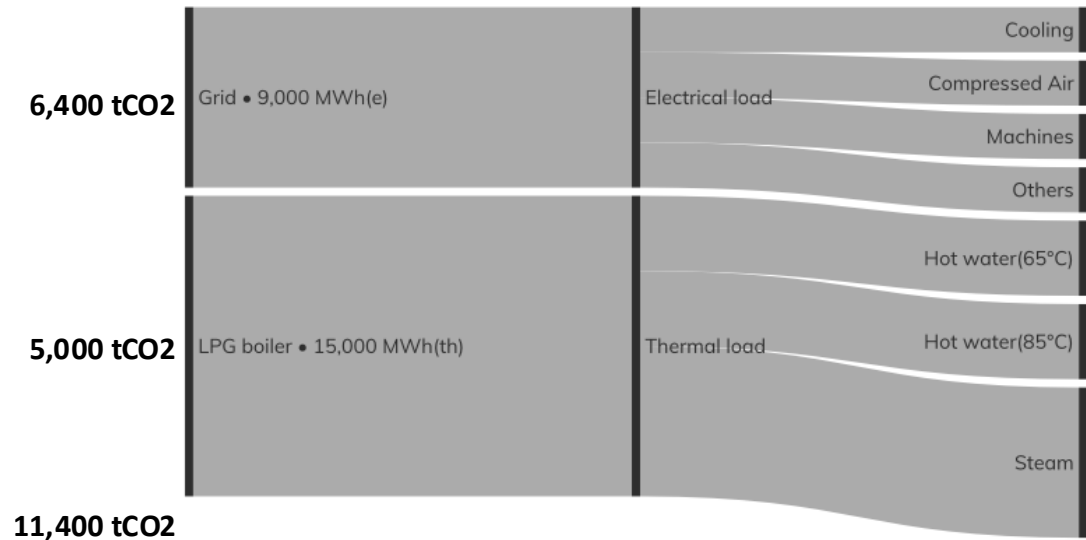


Understanding and mapping clients Energy demand

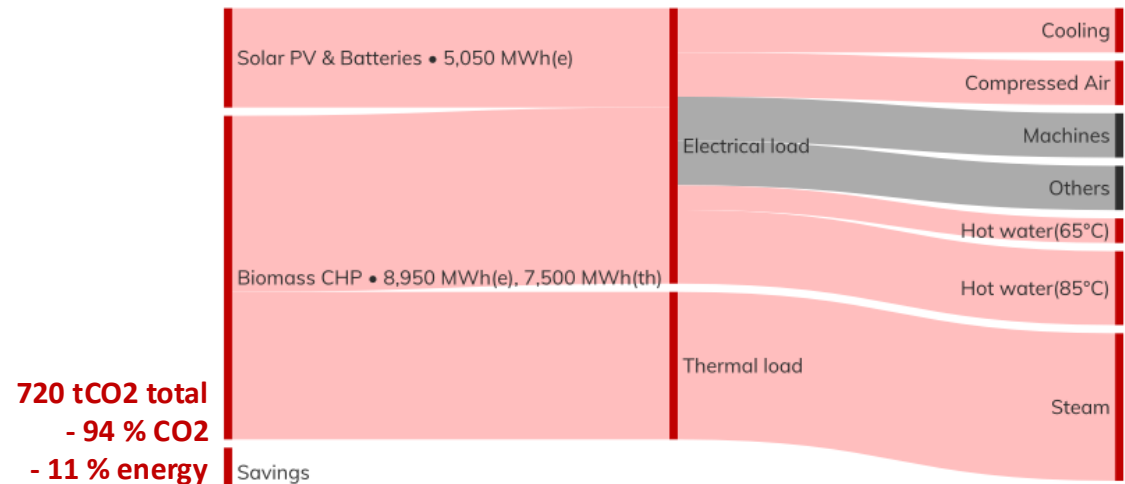
Energy-as-a-Service (EAAS)'s value proposition:

- **ENGAGE** our customers on their key sustainability objectives, and design an energy / CO2 mapping at the site level
- **ASSESS** and measure the electrical and thermal loads
- **ADDRESS** and implement custom design with the most efficient solutions aligned with the customer requirements to 0 CO2 emissions
- **EXECUTE** the construction of the facilities
- **DELIVER** maintenance with dedicated energy monitoring and analytics solutions
- **PARTNER** with our Customers in their global Net Zero Carbon Emissions Journey

Example of an Initial Energy mapping in MWh of a site:



Example of an Ideal Future Energy mapping in MWh* of the same site:



BECIS EAAS

Not BECIS

* Back up capacity such as natural gas or grid for example are not represented



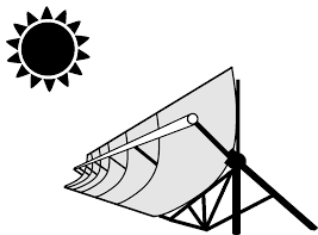
Bioenergy - Solution which gives the maximum impact ?

Solutions	Solar	Battery & Solar	Bioenergy	Cooling	Heat Pump & Heat recovery	Biogas/Bio CNG
GHG Savings	20-40%	0-10%	80-90%	10-30%	30-50%	80-90%
*Financial Savings	10-50%	10-20%	10-40%	10-30%	30-50%	0-10%

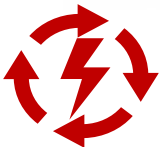
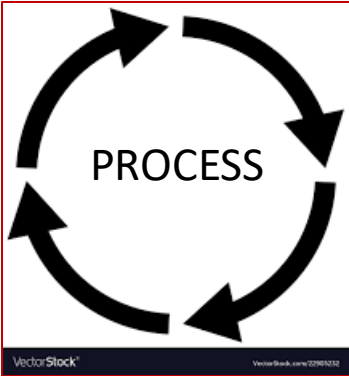
*Commercial savings can vary based on the current type of fuel used



Typical Energy Demand in Industrial application



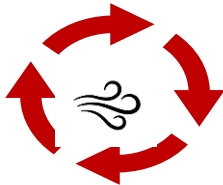
HEAT



POWER



COOLING



COMPRESSED AIR



Key Challenges in Selection & Design of Bioenergy Solutions for Industrial application

- Assessment of thermal demand over a period of time. Lack of data with clients
- Fluctuating demand (product mix, market demand , over capacity)
- Thermal vs Electric demand . Separate systems or Co-generation
- Mismatch between power and electricity demand
- Grid electricity cost and Fossil fuel cost
- Availability of space to install a Bioenergy plant
- Availability of feed stock at reasonable distance (Logistic cost)
- Biomass Security and Cost fluctuation



