



BEIRUT-COPENHAGEN CITY COOPERATION
WASTE-TO-ENERGY AND SOLID WASTE MANAGEMENT, OCTOBER 2016

CO-CREATION WORKSHOP

**THE WAY TO SECURE AN HIGH QUALITY
WASTE-TO-ENERGY PLANT IN BEIRUT**

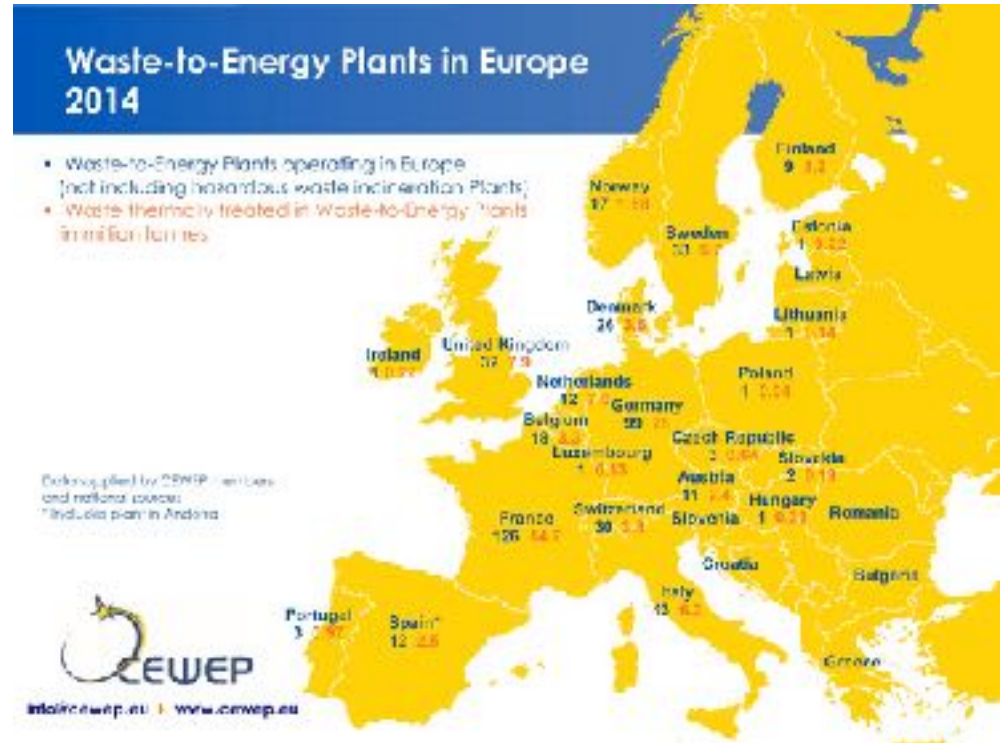
JØRGEN HAUKOHL, RAMBOLL, INDEPENDENT CONSULT

RAMBOLL

IDEA TO REALITY

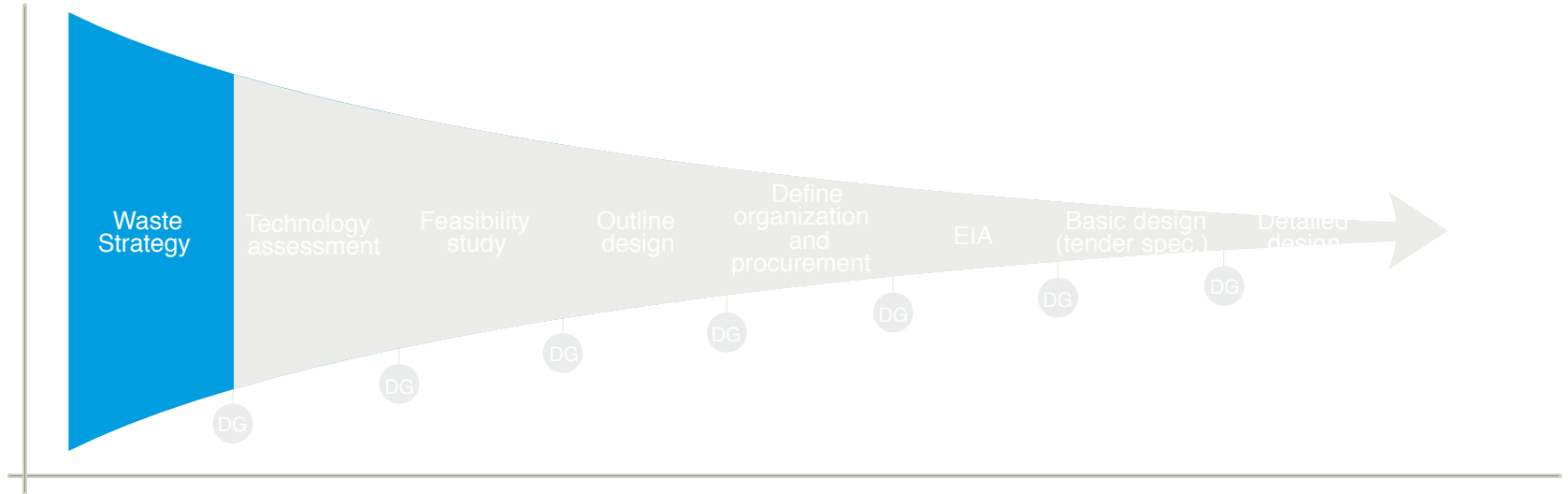
Project structure schemes:

- Technical, environmental and financial analysis
- Conceptual design and layout
- Procurement planning and project structuring
- Management of the procurement process
- Preparation of tender documents, bid evaluation and contract negotiations
- Owners Engineer / EPC: Contract management, design supervision, coordination, works supervision and commissioning
- O&M support

