Waste-To-Energy Plants – Public Private Partnership Singapore

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Singapore

- Island State
- Area : 718 sq km
- Population : > 5 million
- No Natural Resources
- Hot and Humid Weather

CENTRE for LiveableCities SINGAPORE

Singapore - 1950s & 1960s

A country plagued with challenges of industrialization and urbanization

Singapore – Solid Waste Management

1970 – 2000

- Solid waste grew at 8%-10% per annum
  - 1970 - 1,200 tons/day
  - 2000 - 7,700 tons/day

  > 7-fold increase
- This is not sustainable, as no more land is available before the turn of century
- Need to reduce waste growth
  - More effective policies, strategies and programs
  - Use of technologies and innovations

2000 – 2015

- Solid waste generation stabilized at ~ 7,700 tons/day

Technology

Early 1970s

To reduce waste growth, Singapore considered the following technologies:

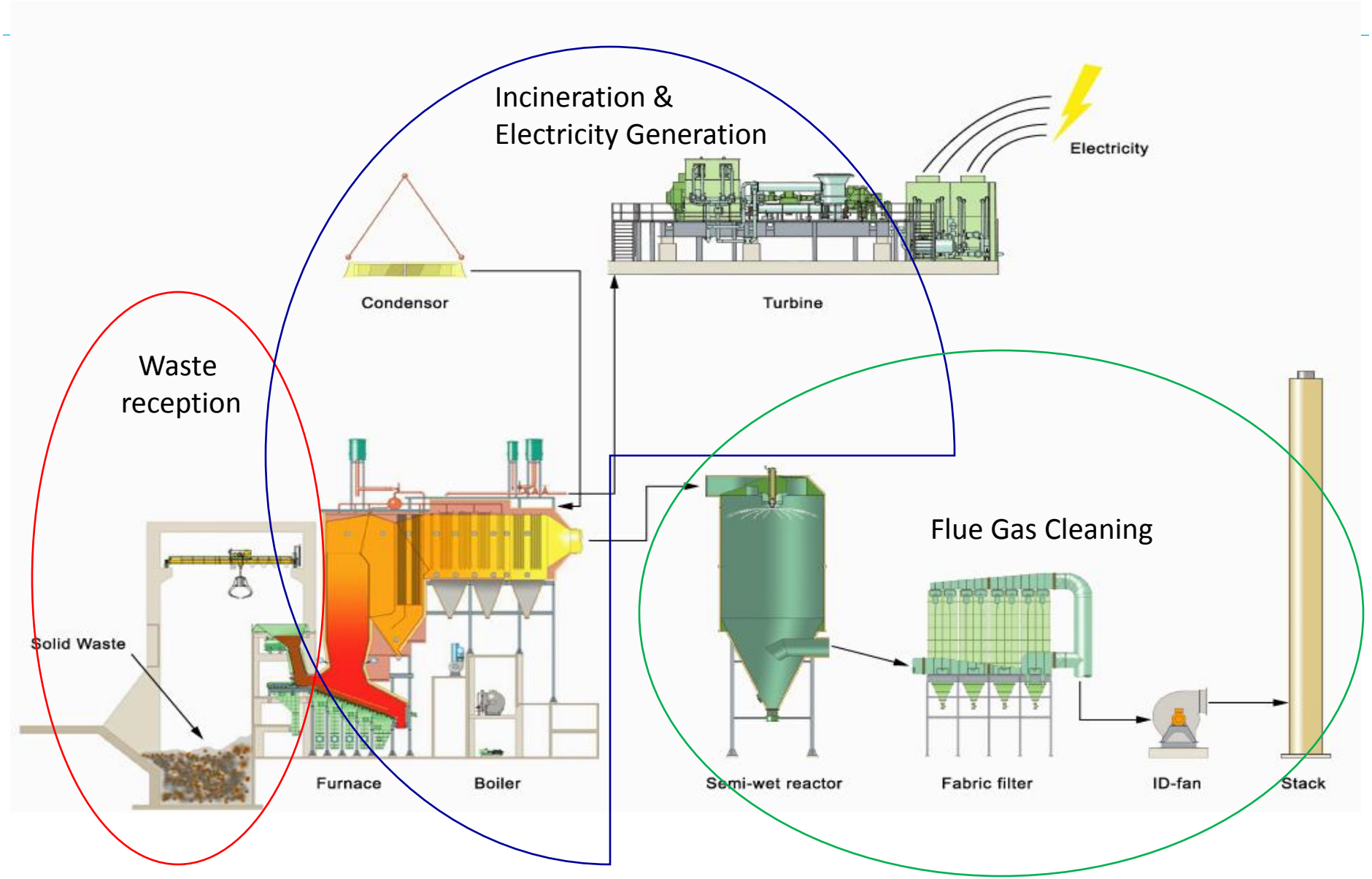
- Mass burn incineration
- Composting
- Baling
- Others