Key Design Criteria for A Bioenergy Facility



FUEL
FLEXIBILITY

PRESSURE
COMPENSATION

CULINARY
STEAM

SAFETY
COMPLIANCE

EMISSIONS
COMPLIANCE



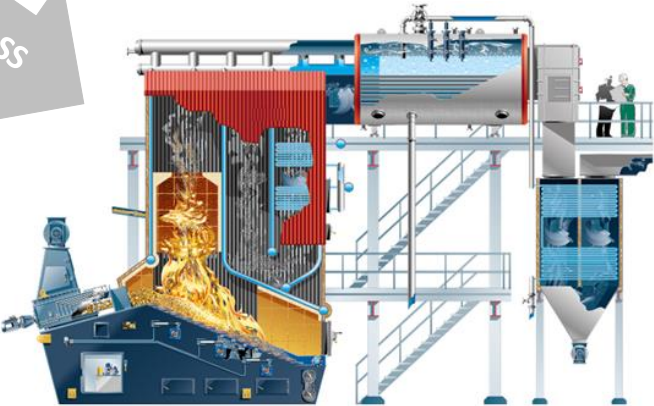
Bioenergy Options for Energy Demand

SUSTAINABLY CERTIFIED BIOMASS



BIOMASS

BIOMASS ENERGY SYSTEM



STEAM

CLIENT'S DIRECT THERMAL CONSUMERS



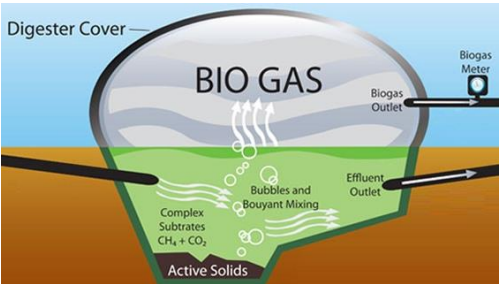
STEAM TURBINE

STEAM



ABSORPTION CHILLER

STEAM