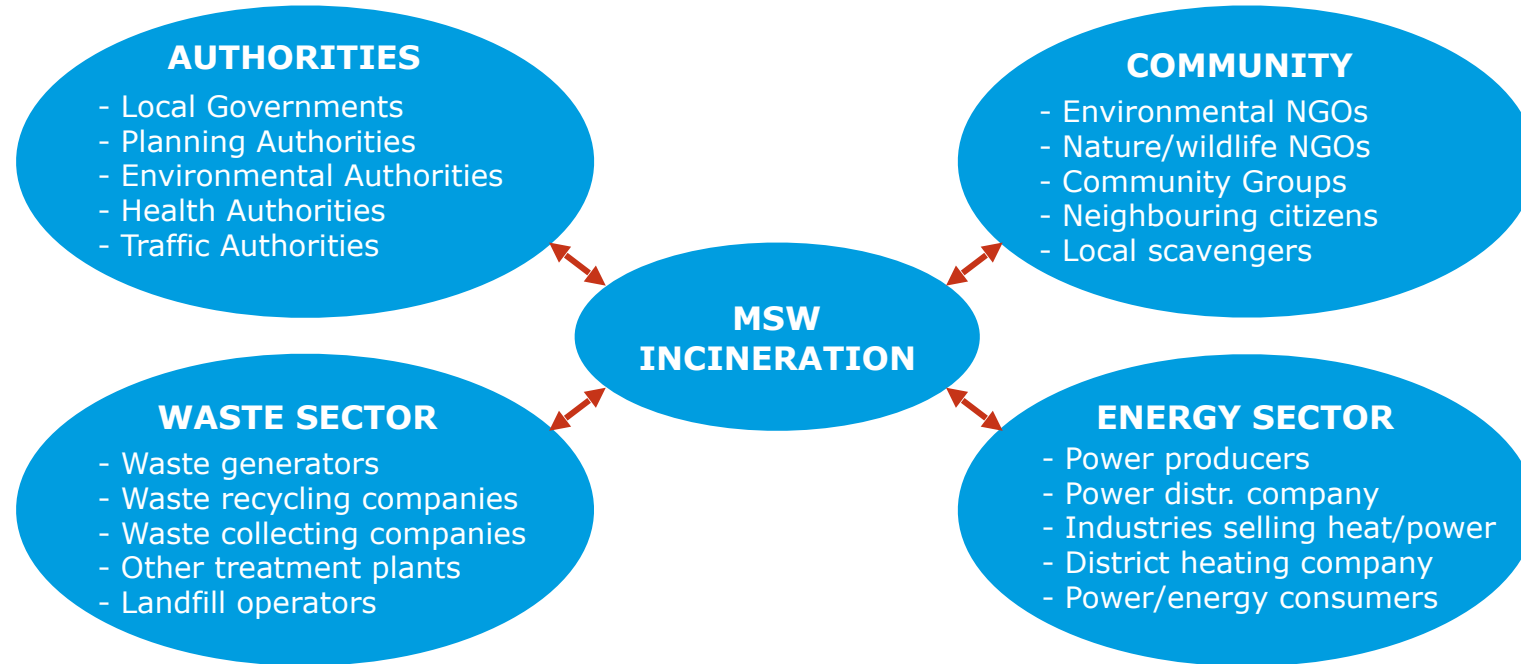


WASTE STRATEGY

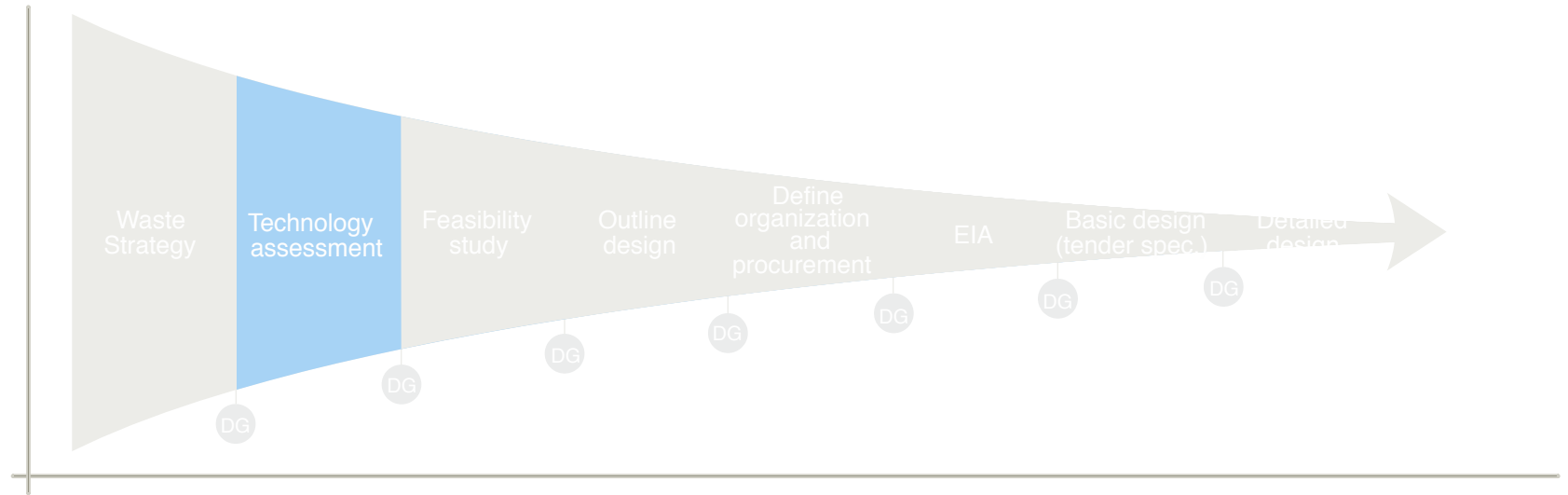
WASTE QUANTITY AND QUALITY



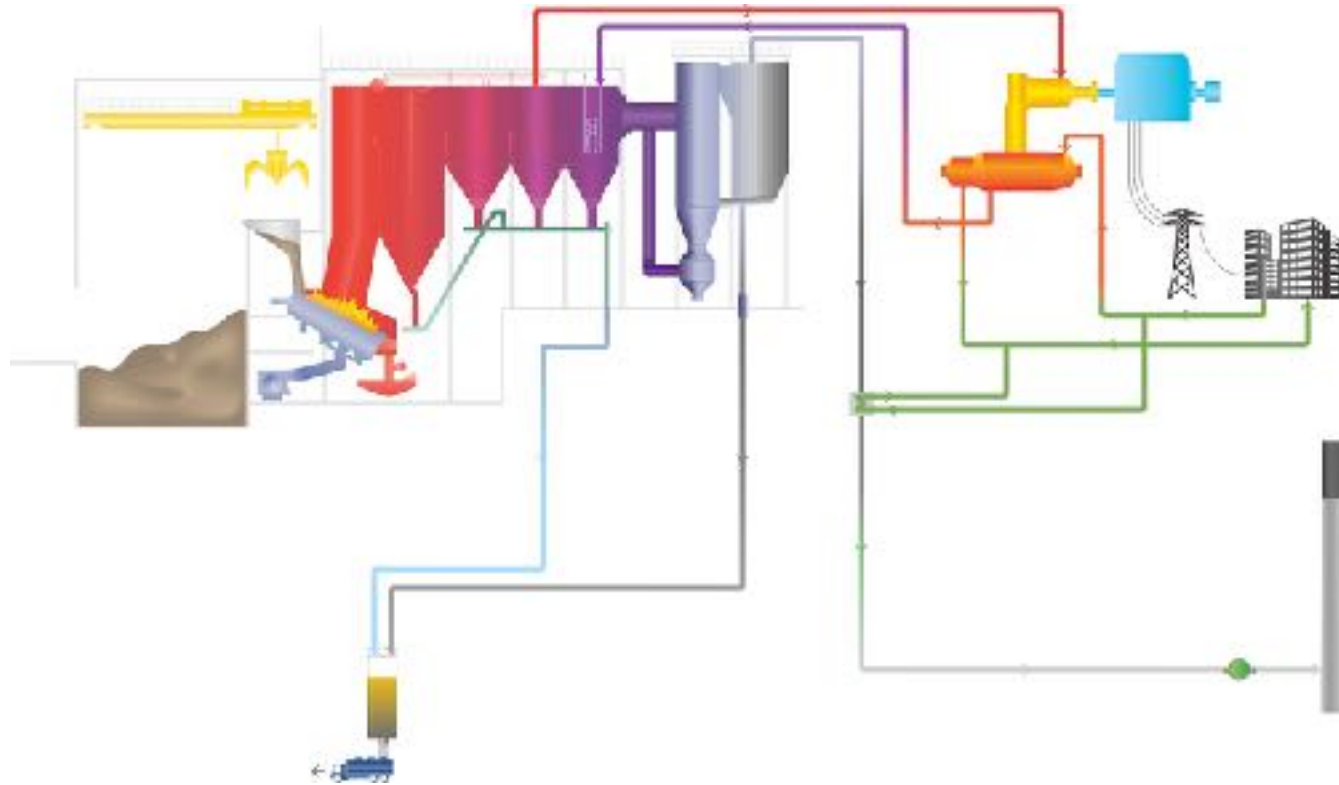
STAKEHOLDERS TO BE CONSIDERED



