

IGCC Roadmaps for the Asian Pacific Partnership

Cleaner Fossil Energy Task Force
Grand InterContinental Seoul, Seoul, Korea
31 March – 2 April 2009

Ian Barnes



IEA CCC Current Situation

Non-Profit making organisation supported mainly by members subscriptions

Annual turnover around £1.8m (US \$ 3.6m)

Staff – 25

Members – 26 members inc those in process

Special Reports – 14 -16 every year

Technical focus – coal fired power and environment

- Co-firing**
- Greenhouse towards zero emissions**

Databases

Abstracts

Expert Advice

Ad hoc consulting for members

IEA CCC Mission Statement

The IEA Clean Coal Centre will provide a source of unbiased information on sustainable use of coal world-wide. Services will be delivered to governments and industry through:

- **direct advice**
- **review reports**
- **facilitation of R & D and**
- **provision of networks**

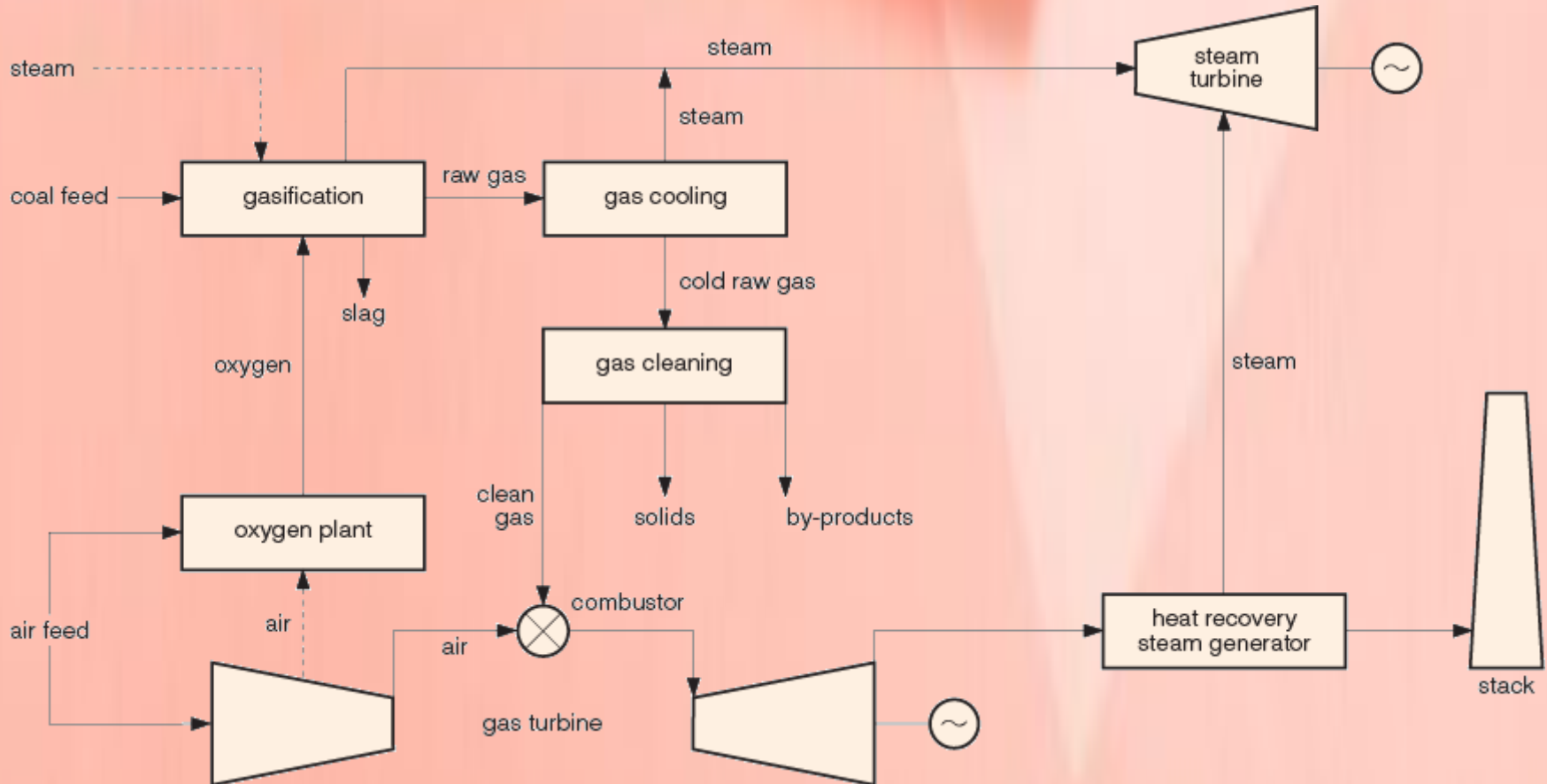


IGCC Roadmaps for the APP

Study for the APP IGCC working group to report on:

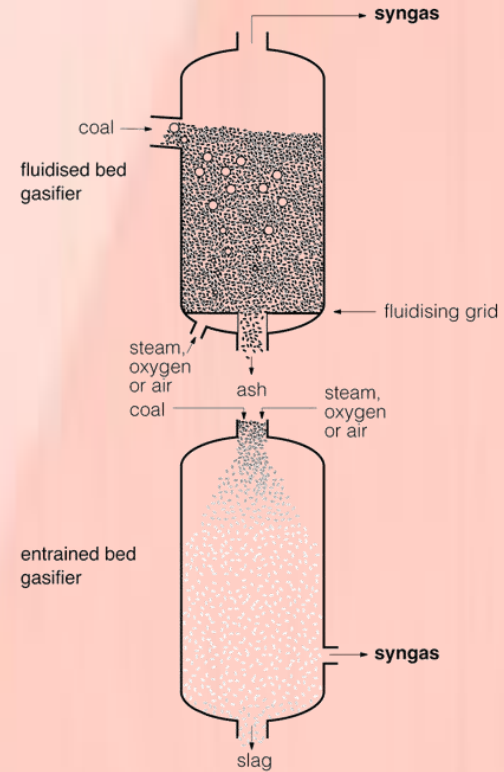
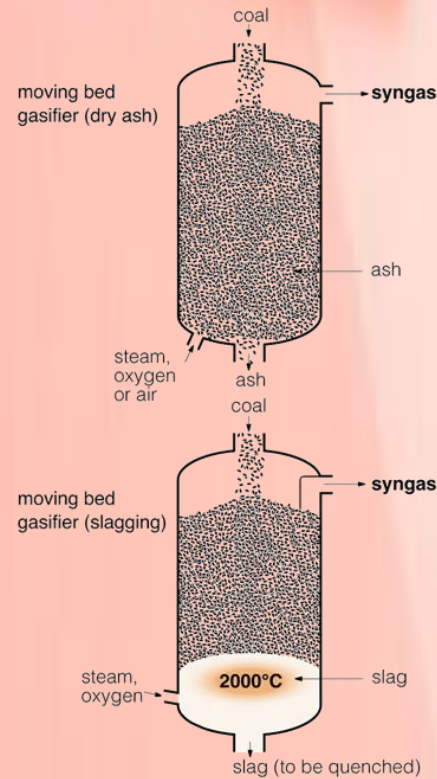
- **Scope and status of existing and proposed IGCC projects in APP countries and globally**
- **Identify the major technical, economic and policy barriers to the demonstration and deployment of IGCC technology**
- **Medium (2020) to long term (post-2020) options for IGCC +carbon capture and storage (CCS)**
 - **APP Country roadmaps**