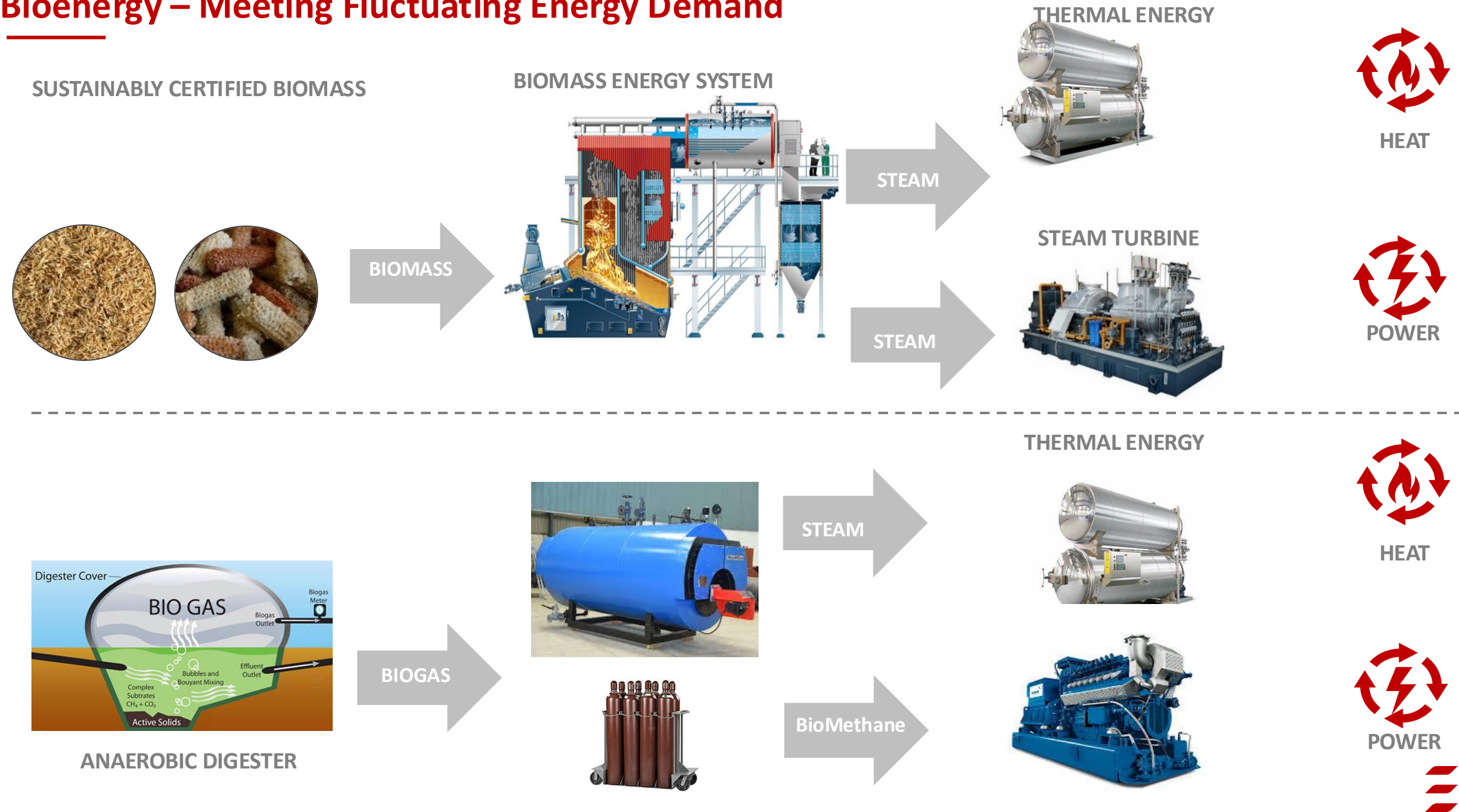
ANAEROBIC DIGESTER

BIOGAS

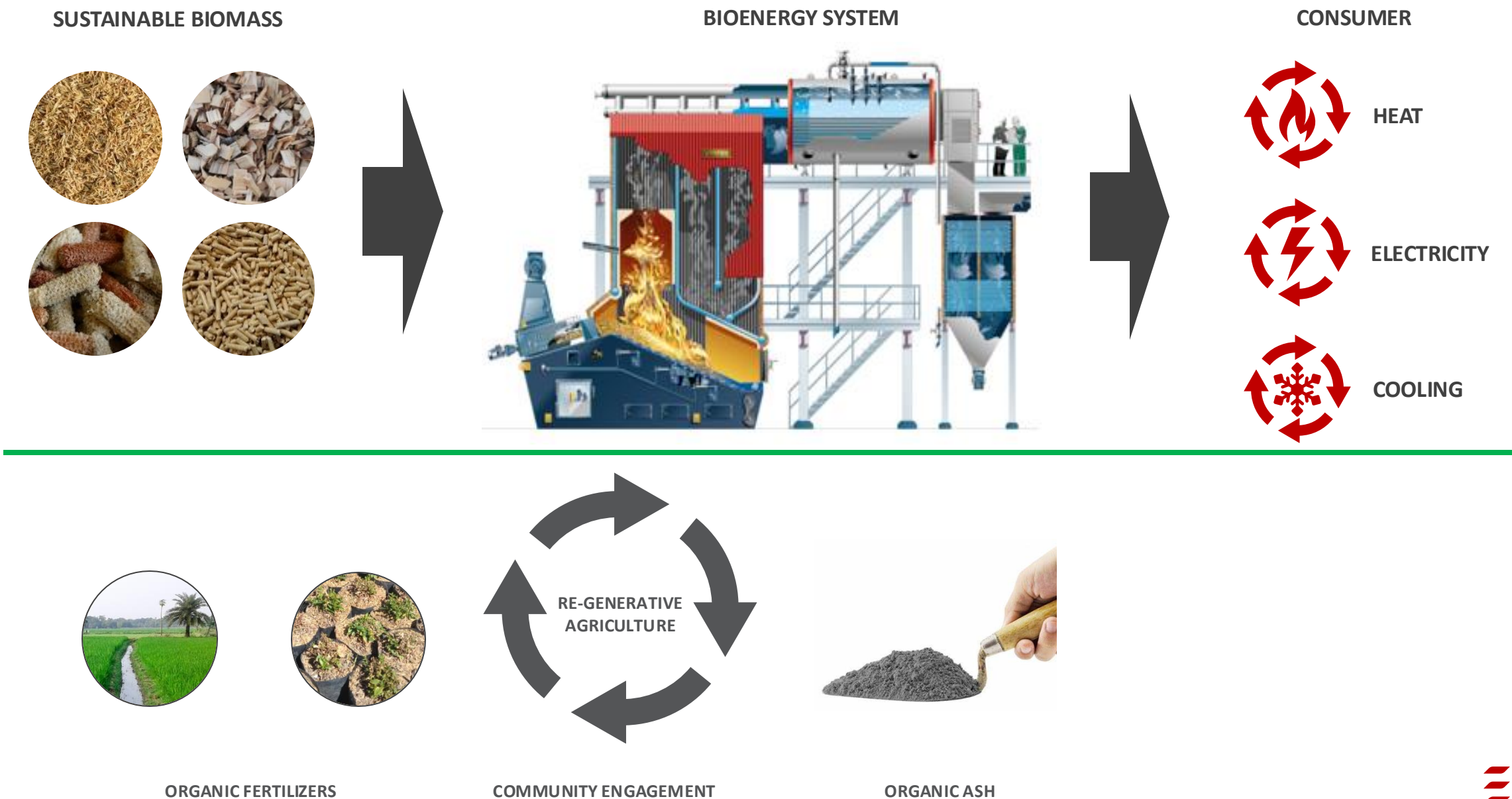
Bio Methane



Bioenergy – Meeting Fluctuating Energy Demand

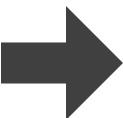


Reducing CO2 Emission and Energy Costs With Circular Economy Benefit

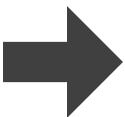


Reducing CO2 Emission and Energy Costs With Circular Economy Benefit

SUSTAINABLE BIOMASS



BIOENERGY SYSTEM
