

PROGRESS TOWARDS COMMERCIALISING WASTE GASIFICATION

: A Worldwide Status Report

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Topics for Presentation

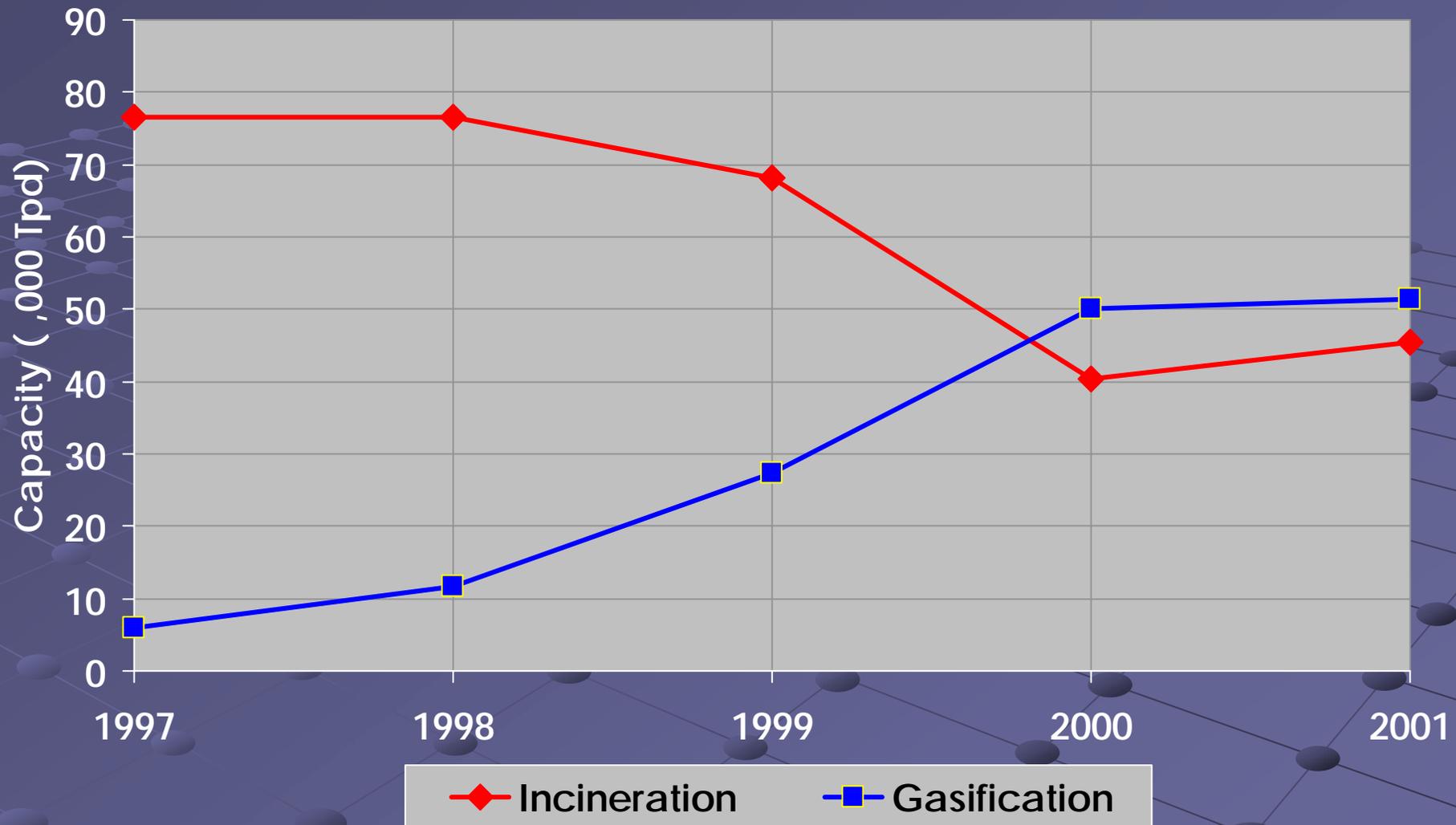
- An updated status report on Waste Gasification trends around the world
- Why has progress towards commercialization slowed down outside Japan?

... and what does this mean for the future outlook?

Where is the current activity?

| | |
|-----------|--|
| Europe | <i>STALLED - lots of interest but no action</i> |
| USA | <i>NONE (except for a very few States / companies)</i> |
| Canada | <i>INTEREST IS PICKING UP</i> |
| Australia | <i>INTEREST IS DYING DOWN</i> |
| Japan | <i>VERY ACTIVE</i> |

EfW orders placed in Japan (1997 – 2001)