IGCC Roadmaps for the APP



IGCC Roadmaps for the APP

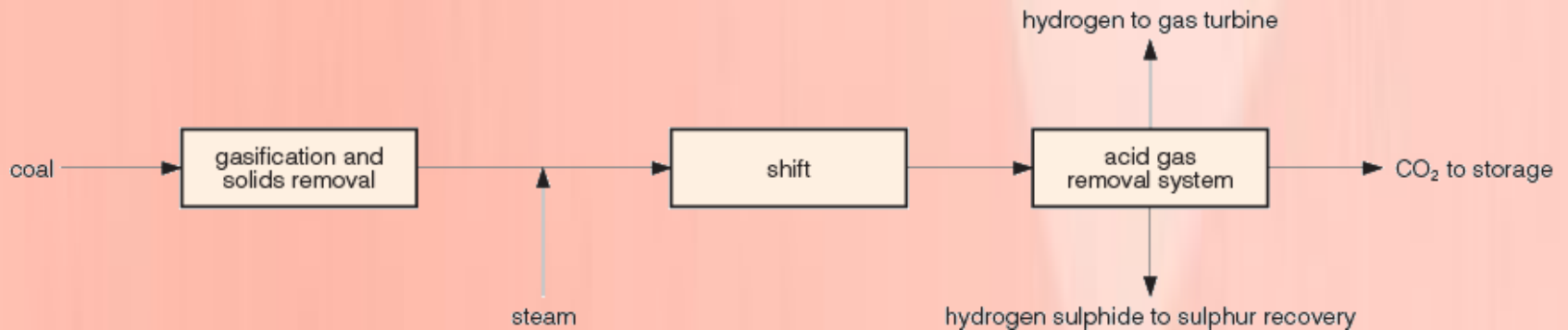
- **Gasifier variants**
 - **Moving bed**
 - **Dry or slagging**
 - **Fluidised bed**
 - **Dry**
 - **Entrained flow**
 - **Agglomerating or slagging**



IGCC Roadmaps for the APP

CO₂ capture in IGCC systems

Preferred route – shift, then solvent scrubbing



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Carbon Capture and Capture Ready IGCC Plants

- **No agreed universal definition of what ‘capture-ready’ means**
 - **Provision can be made ranging from moderate, to extensive**
 - **Capital cost and efficiency implications**

Barriers to IGCC Uptake

- **Technical**
 - **The gasifier;**
 - **Gas cleaning system;**
 - **Oxygen production plant;**
 - **Gas turbine;**
 - **Syngas cooler, heat recovery steam generator, steam turbine cycle;**
 - **CO₂ capture systems (for capture ready- and full capture plants)**



Barriers to IGCC Uptake

- **Economic**
 - **Very significant increases in capital costs, mid decade**
 - **Conservative approach to IGCC technology by investment banks and credit rating agencies**
 - **Impact of the ‘credit crunch’?**



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Barriers to IGCC Uptake

- **Policy and public attitudes**
 - **30 year investment period, but uncertain and changing regulatory background**
 - **Strategic benefits of using coal**
 - **CO₂ reduction (efficiency and capture)**
 - **Public perception - 'just another dirty coal plant'**



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Barriers to IGCC Uptake

- **Skills and resources**
 - **IGCC development and deployment requires a broad mix of scientists and engineers**
 - **Reported shortage of skilled labour, and ageing resource pool**
 - **New flagship projects attracting graduates**
 - **Signs that graduates turning from banking to physical sciences**



IGCC Roadmaps for the APP

IGCC projects within APP countries

- **Comprehensive review country-by-country**
 - **Projects announced, and disappear almost daily (Google news alerts)!**
 - **IGCC activities listed by capture- and capture ready- status**
 - **Annexe summarises significant non-APP activities**



IGCC Roadmaps for the APP

Example extracted from report

| Table X IGCC projects and proposals featuring CCS – Republic of Korea | | | | | | |
|---|----------|----------------|---|---------------------------------------|---|---|
| Developer | Location | Capacity (MWe) | Technology | Feedstock | Destination of CO ₂ | Status/Comments |
| KEPCO (Korea Western Power, Doosan Heavy Industries) | Taeon | 300 | MHI 2-stage, dry feed, entrained flow, air-blown gasifier | Coal and other fuels (biomass, waste) | Not specified, but plant capture ready. | Design (2006-09) Construction (2009-12) Operation (2012-14) |

