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CLIMATE SOLUTIONS

$$BE_y = \varphi \times (1-f) \times GWP_{CH4} \times \sum_{x-1}^{y} \sum_{j} W_{j,x} \times DOC_j \times e^{-kj \times (y-x)} \times \left(1-e^{-kj}\right)$$

Phitsanulok Energy Park – introducing MBT with AD and RDF production in Thailand

P. BANSITH, Green Tree Foundation & K. KRELL, Greenovate Ltd.

4th International Conference on Sustainable Solid Waste Management - Limassol 24 June 2016

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Thailand

- Area: 513,120 km2
- Population: 67,959,000 million
- 77 provinces

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$$BE_y = \varphi \times (1-f) \times GWP_{CH4} \times \sum_{y} \sum_{j,x} W_{j,x}$$

$$BE_y = \varphi \times (1-f) \times GWP_{CH4} \times \sum_{x=1}^{y} \sum_{j} W_{j,x} \times DOC_j \times e^{-kj \times (y-x)} \times (1-e^{-kj})$$

Waste generation in Thailand

- **2009:** 15.1 million tons generated; 3.3 million tons recycled (22%)

- **2015:** 26.9 million tons generated; 5 million tons recycled (18.5%)

- Further yearly increase of 600,000 tons expected due to population increase and tourism

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Roles and responsibilities

Royal Thai Government

1. Central Government
   - **Stimulate regulation, policies and standards**
   - **Pollution Control Department (PCD)**
2. Regional Governments
   - **Coordinate Central and Local Governments**
3. Local Governments
   - **Waste management in their governed area**
   - **Contract private companies to dispose of waste; granted right by PCD**

$BE_y = \varphi \times (1-f) \times GWP_{CH4} \times \sum^{y} \sum W_{j,x} \times DOC_j \times e^{-kj \times (y-x)} \times (1-e^{-kj})$

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The Phitsanulok Energy Park Project

$$BE_y = \varphi \times (1-f) \times GWP_{CH4} \times \sum_{x-1}^{y} \sum_{j} W_{j,x} \times DOC_j \times e^{-kj \times (y-x)} \times (1-e^{-kj})$$

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Phitsanulok project

- For the region of Phitsanulok
- MSW generation:
  - **300 tons / day every day**
  - **Ca. 110.000 tons / year**
- Current treatment:
  - **Rudimentary MBT**
  - **Waste pickers at dump**
  - **Dumping**

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$$BE_y = \varphi \times (1-f) \times GWP_{CH4} \times \sum_{y} \sum_{j,x} W_{j,x}$$

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The ‘ideal’ waste management project

…is fiction!

While we’re waiting for the framework conditions to become ideal for our ideal project, we need to deliver solutions now.

What is possible as of today? What do we have now?

$$BE_y = \varphi \times (1-f) \times GWP_{CH4} \times \sum_{x=1}^{y} \sum_{j} W_{j,x} \times DOC_j \times e^{-kj \times (y-x)} \times (1-e^{-kj})$$

Waste composition analysis

Organic	57%
PP, PET PVC, PS, EPS, HDPE LDPE	24%
Paper & cardbord	6%
Inerts	5%
Glass	4%
Textiles	2%
Metals	1%