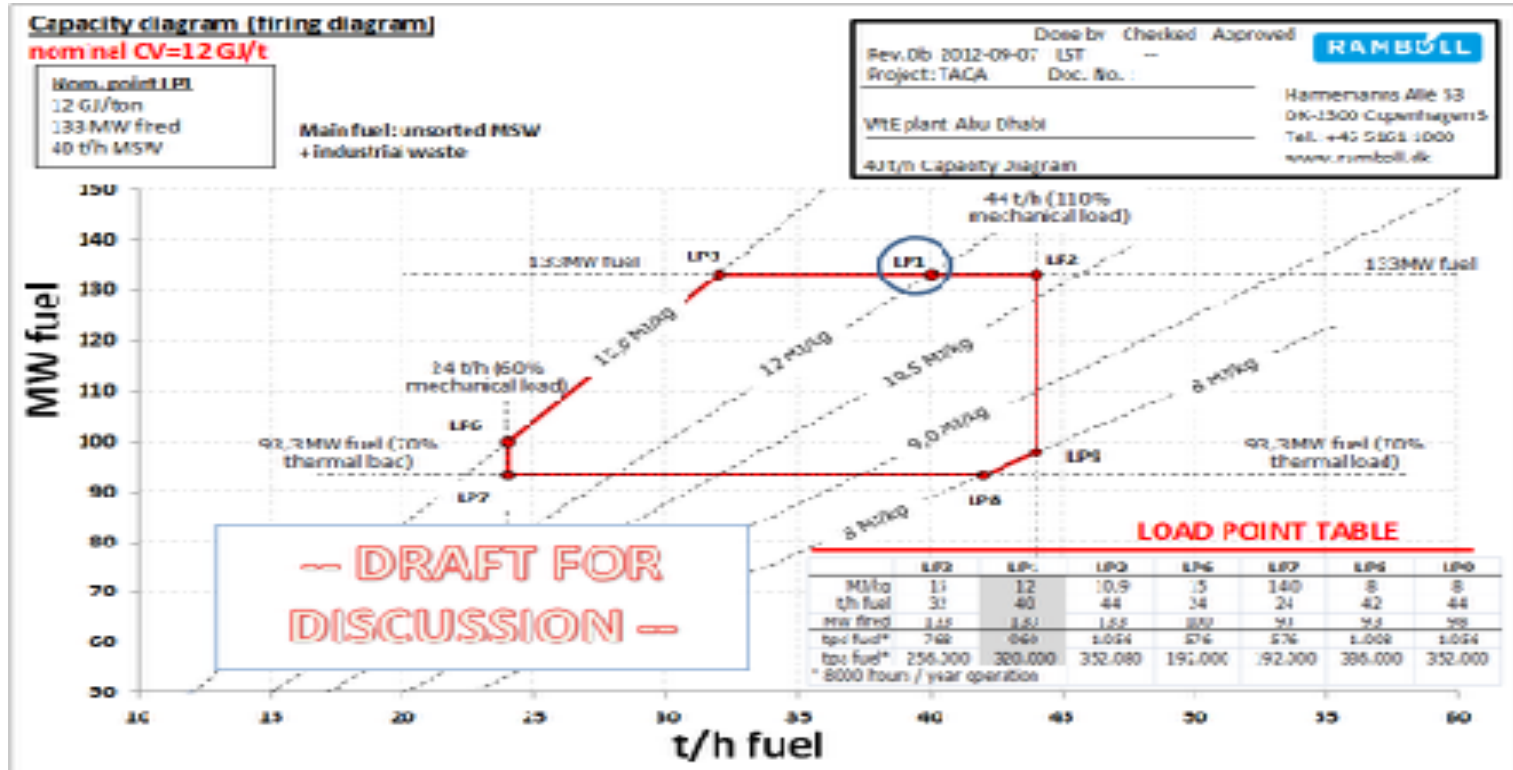
TECHNOLOGY ASSESSMENT



WTE FACILITY PROCESS DESIGN

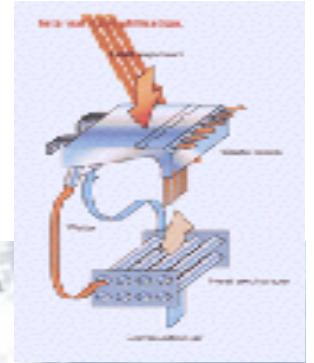
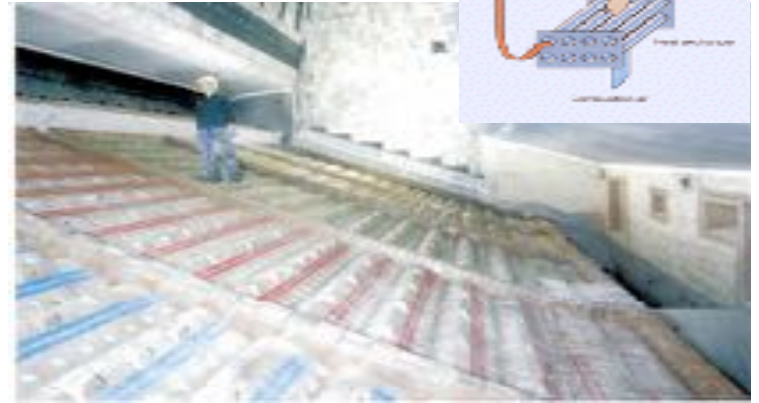