Main drivers for gasification technologies

Japan

Shortage of landfill / Desire to avoid incineration

USA

Proposed RCRA exemption

Europe

*Desire to avoid incineration
Landfill diversion targets*

Canada

Desire to avoid incineration

Australia

Desire to use 'green' solutions

Main barriers to gasification technologies

Japan

State of the economy

USA

Cheap disposal (in most States), delays to RCRA

Europe

Process risk

Canada

Increased costs

Australia

Cheap disposal, disillusionment with suppliers

Main applications

Japan

MSW, incinerator residues, ASR

USA

Industrial wastes, MSW (a few States), biomass

Europe

Residual wastes, EoL, Industrial wastes

Canada

MSW, bio-wastes, tyres

Australia

MSW, biomass

Japanese gasification technologies

| Gasification process type | Companies |
|--|---|
| Fluidised bed gasification + melting furnace | Ebara, Sumitomo, KHI, MHI, Hitachi Zosen, Kobe Steel, |
| Pyrolysis kiln + melting furnace | Mitsui, Takuma, Toshiba, Hitachi Zosen, IHI |
| Shaft furnace (updraft gasifier) | Nippon Steel, JFE (NKK) |
| High temperature gasification | Ebara, JFE (Kawasaki), Mitsubishi Materials |

Status of the Technology in Japan

- Only one gasification technology is currently classified as 'fully commercial' for **MSW** applications by Juniper
 - Nippon Steel (*at ~ 150,000 tpa*)
 - can now be described as 'mature technology'
- We expect to be able to shortly uprate 3 others for similar applications
 - Ebara TIFG (TwinRec)
 - JFE (Thermoselect)
 - Mitsui R21

Kazusa, Japan, Nippon Steel, 2002, 60,000 kTpa



Aomori, Japan, Ebara, 2001, 135,000 kTpa (ASR)



Kawaguchi, Japan, Ebara TIFG, 2002, 125,000 kTpa



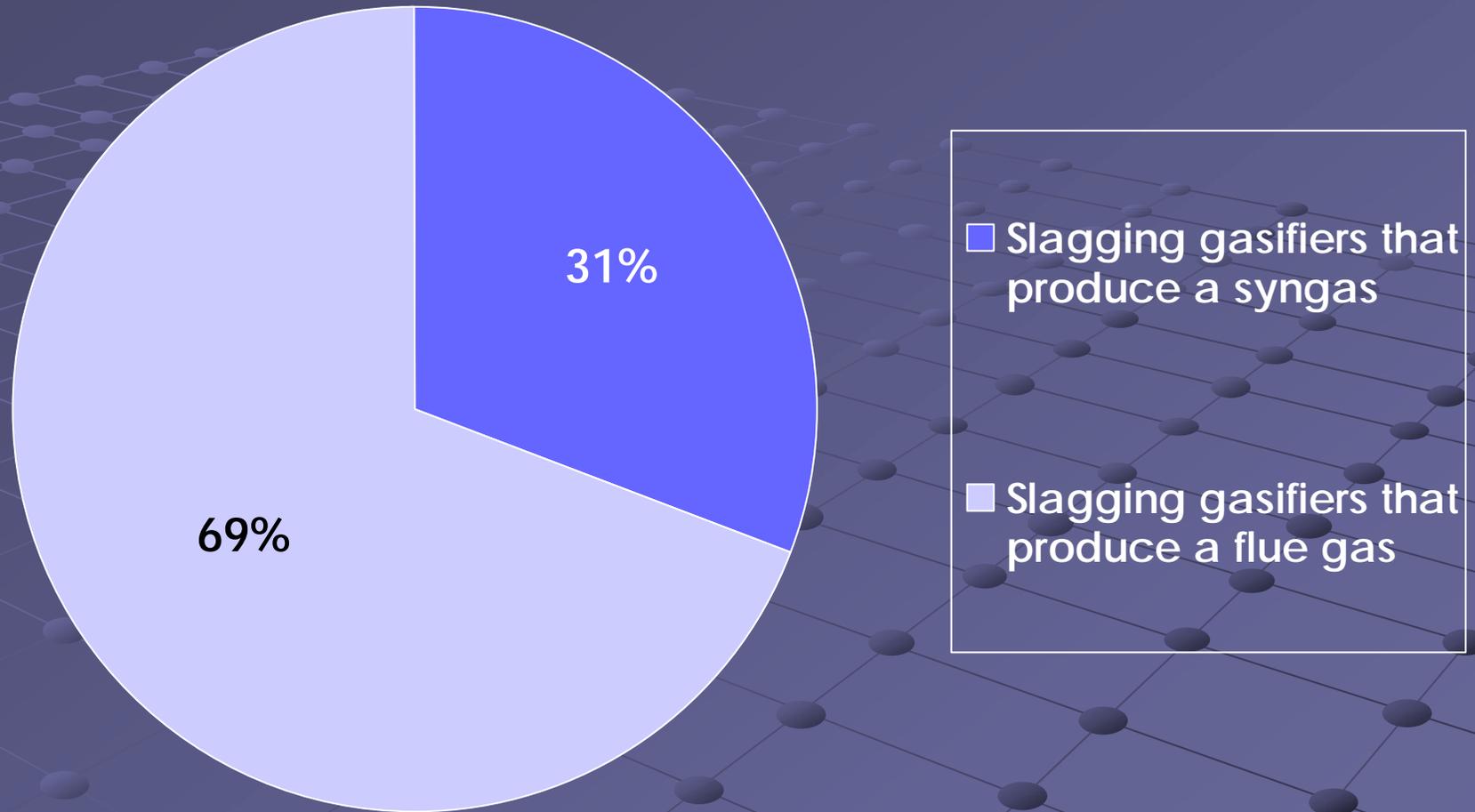
Toyohashi, Japan, Mitsui R21, 2002, 120,000 kTpa