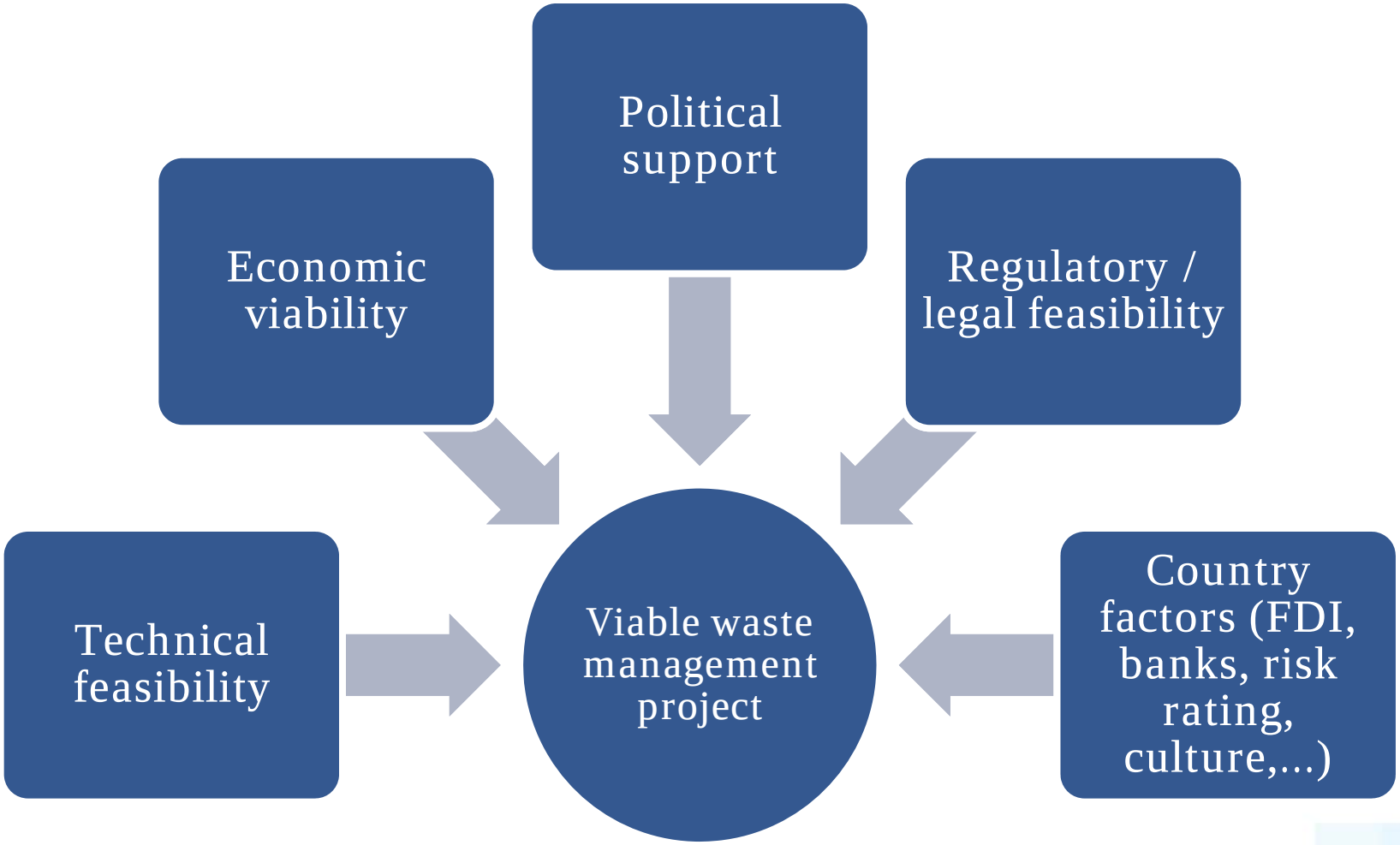
Rather wet waste

Little pre-sorting at homes

- Ca. 60% good for biogas and / or composting
- Ca. 30% good for recycling and / or RDF

$$BE_y = \varphi \times (1-f) \times GWP_{CH4} \times \sum^{y} \sum W_{j,x} \times DOC_j \times e^{-kj \times (y-x)} \times (1-e^{-kj})$$