CAPACITY DIAGRAM - PRINCIPLE



GRATE - SYSTEM

- Robust and proven design
- Advanced ACC system (Automatic Combustion Control)
- Lower burn-out (1-1.5%)
- Water cooling if high calorific value
- Suppliers (worldwide):
 - Martin
 - Hitachi Zosen
 - Fisia Babcock
 - Keppel Seghers
 - Babcock & Wilcox Vølund

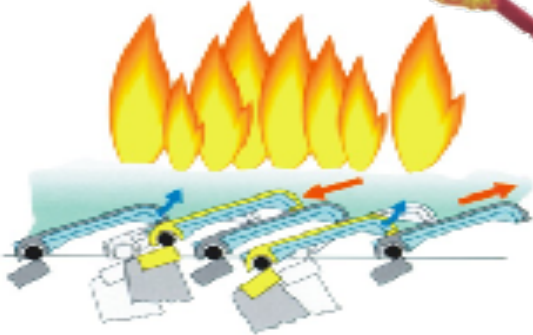
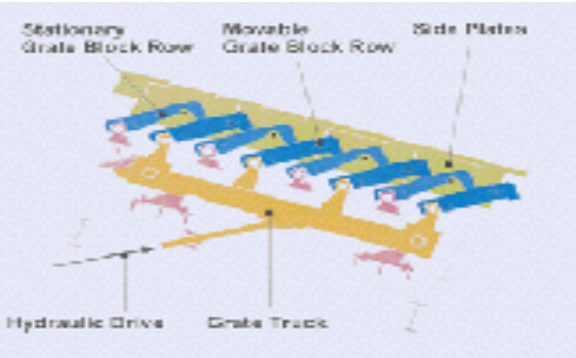
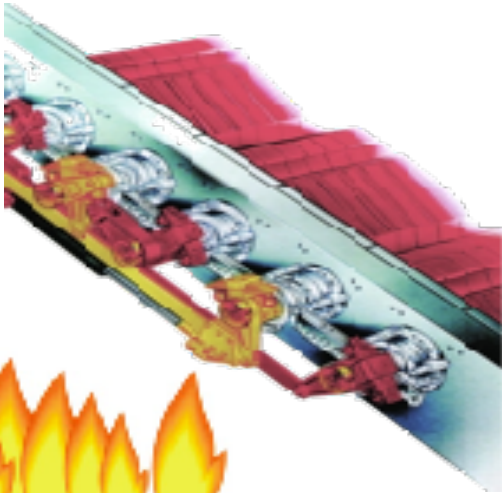


GRATE TECHNOLOGY

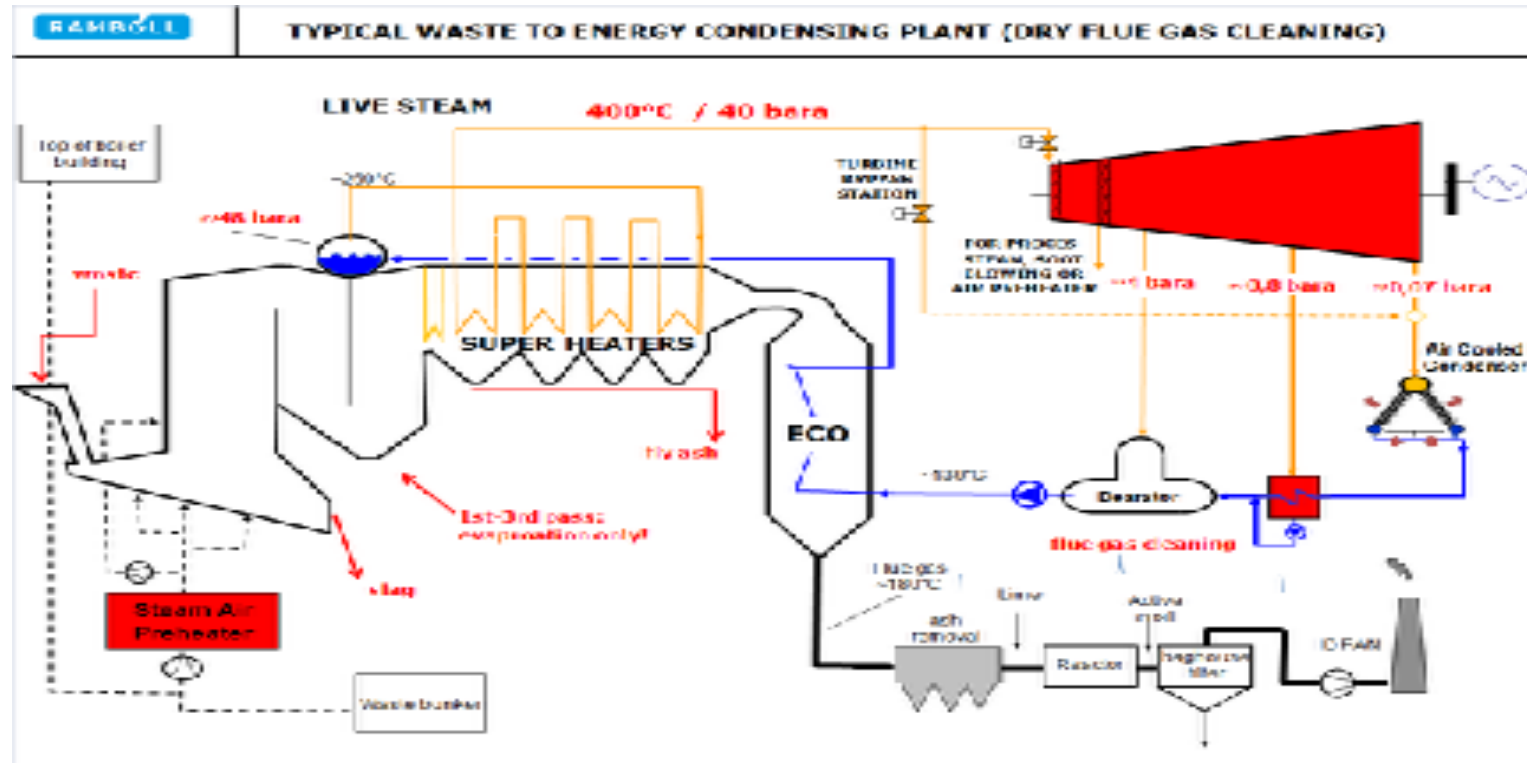
TECHNOLOGY ASSESSMENT



1 - Fixed grate
2 - Movable grate

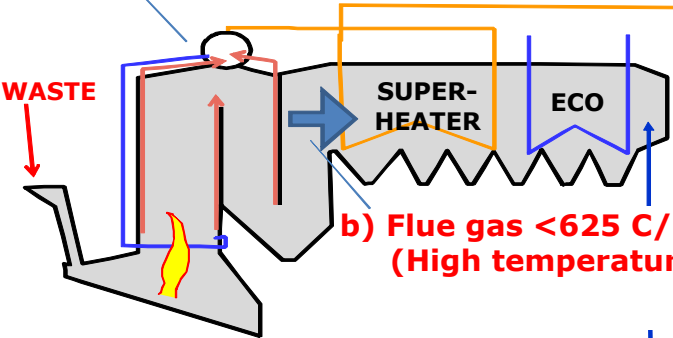


CONDENSING TURBINE (POWER)