Decided on mass burn incineration

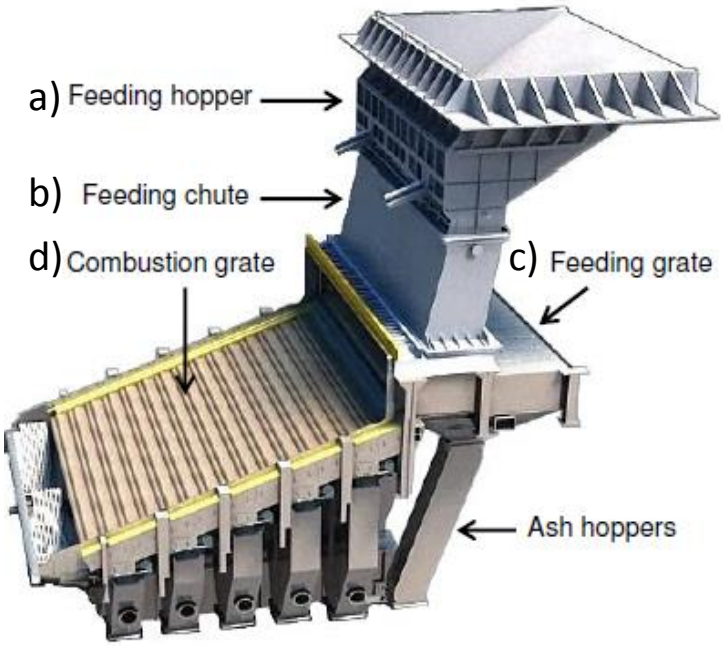
- 90% waste volume reduction
- electricity generation
- bottom ash and fly-ash recycling
- scrap metal recovery

WTE Plant
Mass-Burn Technology

WTE Process

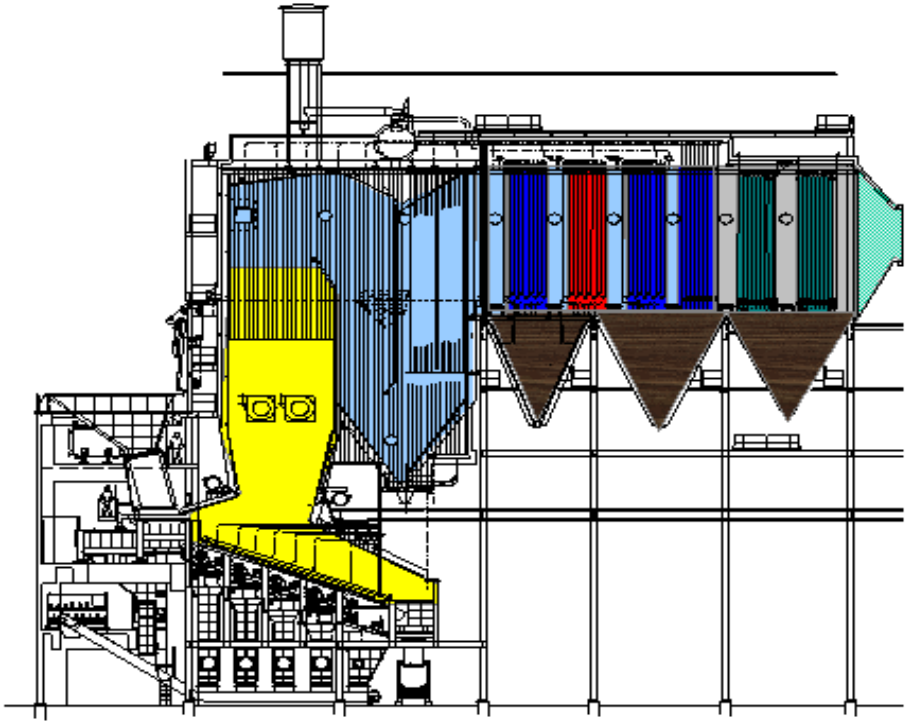

Incineration &
Electricity Generation
Electricity
Condensor
Turbine
Waste
reception
Flue Gas Cleaning
Solid Waste
Furnace
Boiler
Semi-wet reactor
Fabric filter
ID-fan
Stack