Framework analysis



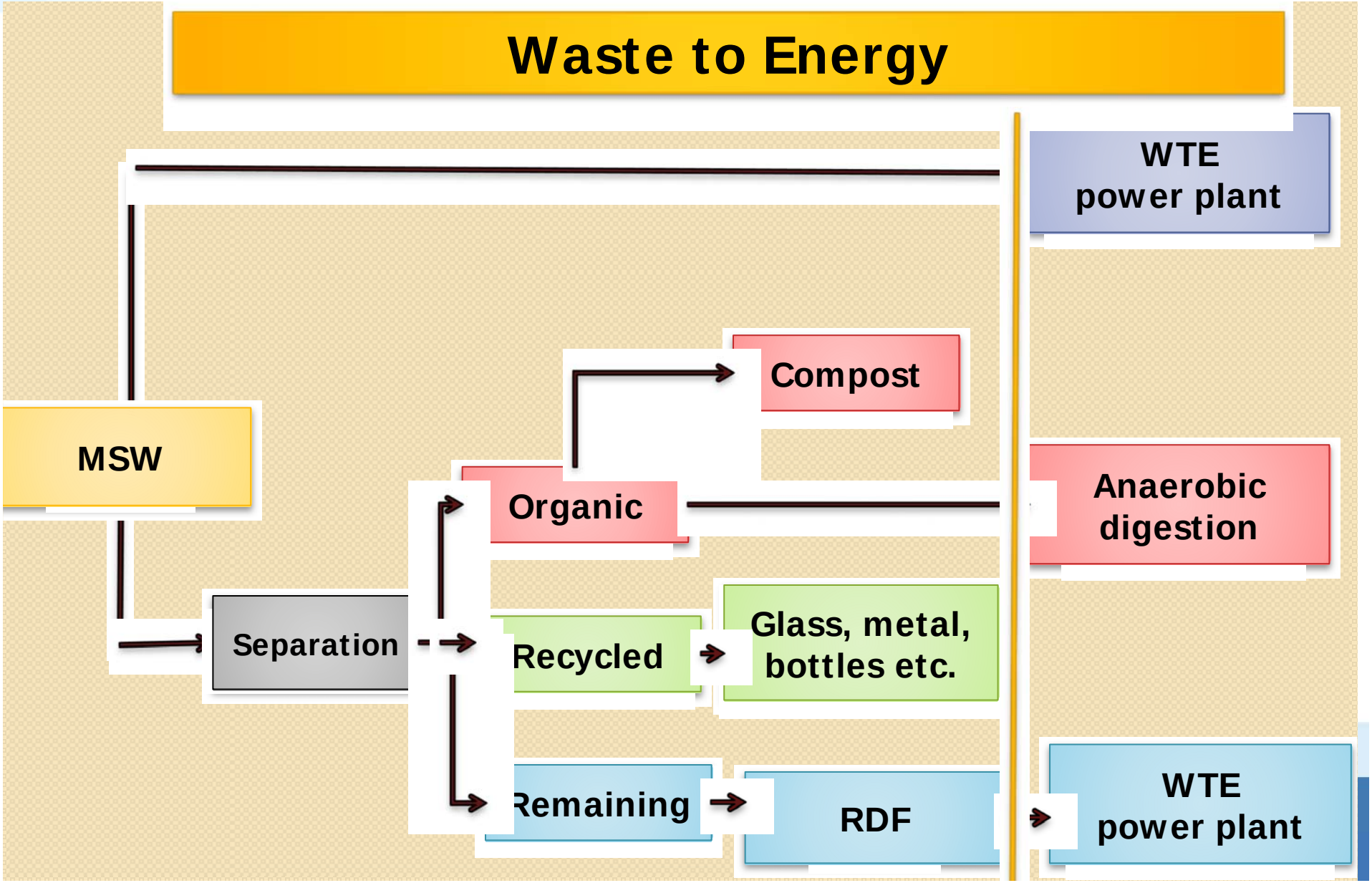
$$BE_y = \varphi \times (1-f) \times GWP_{CH4} \times \sum^{y} \sum W_{j,x} \times DOC_j \times e^{-kj \times (y-x)} \times (1-e^{-kj})$$