DEVELOPED BY BECIS



CONSUMER



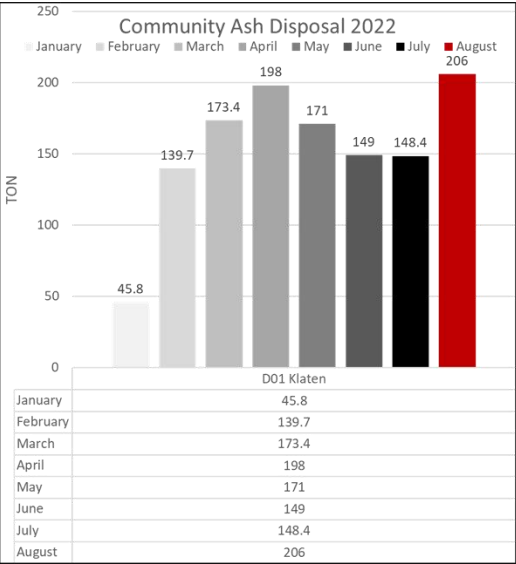
ORGANIC ASH



ORGANIC FERTILIZERS



COMMUNITY ENGAGEMENT



CSR Activity to Local Community

Gapoktan Kemudo for Ash Utilization:

- Organic Composting Fertilizer
- Direct apply to landfill area
- Support Crusher machine for composting activity
- Banner for "Rumah Kompos".



Ash Utilization for Organic Composting, Direct Landfill & mixture of brick making materials