Technology trends in Japan

- All leading Japanese thermal process companies now offer gasification solutions alongside incineration
- Companies are developing new concepts to respond to changing market parameters & export market needs
- For example, Ebara is developing a family of fluidised bed processes
 - optimised to specific applications
 - new concepts for
 -  *carbon sequestration*
 -  *industrial wastes (RCRA criteria)*
 -  *'stackless' facilities*

Will these processes meet the RCRA exemption?

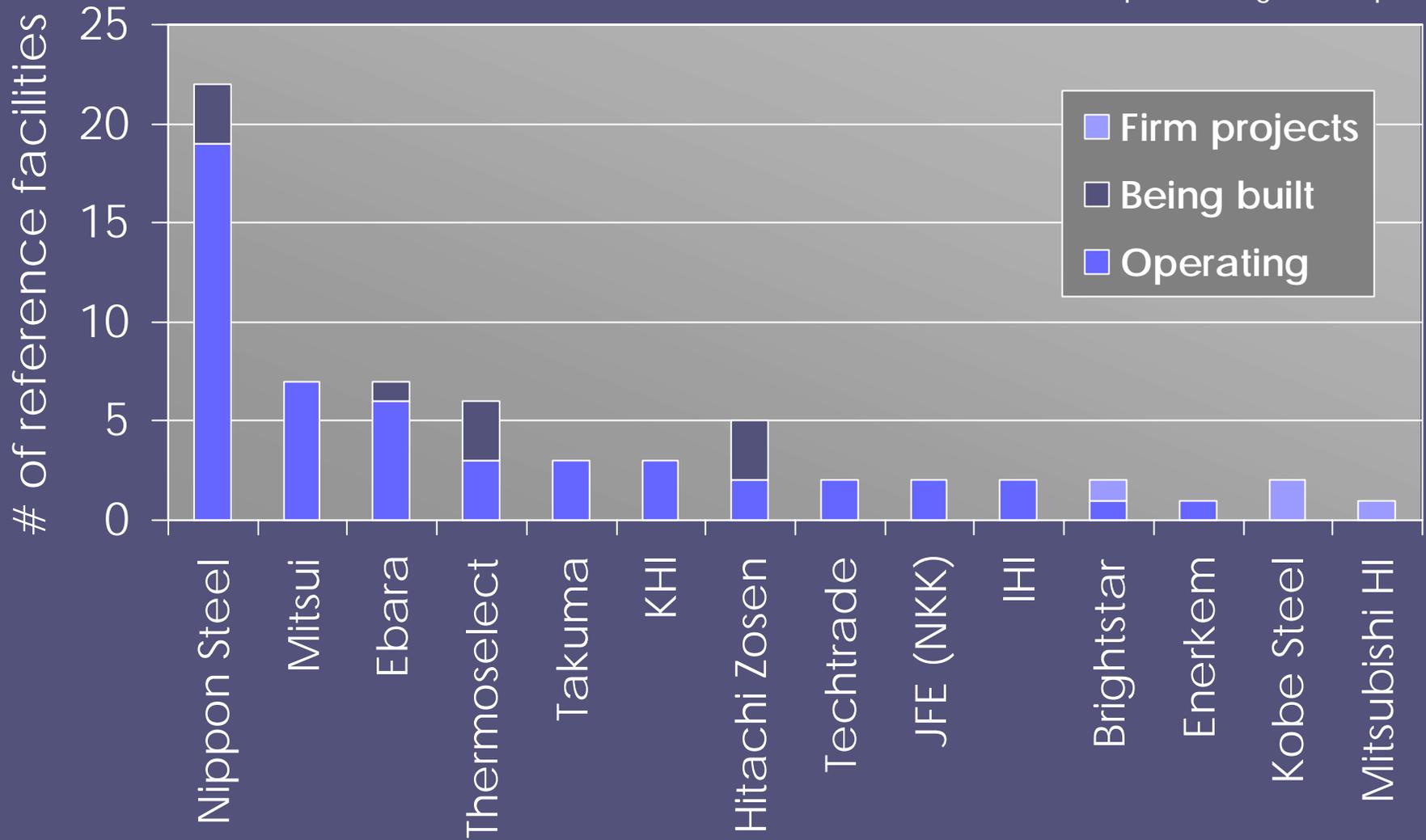


The 'Top 10' Waste Gasification Plants in the World

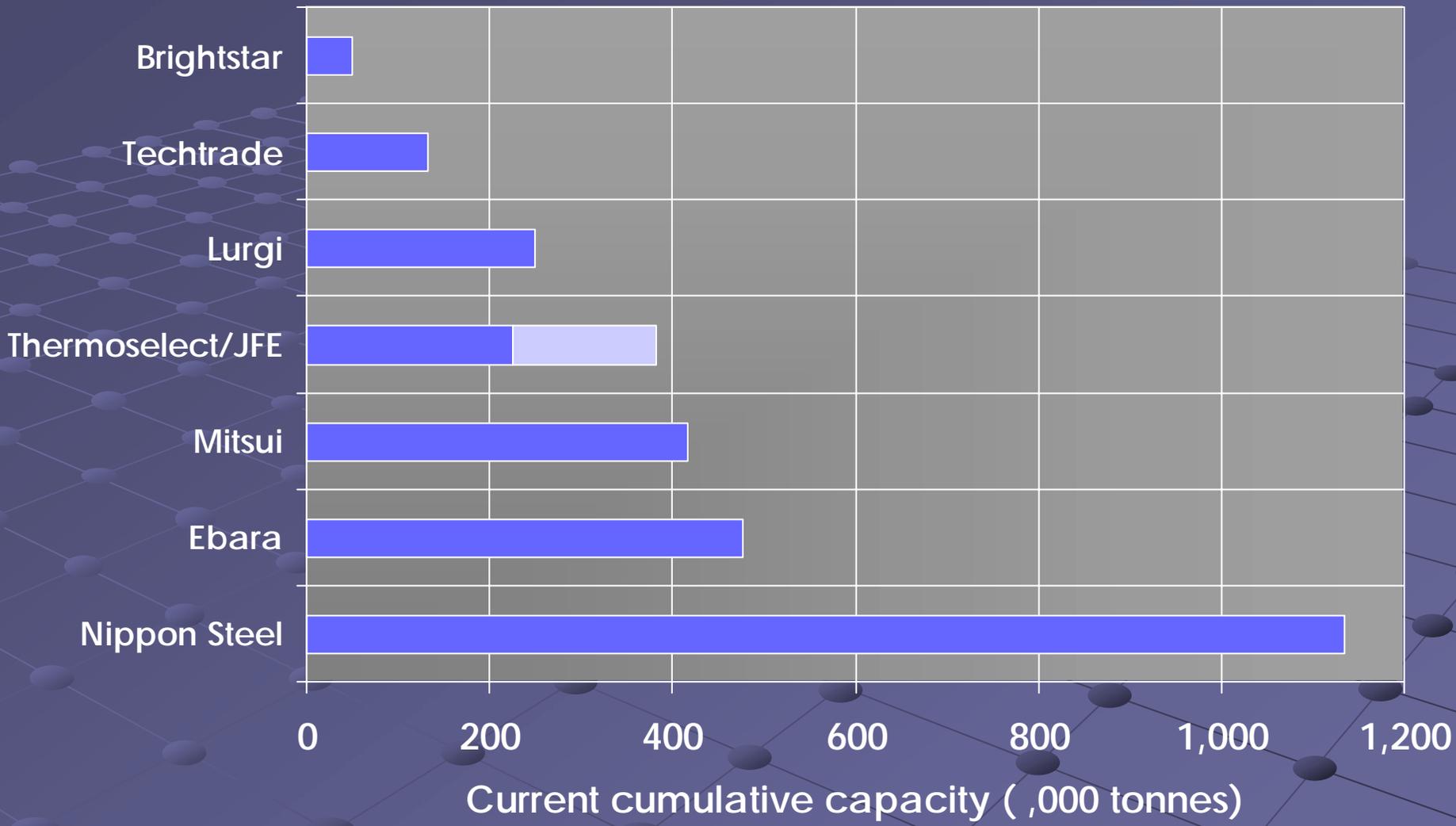
| Location | Capacity kTpa | Process | Date | Type |
|--------------------|------------------|--------------------|------|---|
| SVZ, Germany | 250,000 | Envirotherm BGL | 2001 | Gasification + Melting |
| Karlsruhe, Germany | 225,000 | Thermoselect | 2001 | Gasification + Melting |
| Ibaraki, Japan | 135,000 | Nippon Steel | 1980 | Gasification + Melting |
| Aomori, Japan | 135,000 | Ebara | 2001 | FB gasification + Combustion + Melting |
| Kawaguchi, Japan | 125,000 | Ebara | 2002 | FB gasification + Combustion + Melting |
| Toyohashi, Japan | 120,000 | Mitsui | 2002 | Pyrolysis + Combustion + Melting |
| Akita, Japan | 120,000 | Nippon Steel | 2002 | Gasification + Melting |
| Oita, Japan | 115,000 | Nippon Steel | 2003 | Gasification + Melting |
| Chiba, Japan | 100,000 | Thermoselect | 2002 | Gasification + Melting |
| Hamm, Germany | 100,000 | Techtrade | 2002 | Pyrolysis + Combustion |