‘Make or break’ factors for project viability

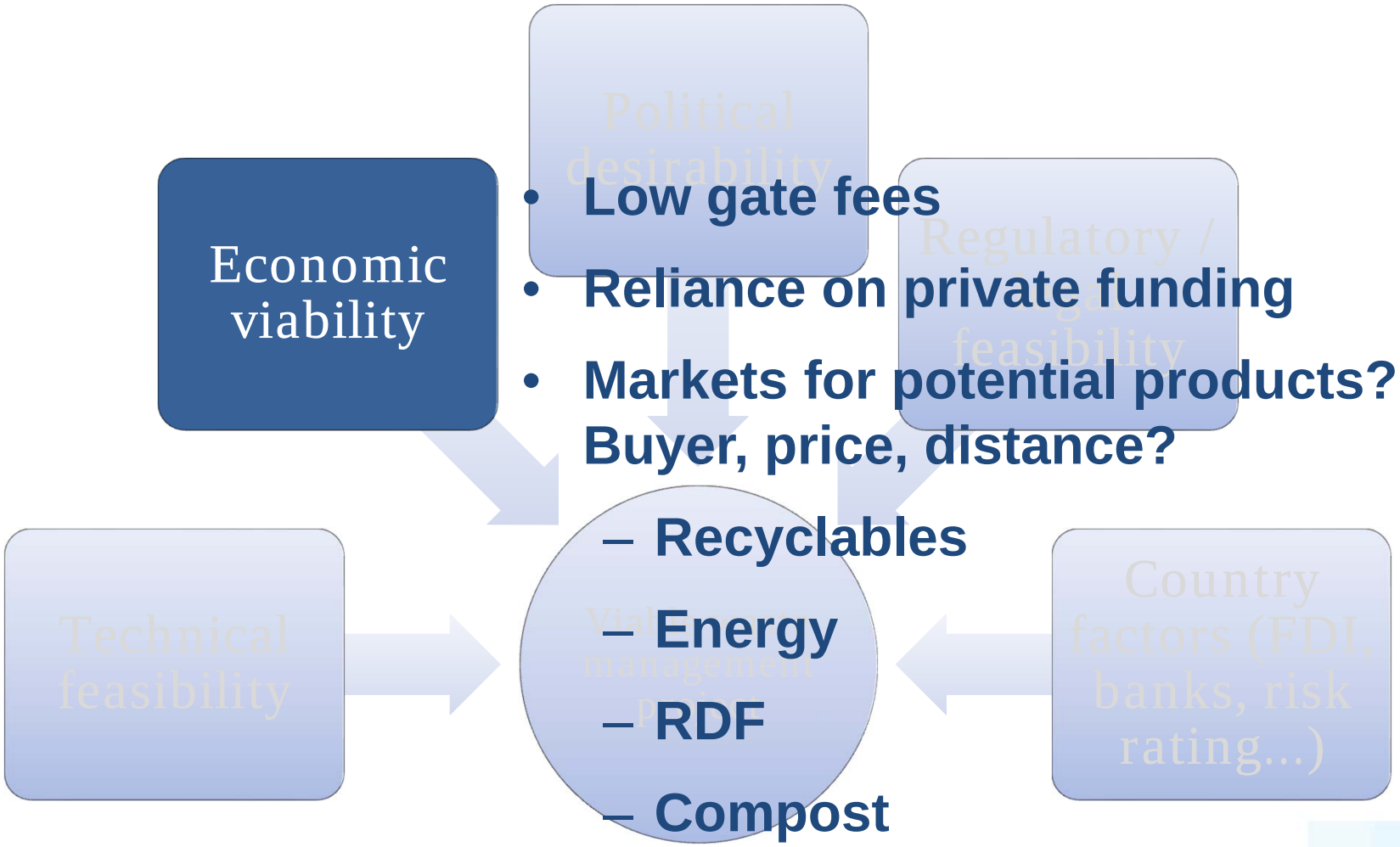
- **Military Government made waste management a national priority**
- **Waste strategy under development**
  - **Roadmap of solid waste & hazardous waste management in Thailand (Aug 2014)**

$$BE_y = \varphi \times (1-f) \times GWP_{CH4} \times \sum_{y} \sum_{j,x} W_{j,x} \times DOC_j \times e^{-kj \times (y-x)} \times (1-e^{-kj})$$