Furnace



- Hopper guides waste into furnace
- Feeding grate ensures a dosed feeding of the waste to the grate
- Combustion grate functions as support for horizontal combustion processes

Steam Boiler designed to optimize electricity generation



The boiler

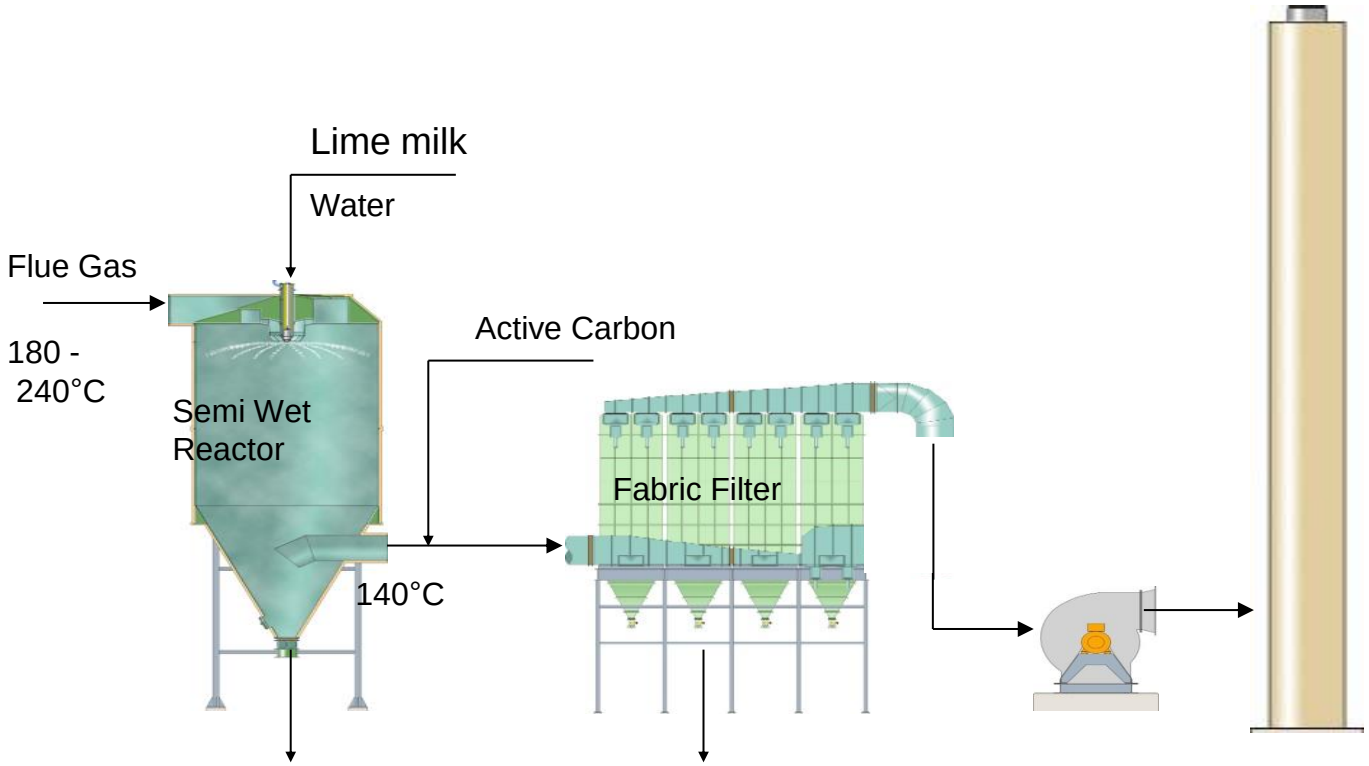
a) Vertical, three-pass radiant section with membrane walls

b) Convection section with one horizontal flue gas passage with vertically placed boiler bank tubes