Top Process Companies in terms of References *

* commercial facilities processing > 30kTpa



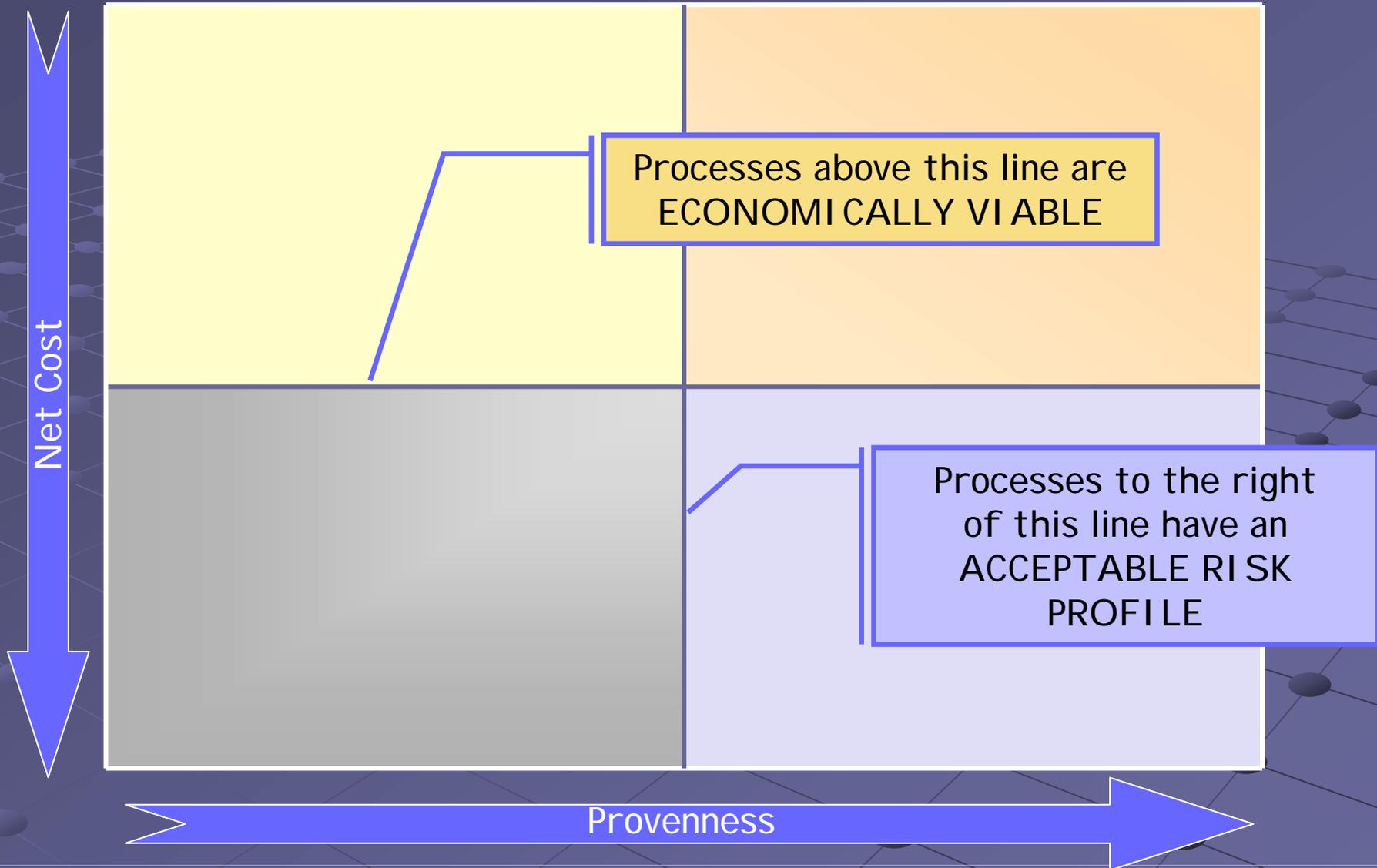
Cumulative Installed Capacity for Key Suppliers