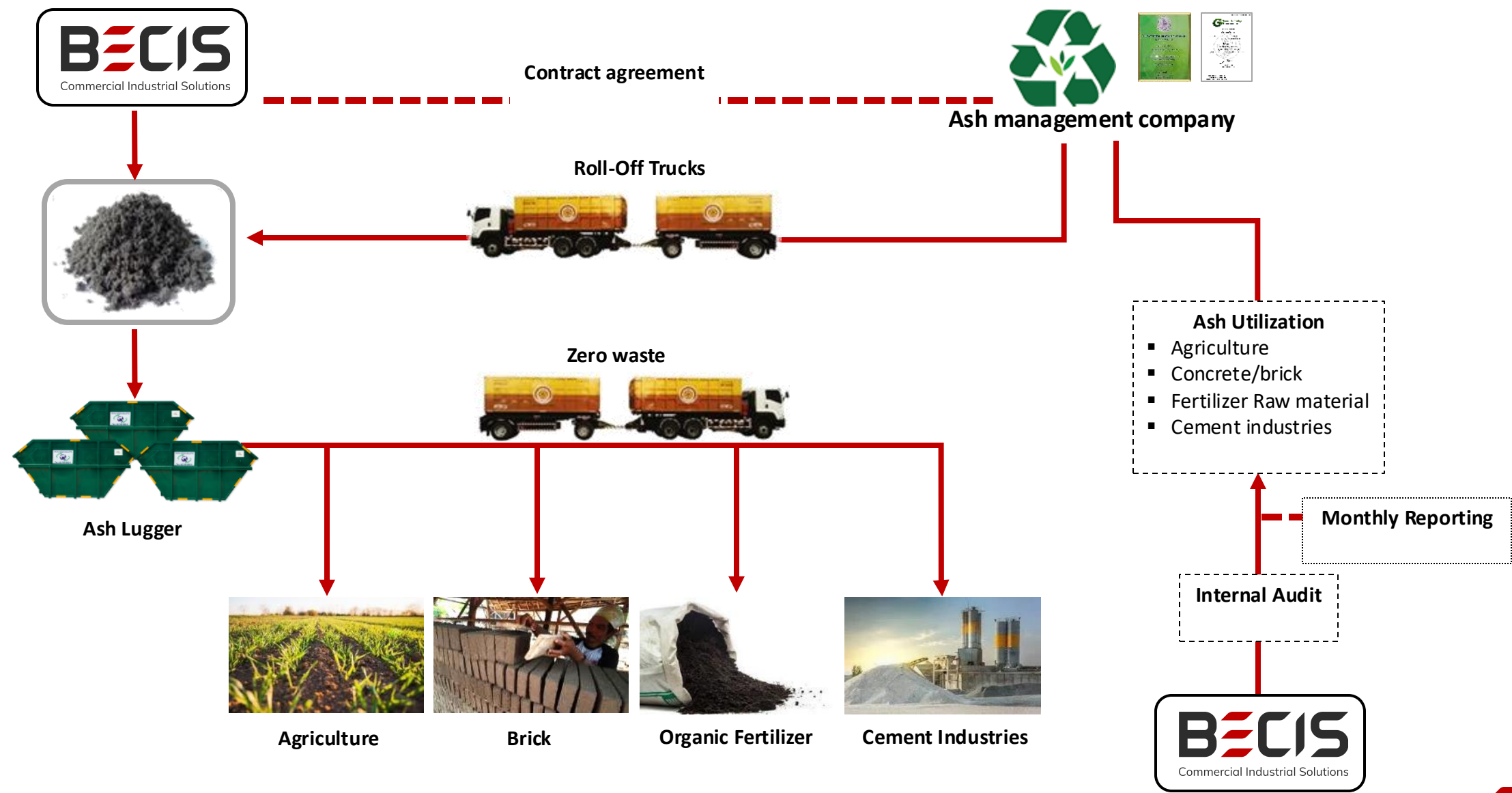
Ash Usage – Organic Fertilizer



Mixing of Biomass Ash for Organic Fert



Ash Management Plan





BIOMASS SUPPLY CHAIN - CHALLENGES AND OPPORTUNITIES

Biomass Characteristics

Following are important for solid fuels for combustion/thermal processing :

- ✓ *Particle size and size distribution*
- ✓ *Bulk density*
- ✓ *Moisture content*
- ✓ *Calorific value*



Illustration ; Energy Density Differences of the same Weight Material by Different Product



Rice Straw



Rice Husk



Sugarcane Leaves



Coco waste



Wood Chips



Saw Dust

Energy density is another common measure of the possible potential of a fuel. Energy density is the heating value per unit volume. It is measured as MJ/kg per cubic meters



Biomass Procurement Strategy

Procurement strategy to ensure security in feedstock supply as well as the associated costs

General approach

- Sustainability of the biomass is the first priority;
- Use of only a small portion of the available biomass in the vicinity of each project;
- Superior data and knowledge of biomasses, competition and logistics
- Biomass availability is typically assessed within 50-250km radius from the project site;
- Several layers of security of supply; and
- Biomass sourcing must also account for seasonality.



Customized biomass sourcing solution



Main biomass suppliers: Biomass is sourced from specific suppliers under long-term partnerships. These would typically be larger agricultural/wood processing facilities or fuel suppliers.

Back-up suppliers: Smaller share of fuel sourced from the market to maintain a procurement network which can be activated in the event of a supply disruption.

Fuel storage facility: On-site storage and centralized off-site warehousing to mitigate short-term swings in supply.

Maintain market relations (traders): Maintain relationships with various suppliers to have access to the wider market and market information.