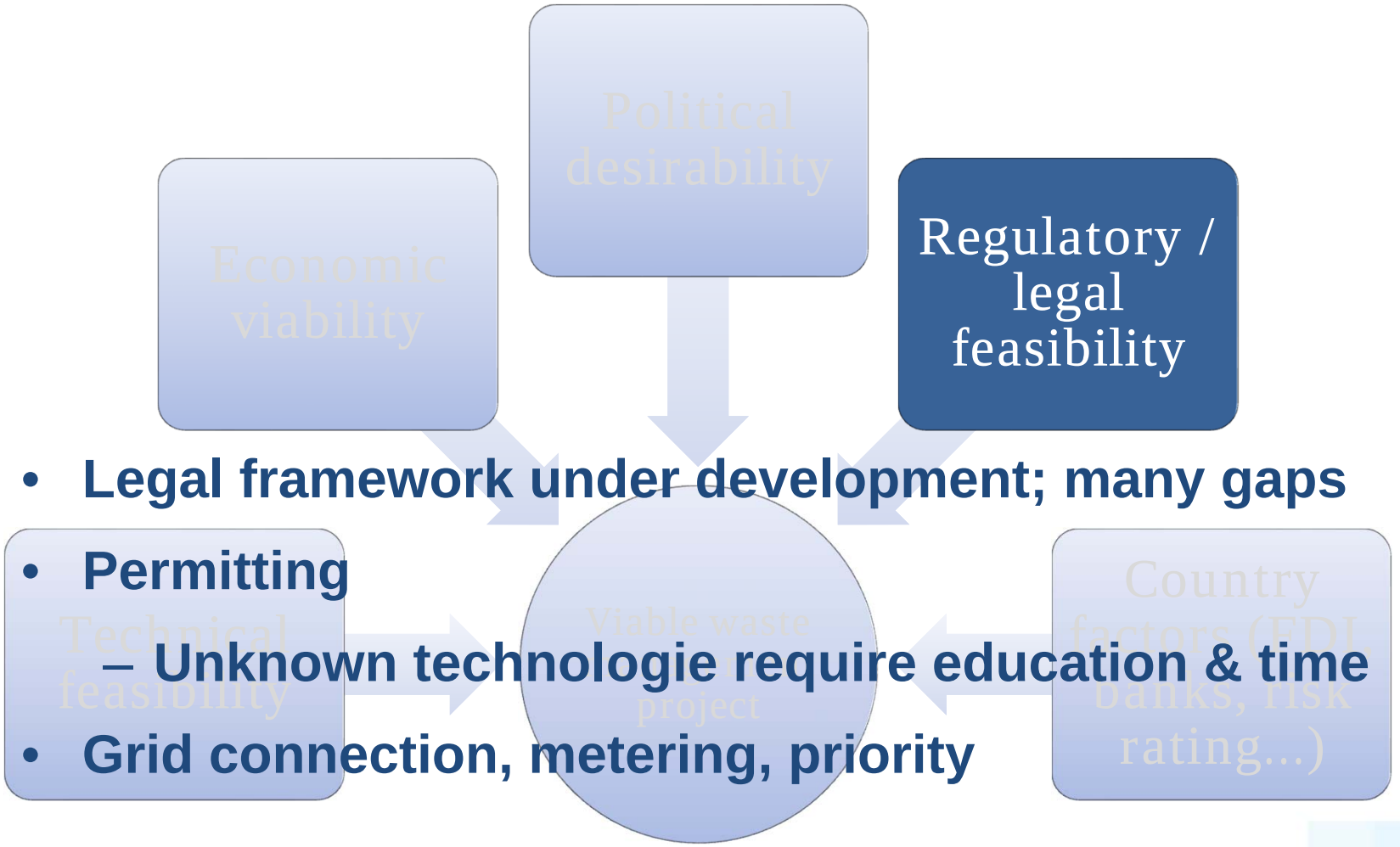
Thai waste strategy – energy focused



‘Make or break’ factors for project viability

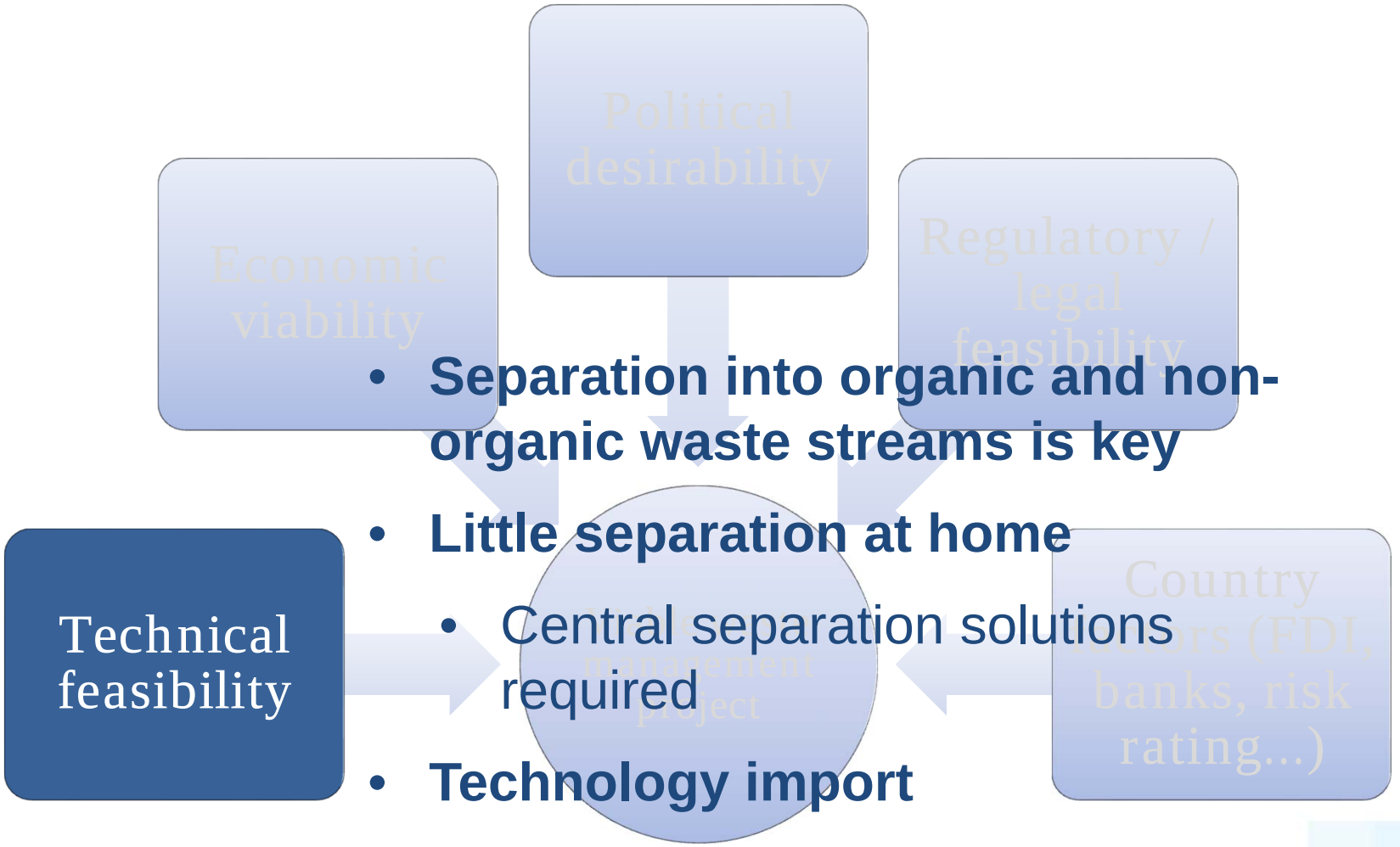


‘Make or break’ factors for project viability