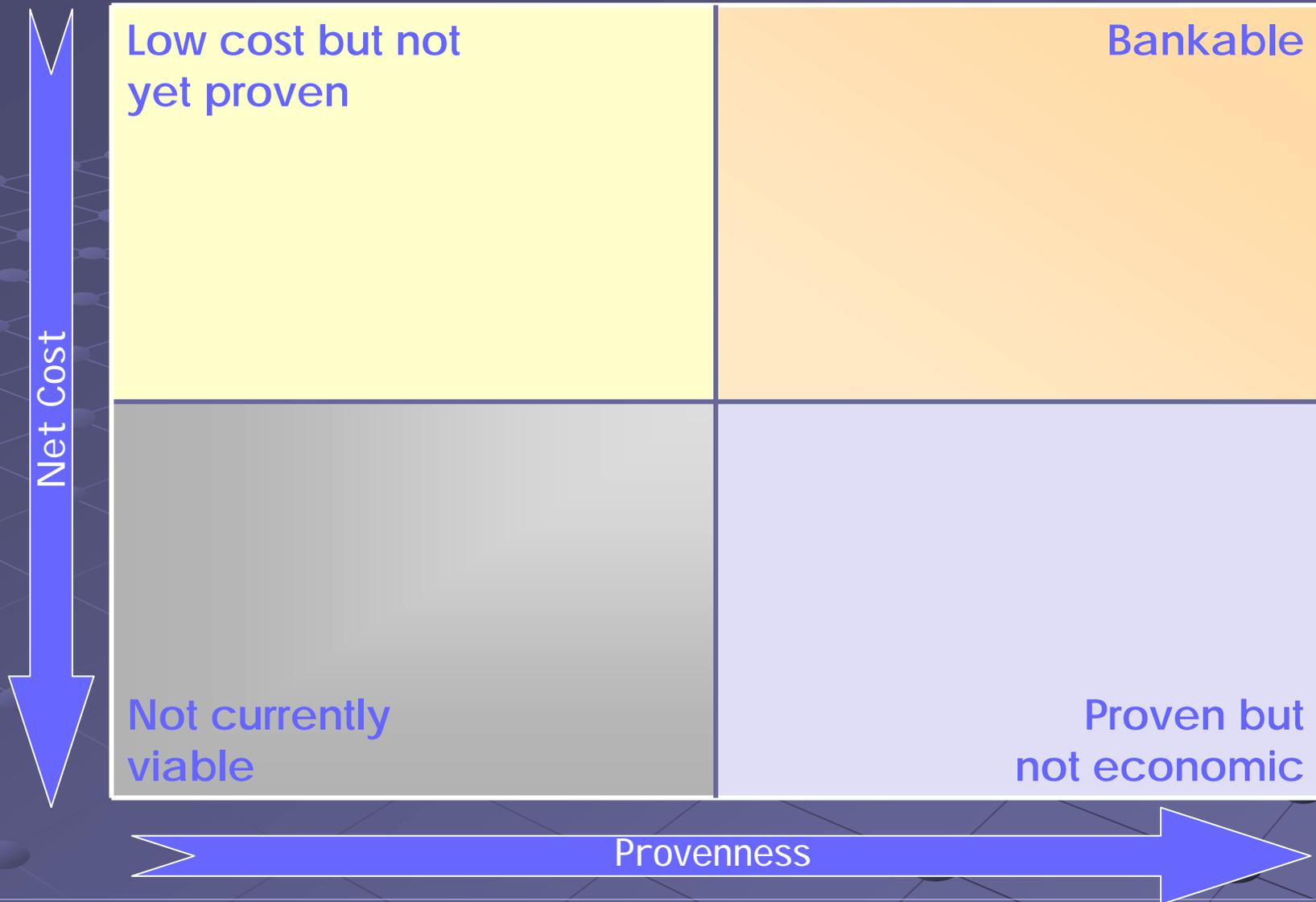
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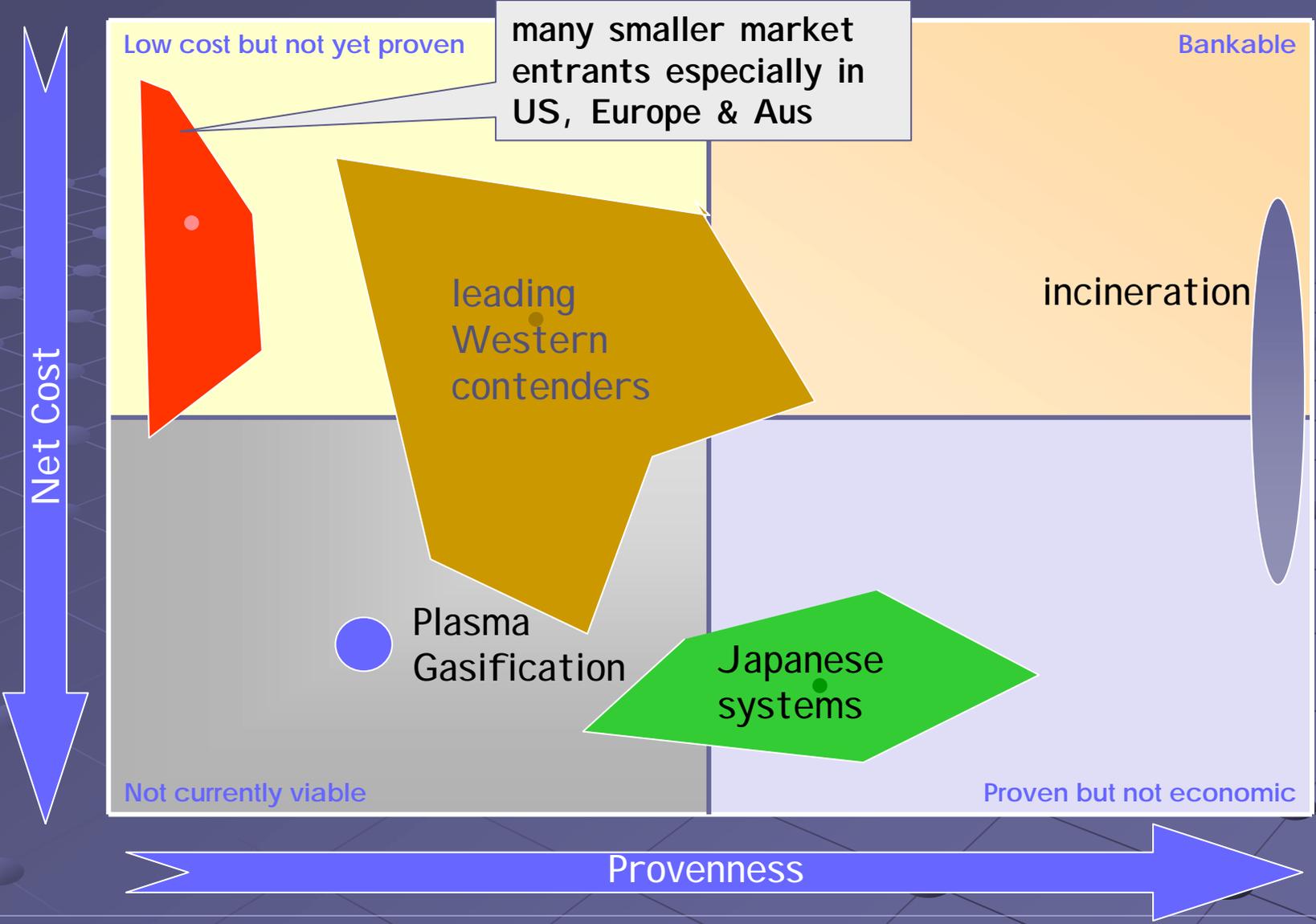
Assessing bankability