Steam Boiler designed to optimize electricity generation

Flue Gas Treatment
Meets International Emission Standards

Pollutant
HCl
SOx
HF
PCDD/F
HM
Cd + Tl
Hg
dust
NOx
CO

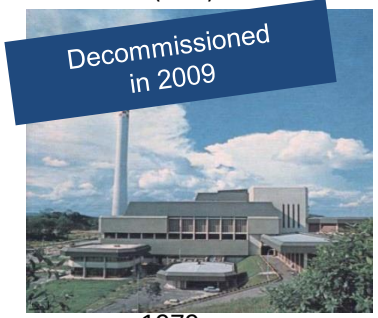


WTE Plants
Singapore

Incineration (Waste-To-Energy) Plants In Singapore

- 1979 - First WTE (Waste-To-Energy) plant built in Singapore
  - Designed and constructed by the private sector
  - Government operated the plant for 30 years
  - Plant was decommissioned in 2009
- 3 more WTE plants were built in Singapore
  - Also designed and constructed by the private sector
  - Government operate the 3 plants, which are still in use
- For the 4 WTE plants, all financing, design and operational risks were borne by Government
  - Capital-intensive nature of constructing and operating WTE plants
  - Need to ensure reliable incineration services
- 5th WTE Plant
  - Replace the first WTE plant
  - Develop by private sector using PPP (Public-Private-Partnership) model with a concession to operate plant for 25 years

Ulu Pandan
(NEA)



1979
1,100 tons/day

Tuas
(NEA)

1986
1,700 tons/day

Senoko
(Keppel Seghers)

1992
2,400 tons/day

Tuas South
(NEA)

2000
3,000 tons/day

5th WTE Plant
(Keppel Seghers)

2009
800 tons/day

5th WTE Plant

- Decision to develop 5th WTE plant using PPP model

  - To liberalize incineration industry in Singapore, having successfully
    - built and operated 4 WTE plants
    - privatized waste collection service in 1999

  - Inject competition into waste incineration sector to increase efficiency
  - Develop environment engineering industry by transferring expertise residing in the Government to private sector

5th WTE Plant

- 2001 - Open tender called for development of 5th WTE plant
  - Developers to undertake financial, design and demand risks
  - Tender not well received by the market
  - Only one non-compliant bid submitted

- Reasons
  - Developers unable to bear the demand risks owing to
    - uncertain waste growth; and
    - waste stream for plant not guaranteed

  Factors are crucial with high capital outlay for WTE plants

- No award of tender

5th WTE Plant

- A study of the industry structure was commissioned, taking into consideration lessons from failed tender

- Outcome of study

  - Adopt DBOO (Design, Build, Own, Operate) scheme with full 'take-or-pay' approach
  - Government to enter into 'take-or-pay' agreement with developer to buy 100% of incineration capacity at a price determined through the tender
  - Government to bear demand risks by giving operator full capacity payment, regardless of the actual utilization rate of the plant

To address market's concerns and allow private sector to bid more competitively

- Provision of incineration services are safeguarded through an Incineration Services Agreement

  - Technical requirements
  - Service Performance standards
  - Commercial terms & conditions
  - Others

5th WTE Plant

- 2005 - Tender for 5th WTE plant was recalled with
  - ‘take-or-pay’ approach
  - a concession of operating plant for 25 years

- Tender attracted good response from market
  - Nov 2005 - Keppel Seghers awarded the tender
  - 2009 – Keppel Seghers commenced commercial operation of 5th WTE Plant
  - Keppel Seghers has been operating the plant without any major incidents

Singapore WTE Plants

Currently, 4 WTE plants handling all incinerable waste collected

- 2 WTE plants owned and operated by Keppel Seghers, a Singapore private company handling about 50% of incinerable waste collected daily in Singapore
- 2 WTE plants operated by National Environment Agency (NEA)

Public Private Partnership (PPP)
WTE Projects

Public Private Partnership (PPP)

PPP - A long-term public & private sector partner relationship to deliver public services

- Make optimal use of public and private sectors' expertise, resources and innovation
  - more value for money public services
  - meet public needs effectively and efficiently
- Shift risks to private sector
- Public sector focus on acquiring services at most cost-effective basis

Key Features

Project Structure

- Government buys services for incineration of waste
- ‘Take-or-Pay’ payment structure with guaranteed waste amount, to make the project bankable

Project Financing

- Long term contract : 20 - 25 years
- Private sector provides both equity and debt financing

Key Features

Measurable Performance

- Measurable Performance Outcomes
  - Available Incineration Capacity
  - Contracted unit of electricity export
  - Ash quality and flue gas to meet standards
  - Plant service level : EHS, turnaround time, etc