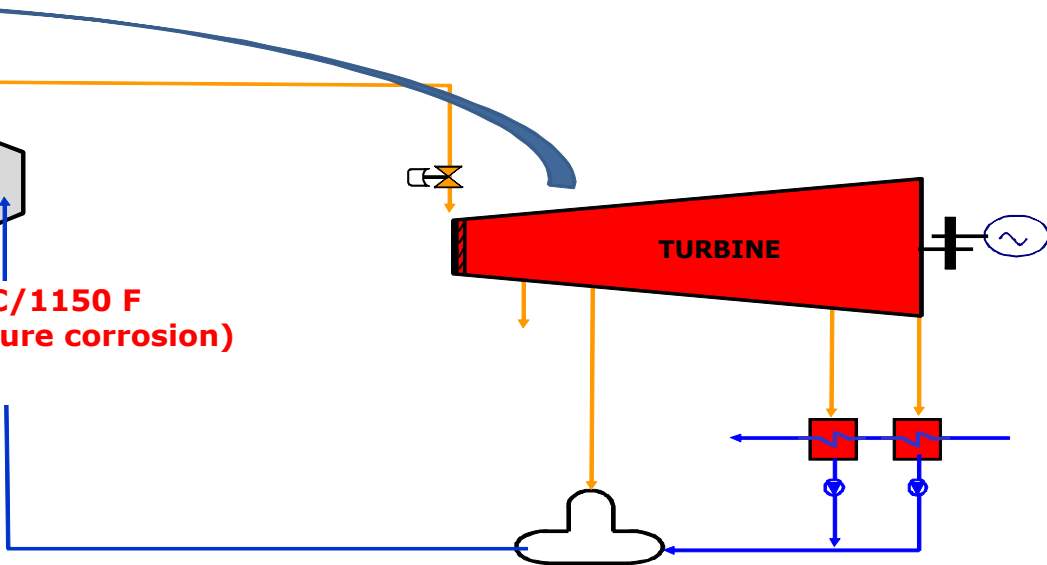


HOW TO AVOID CORROSION

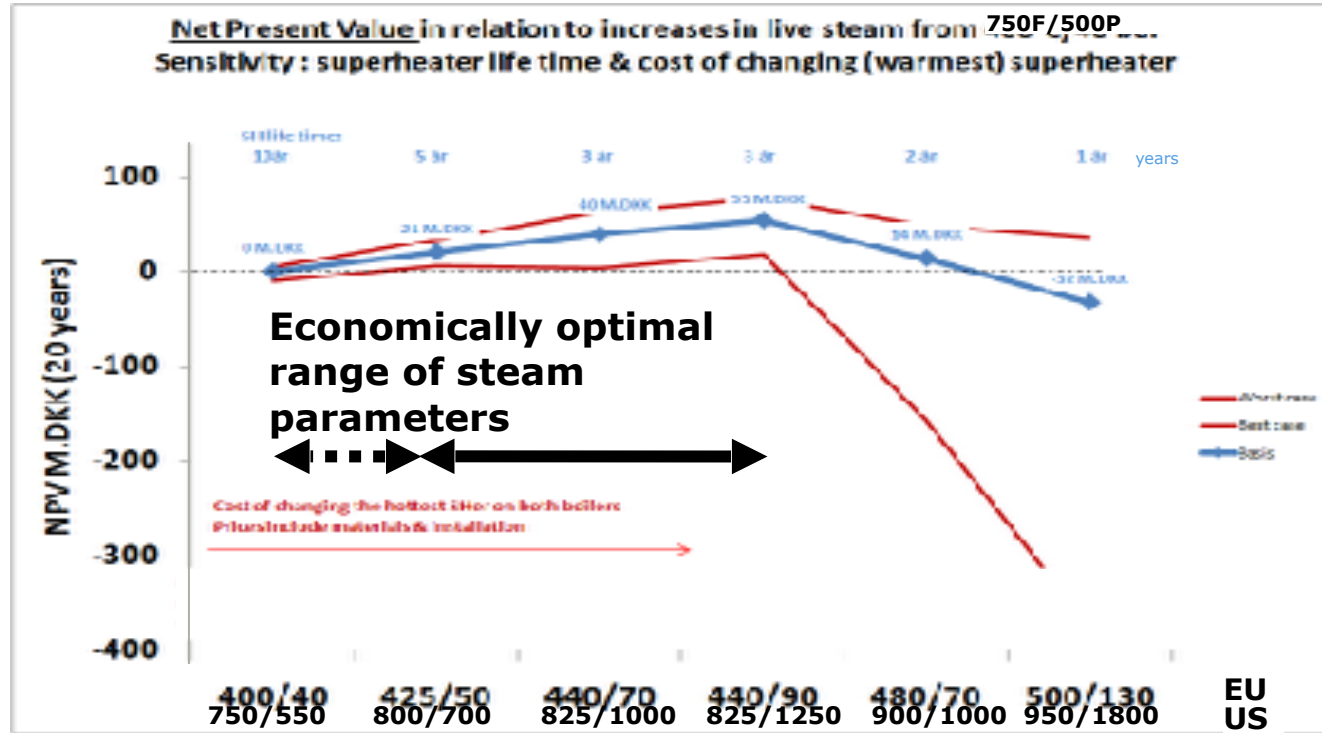
a) Evaporator circuit:
High temperature



b) Flue gas <math>< 625\text{ C} / 1150\text{ F}</math>
(High temperature corrosion)