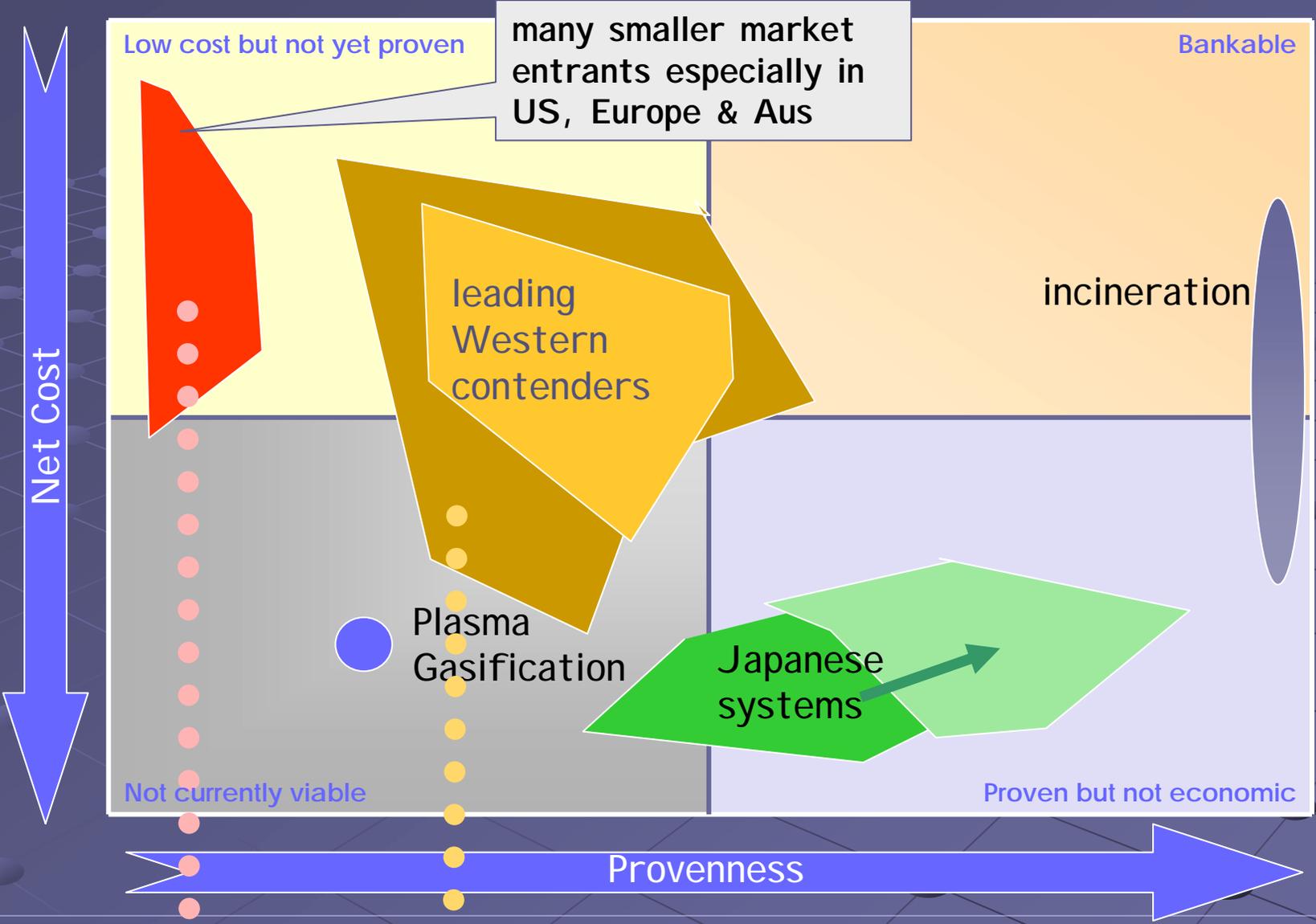
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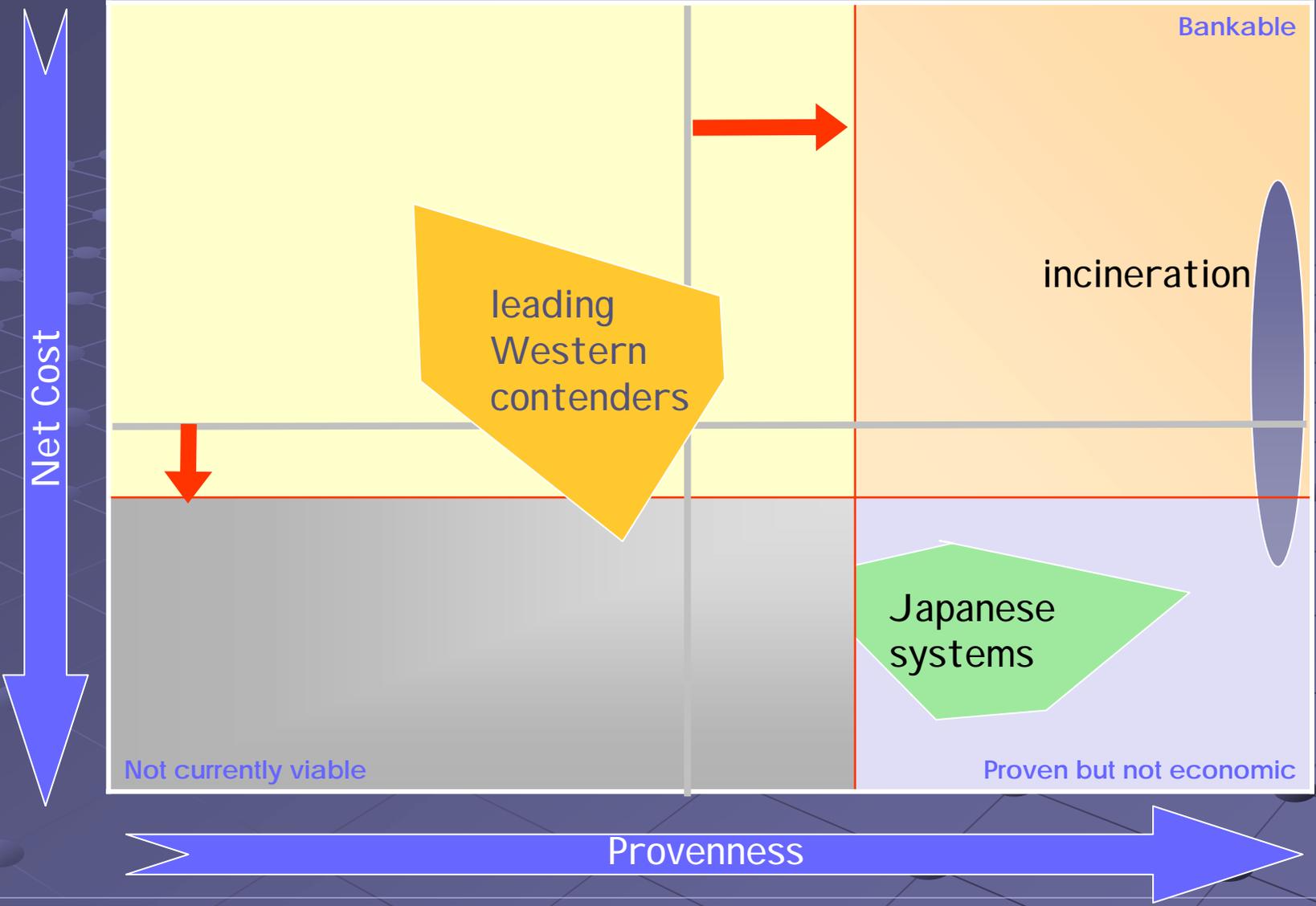
Reasons for Lack of Progress outside Japan



Impact of Recent Trends



... but the market has been changing !



So, what's the outlook in Europe?

- Short-term

- further consolidation in number of suppliers
- relatively few projects converted to orders

- Medium term

- growing demand for alternatives to incineration
- new market sectors in EoL and other residual waste applications
- big market for gasification if :

-  *Japanese processes can be **adapted** to be cost-effective*

-  *local suppliers can **demonstrate** their technology at scale*



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