- **Legal framework under development; many gaps**
- **Permitting**
  - **Unknown technologie require education & time**
- **Grid connection, metering, priority**

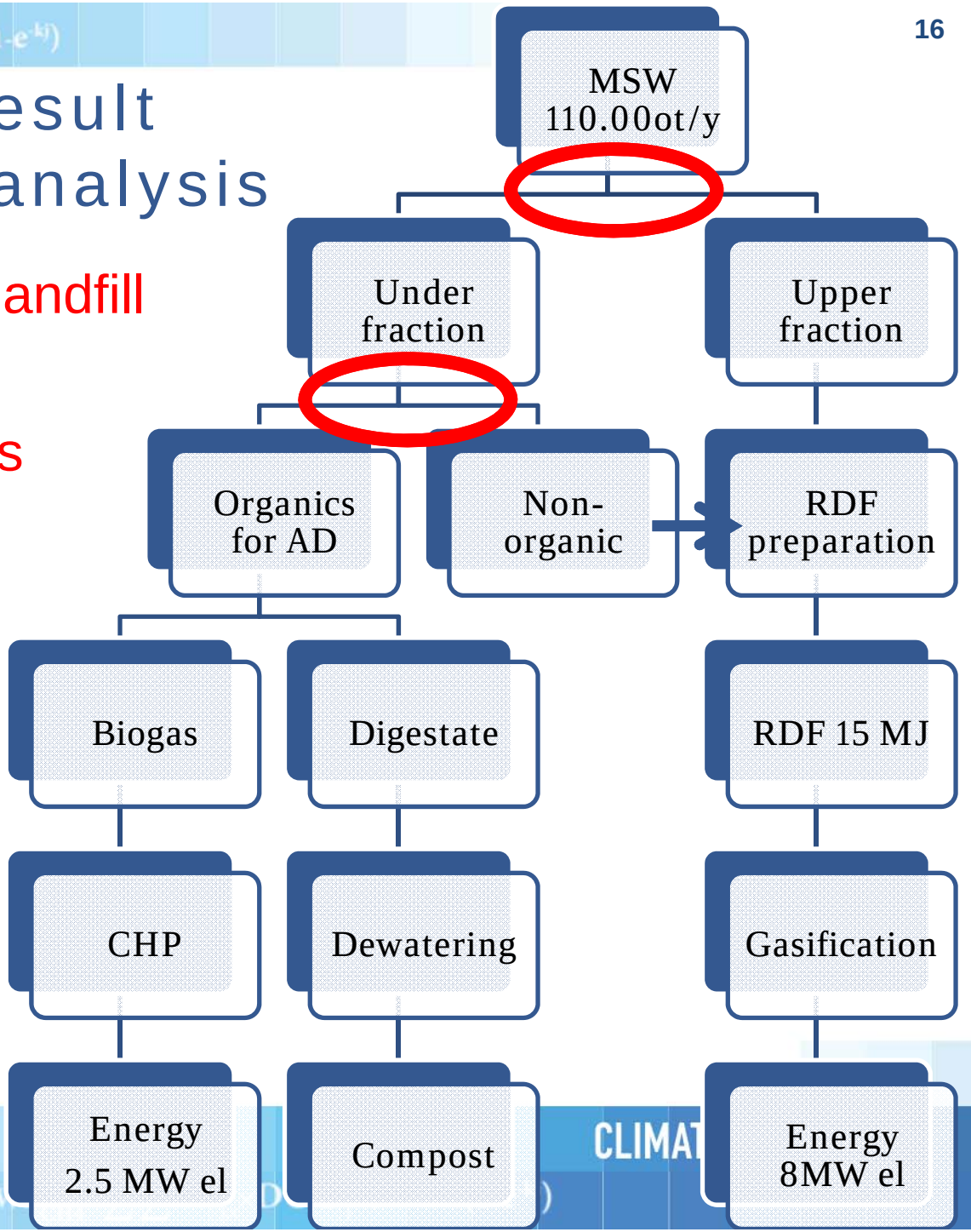
‘Make or break’ factors for project viability