Alternative biomasses: Other biomass residues can be initiated with short notice, incl. wood chips, or wood pellets



Supply Chain Challenges

1. Managing security of supply

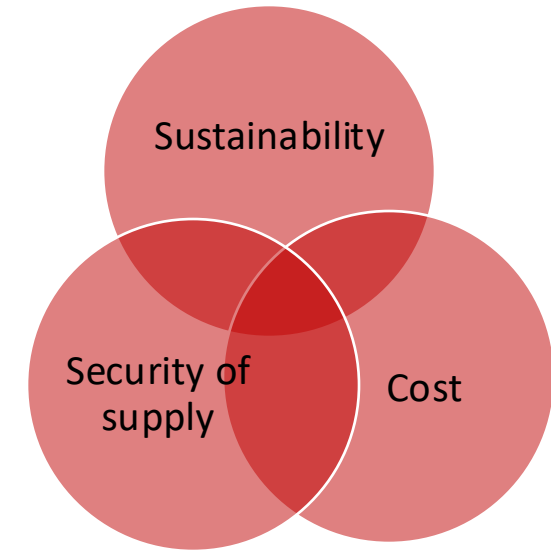
- Seasonality
- Number of suppliers / concentration risk
- Warehousing and hubs
- Densified or loose biomass
- Contractual commitment vs. Trading market

2. Cost efficiency

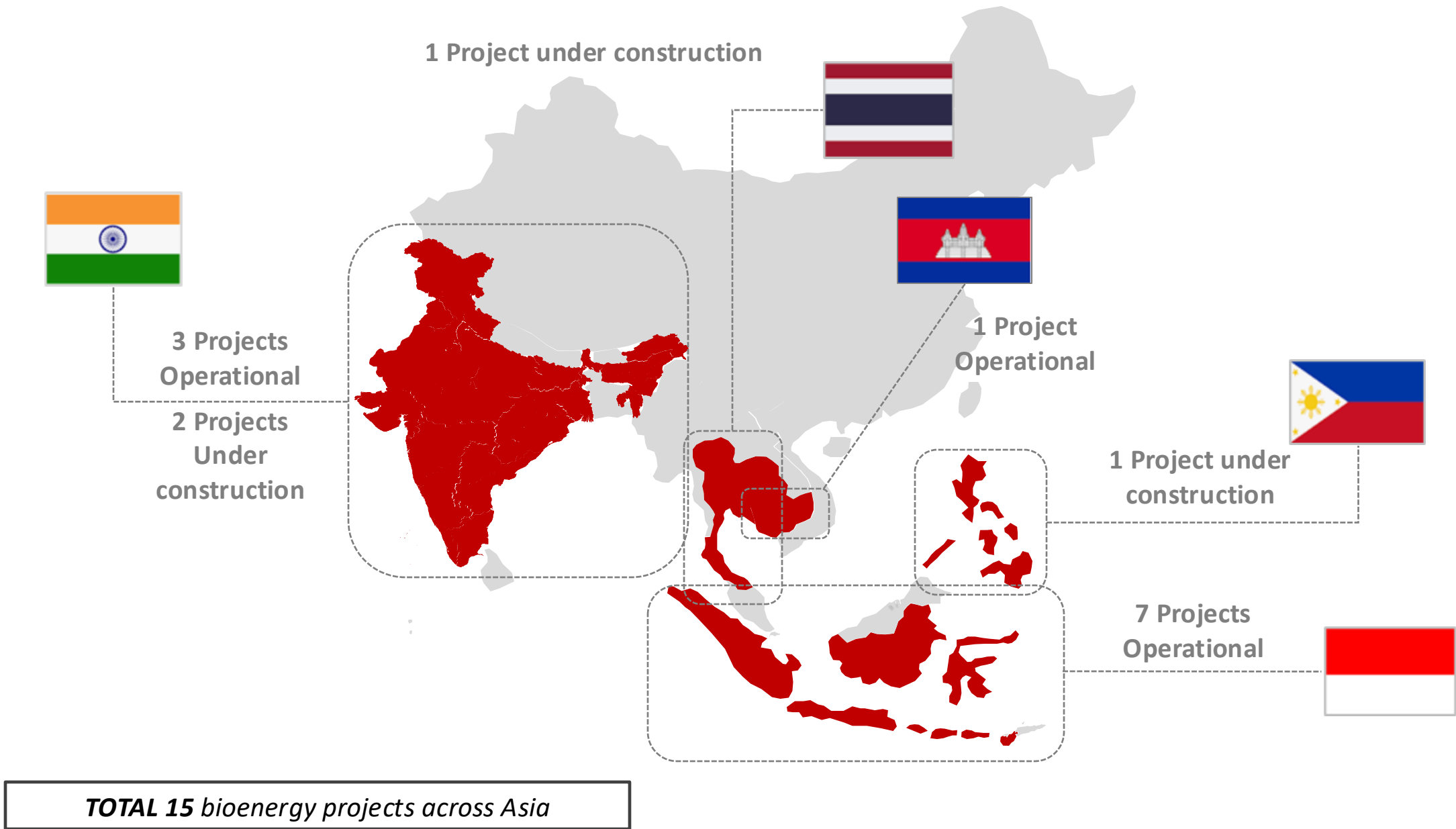
- Cost of biomass
 - Moisture content / heating value
 - Ash content
- Cost of logistics
 - Handling cost (loading, unloading, bags, manpower)
 - Payload (type and density of biomass) and compliance with laws and regulations, incl. Health and safety
 - Turnaround time (traffic, weather etc.)