SUPERHEATER OPTIMISATION



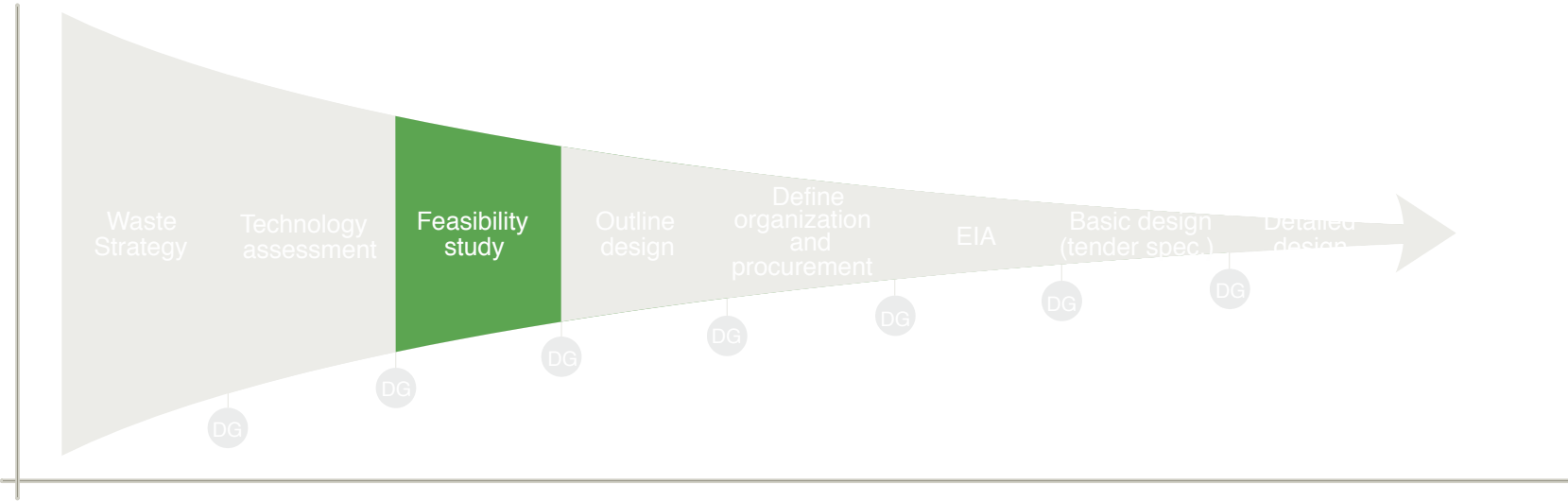
Conclusion:

425/50 –
 800/700
 (EU-US)

440/70 –
 825/1.000
 (EU-US)