- **Separation into organic and non-organic waste streams is key**
- **Little separation at home**
  - Central separation solutions required
- **Technology import**

Design choices result from framework analysis

- Energy production & landfill diversion priviledged
- Recycling: only metals
- Plastics go into RDF
- Sorting only to clean fractions enough for AD & gasification
- Composting to deal with the mass
- Good separation is key to performance



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The OREX press: a new approach to central separation of wastes

SEPARATION

>95% efficiency

Organic

Homogenous semi-liquid biogenic fraction

Non-organic

Plastic & Textiles

Paper & Cardbord

Minerals & Metals

$$\varphi \times (1-f) \times GWP_{CH4} \times \sum_{x=1}^{y} \sum_{j} W_{j,x} \times DOC_j \times e^{-kj \times (y-x)} \times (1-e^{-kj})$$

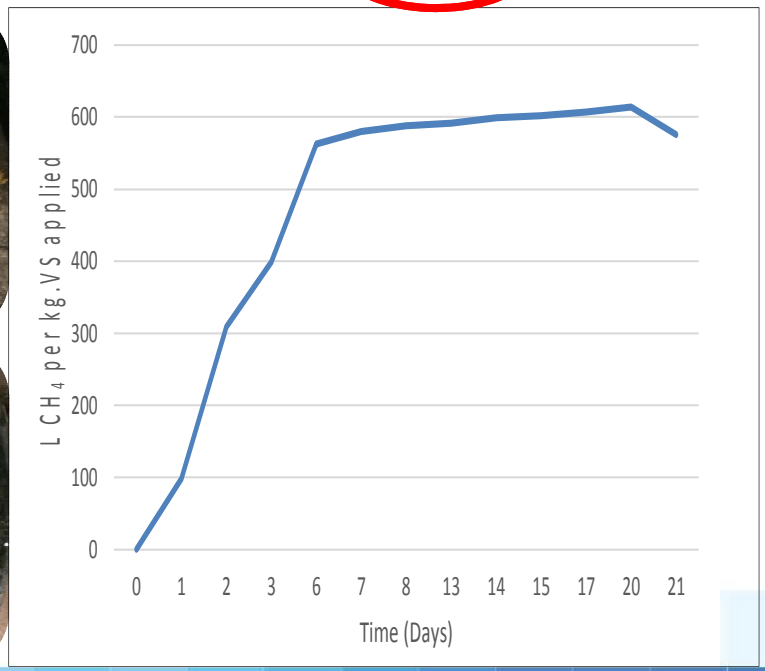
At the heart of the process: the waste press

- MSW is loaded into a chamber and compressed at **extremely high pressure**;
- Organic material behaves similar to a liquid and is pressed from the waste as homogenous paste;
- The remainder is a dry waste fraction with a higher calorific value.

$$BE_y = \varphi \times (1-f) \times GWP_{CH4} \times \sum_{x=1}^{y} \sum_{j} W_{j,x} \times DOC_j \times e^{-kj \times (y-x)} \times (1-e^{-kj})$$