3. Sustainability

- Sustainability cannot be taken for granted, even with agricultural waste. There are issues to beyond sustainability of fuel, that need to be considered (for example, human rights, local food security, land rights)



Bioenergy projects- Helping decarbonize energy demand







Bioenergy Projects



CO₂ REDUCTION : 9,010 tCO₂e/y



CO₂ REDUCTION : 6,260 tCO₂e/y



CO₂ REDUCTION : 10,460 tCO₂e/y



CO₂ REDUCTION : 12,560 tCO₂e/y



CO₂ REDUCTION : 9,960 tCO₂e/y



CO₂ REDUCTION : 19,900 tCO₂e/y



Bioenergy projects



CO2 Reduction 20,060 tCO₂e/y)



CO2 Reduction 15,520 tCO₂e/y)

- Sourcing more than 200.000 TPA of Biomass
- Effectively reducing around 100,00 tCO₂e/y
- Recycling around 20,000 TPA of Ash ensuring circular economy



General Layout



Typical Biomass Steam Plant



FULLY AUTOMATION BOILER SYSTEM



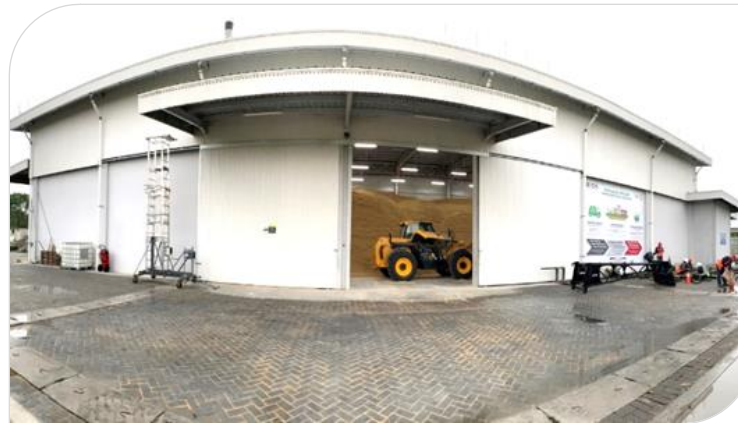
FUEL GAS TREATMENT SYSTEM



ASH HANDLING SYSTEM



BIOMASS STORAGE



BIOMASS STORAGE WAREHOUSE



BIOMASS HANDLING SYSTEM



Safety culture- Important element in managing a Bioenergy plant

Specific programs customized to each site include management of emergency fire, working at heights, confined space, lifting management, heavy equipment operations, energy isolation, safe driving, routine and adhoc inspections, internal and external audits, management reviews.



Incident management



Working at height management



Lifting management



Confined space management



LOTO – Lock Out Tag Out



Fire management drill



Equipment inspection



Full PPE for all personnel





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