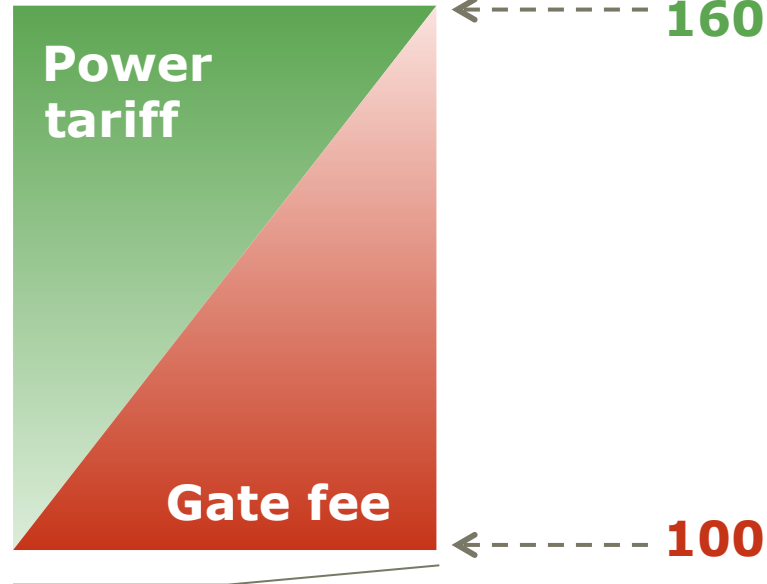
FEASIBILITY STUDY

FEASIBILITY STUDY



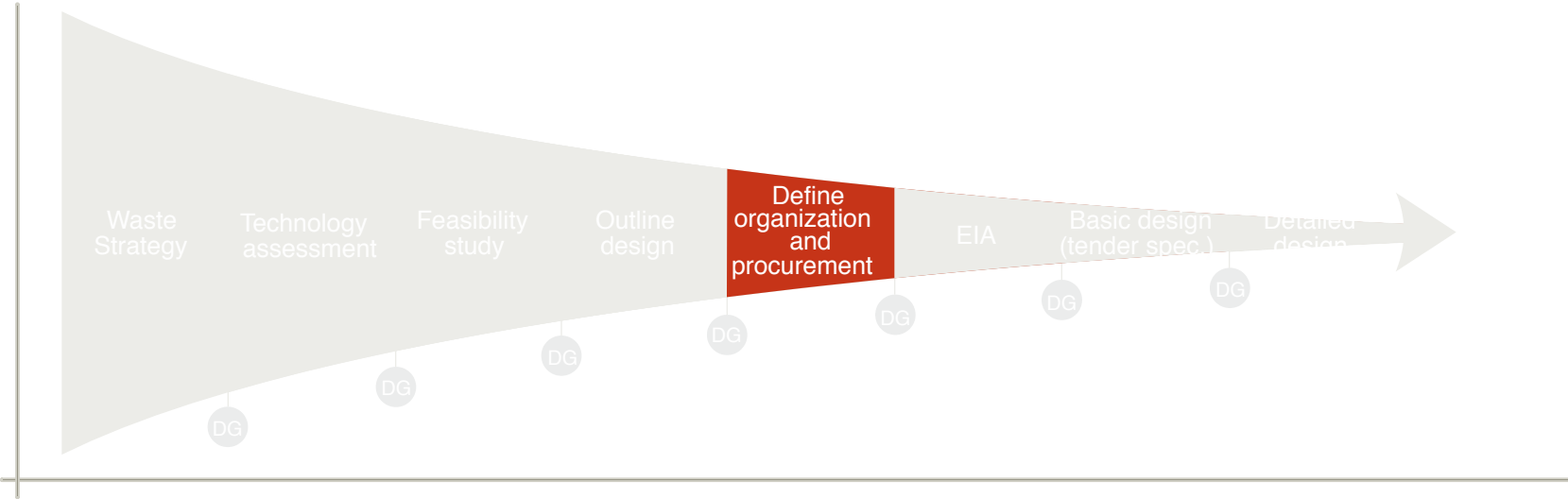
FINANCIAL RESULTS

Income is determined by gate fee and power tariff

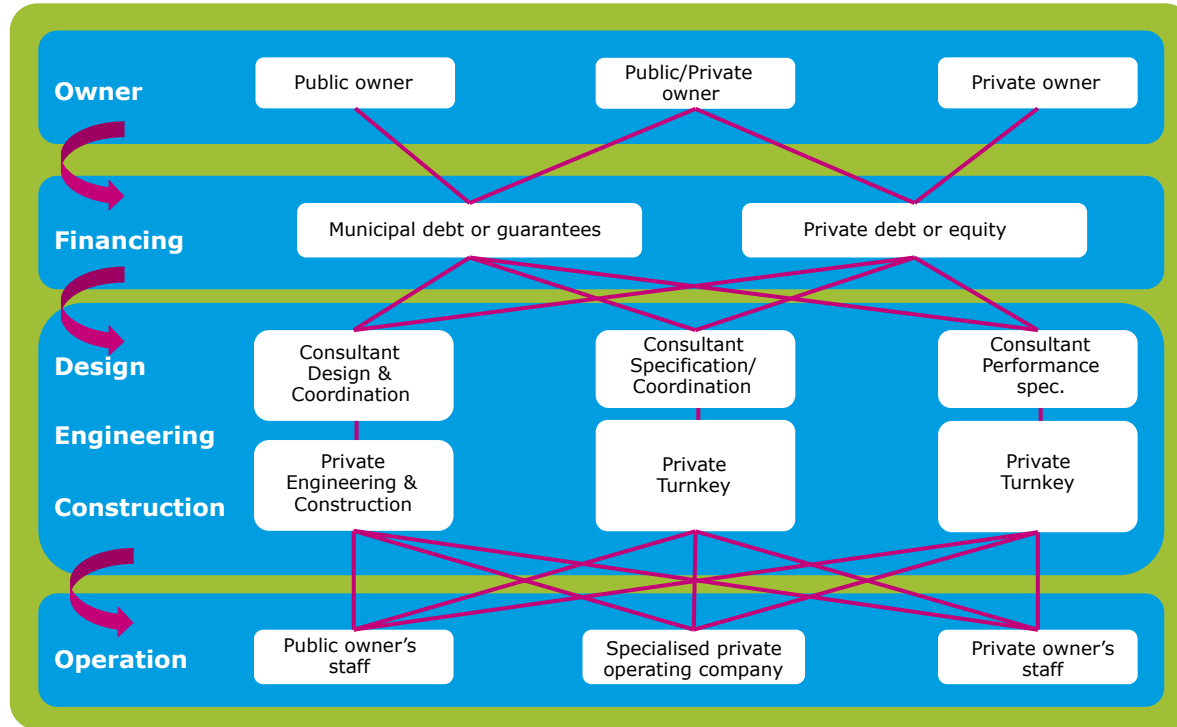


Total Cost
Per ton of waste

DEFINE ORGANIZATION AND PROCUREMENT



ORGANIZATIONAL DECISIONS HIERARCHY



ORGANISATIONAL OPTIONS

DB+O

DESIGN-BUILD + O&M

- One EPC contract
- Operations separate
 - Operations by operation company
- Ownership by Municipality
- Financing by Municipality

DBO

DESIGN-BUILD-OPERATE (20 YEARS)

- One EPC+Operation contract
 - Either one contractor or
 - Consortium of EPC contractor and operation company
- Ownership by Municipality
- Financing by Municipality via Banks or Bonds

DBOO

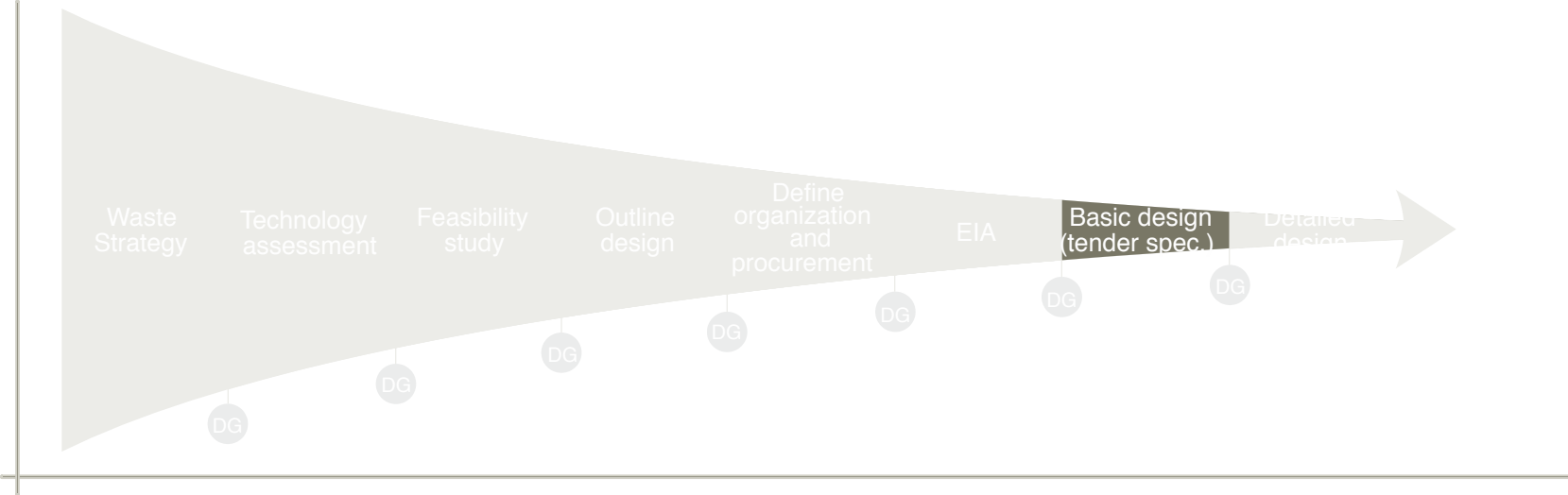
DESIGN-BUILD-OWN-OPERATE

- Design-Build-Operate by EPC+Operation Contractor
- Ownership by Private Investor
- Financing by Private Investor