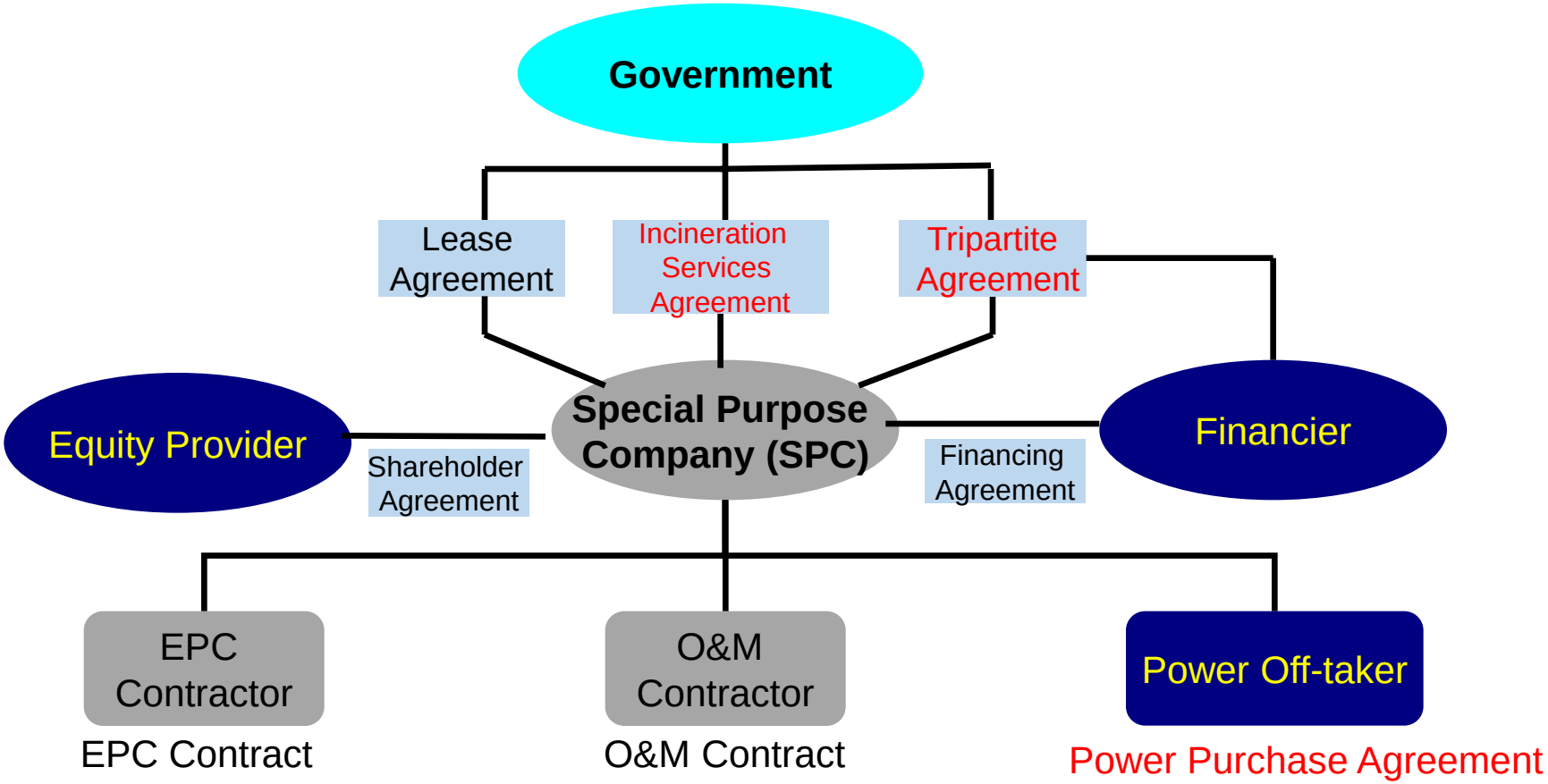
Non-Conformance

- Penalty for non-conformance

Key Agreements

- **Incineration Services Agreement (ISA)**
  - Government to enter into a long-term ‘take-or-pay’ ISA with a Special Purpose Company (SPC) set up by the developer to purchase 100% of capacity
    - ✓ Government to collect gate fee to finance and pay SPC
    - ✓ Government to mandate electricity is exported to electricity grid
    - ✓ SPC to deliver services based on
      - ➢ tendered/agreed price
      - ➢ technical, commercial, legal terms and conditions
      - ➢ service performance standards
    - ✓ SPC to comply with environmental regulations
- **Power Purchase Agreement (PPA)**
  - Export of electricity to grid
  - Technical, commercial and legal terms & conditions
- **Tripartite Agreement (TA)**
  - Financier may step in and take over WTE plant when SPC is in default
  - Government may step in and take over if SPC is unable to render service due to an insolvency event

Typical PPP Structure for WTE Project



Thank You