Test results with waste press

MSW Liverpool (UK)	Average Separation OREX	TS	VS	Moisture	ash	VS/TS
Original	100	36	30,3	64,0	5,7	84%
Dry	55	59	48,5	41,0	10,5	82%
Wet	45	25,5	24,1	71,0	2,6	94%



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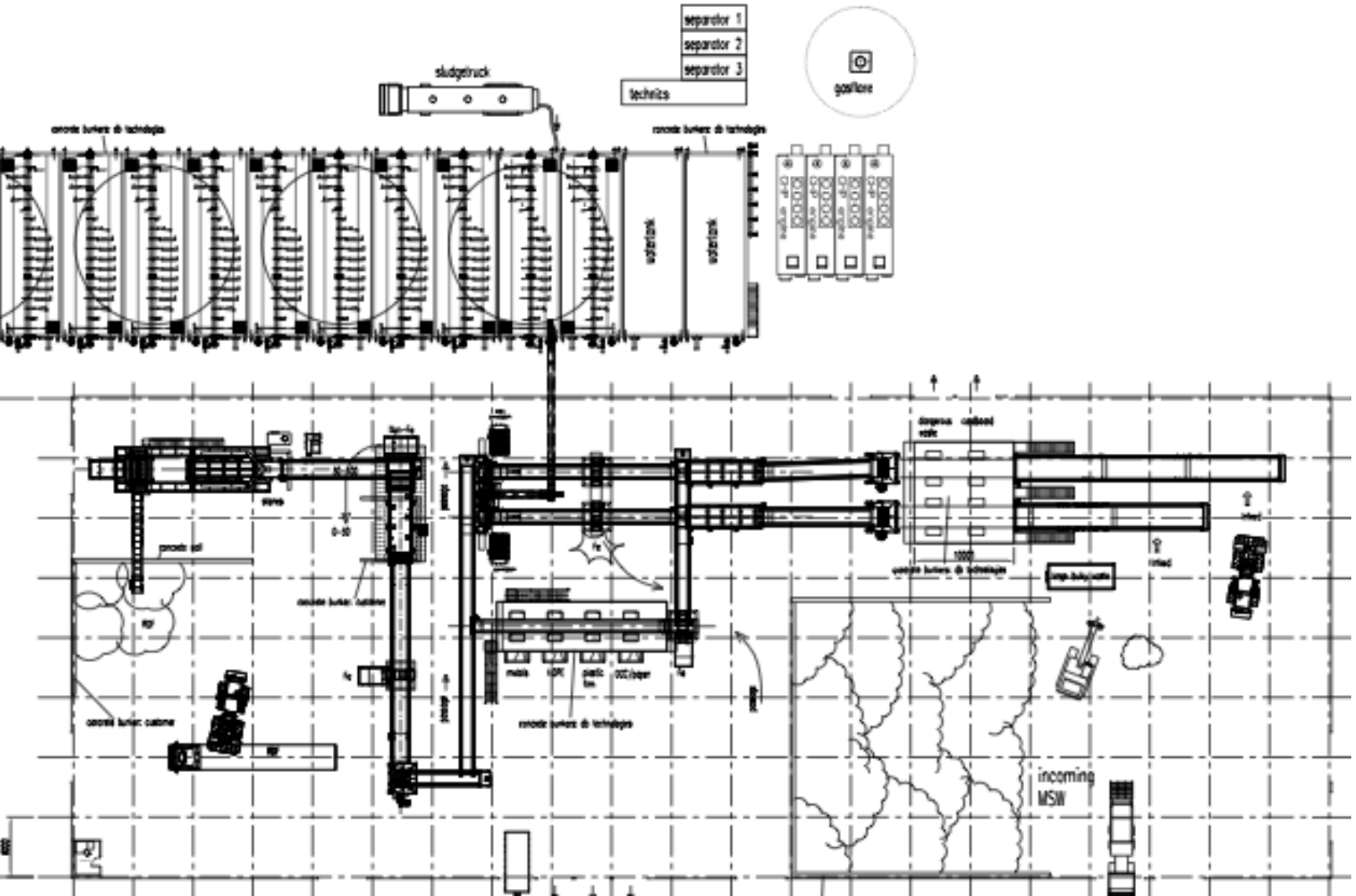

$$\times GWP_{CH4} \times \sum_{y} \sum W_{j,x} \times DOC_{j} \times e^{-kj \times (y-x)} \times (1 - e^{-kj})$$

RDF fluff 16 MJ/ton for gasification

Project development team contacts

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