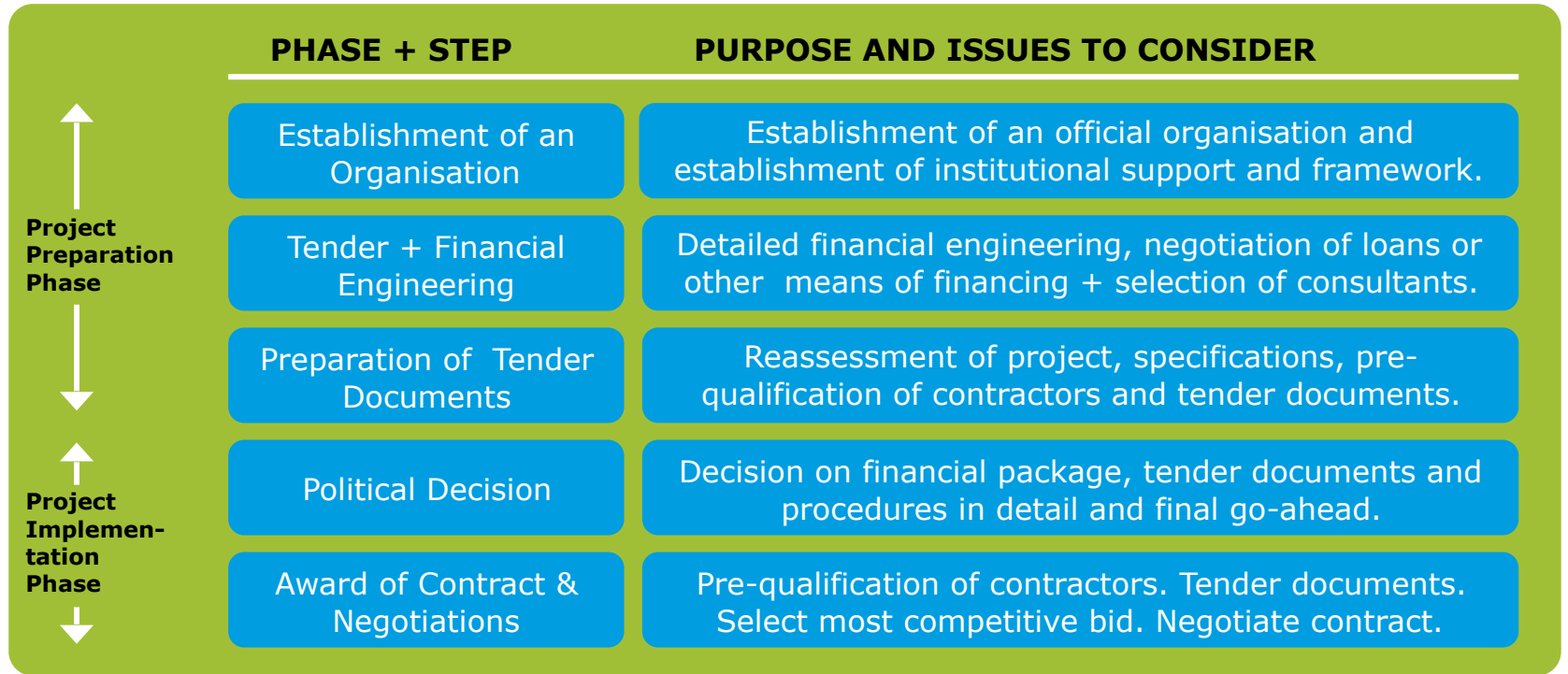
BASIC DESIGN (TENDER SPECIFICATION)

B
A
S
I
C

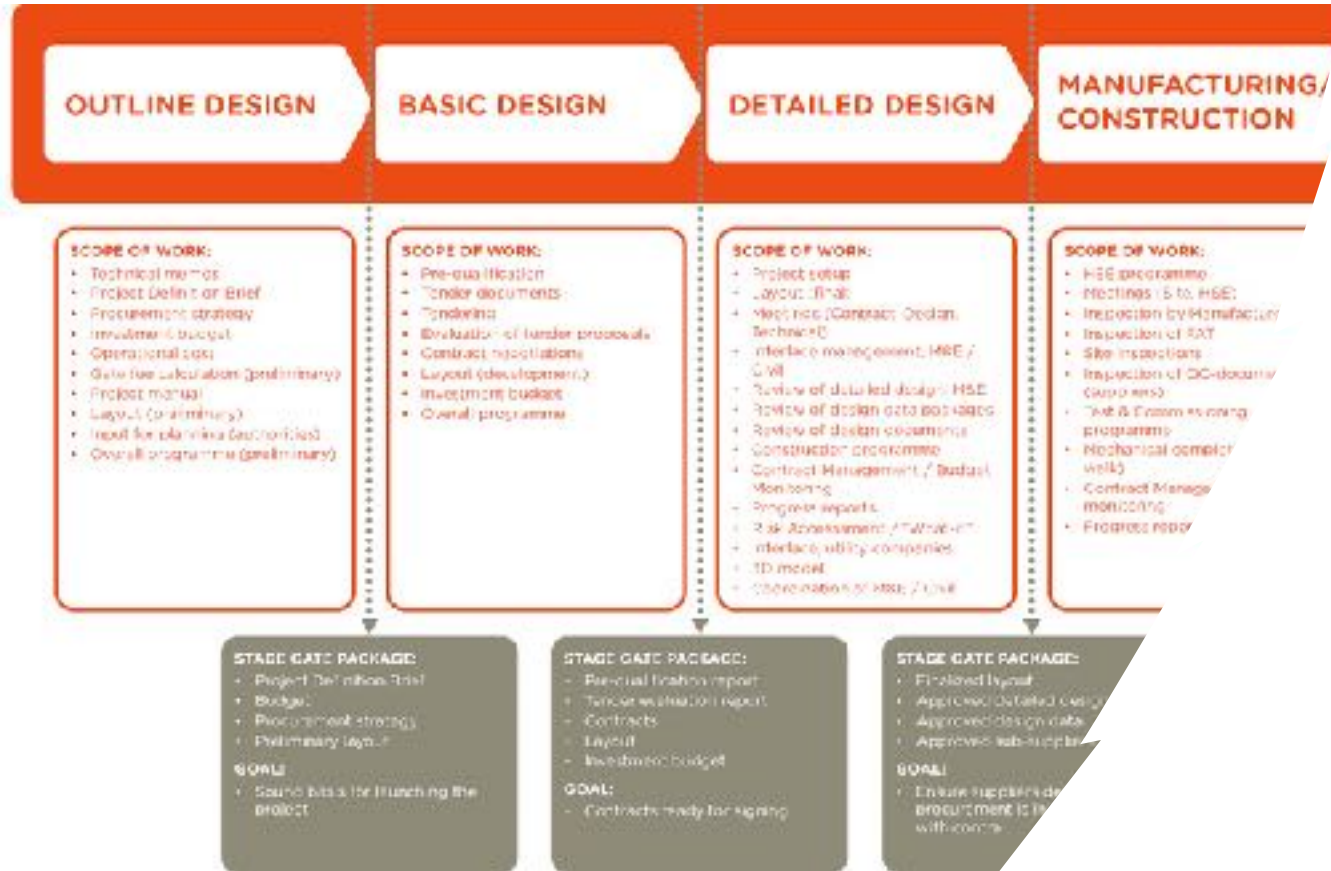
D
E
S
I
G
N



FROM FEASIBILITY TO CONTRACT



THE WAY FORWARD DESIGN – TENDER-CONTRACT



THANK YOU FOR YOUR ATTENTION

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