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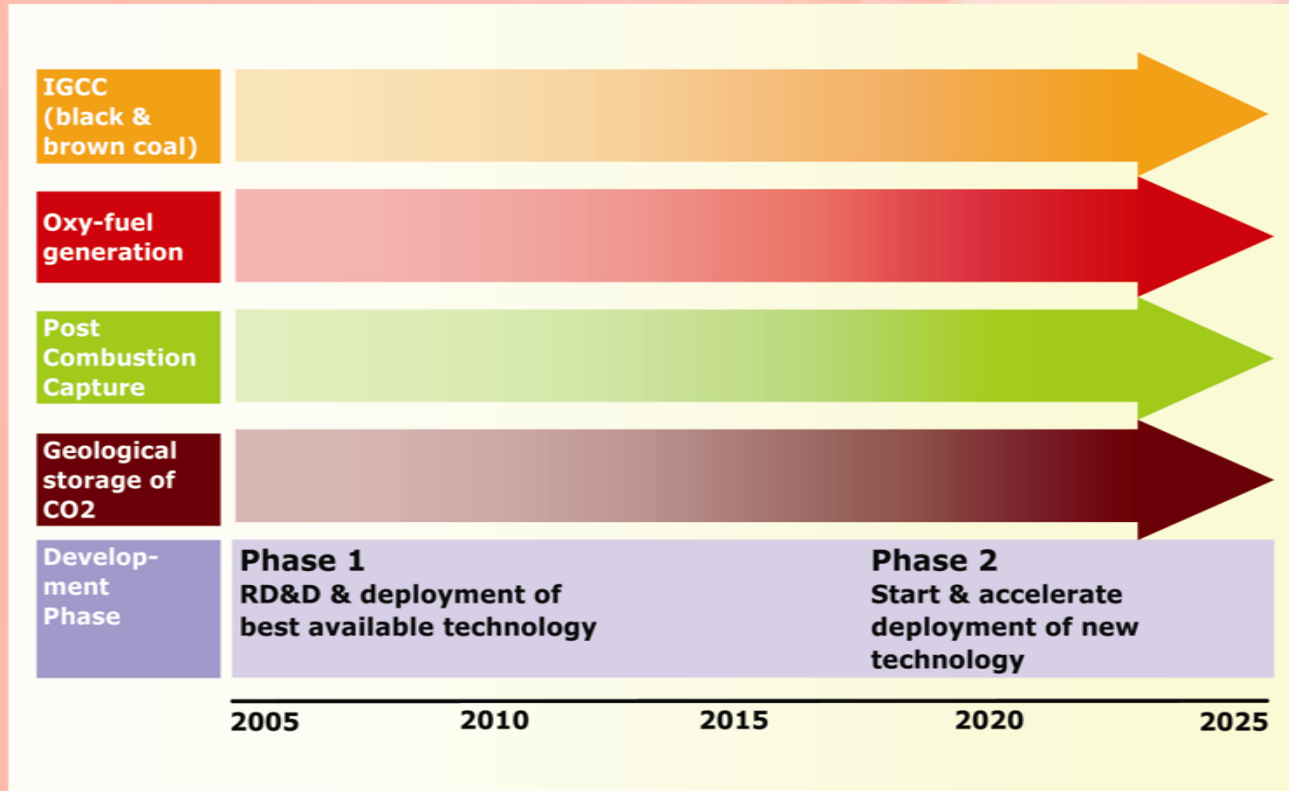
Individual APP country roadmaps

- **Vary from statements of policy to highly detailed action plans**
- **Subject to development and revision (e.g. FutureGen)**
- **Separate roadmaps for technology development and CO₂ capture in some cases**

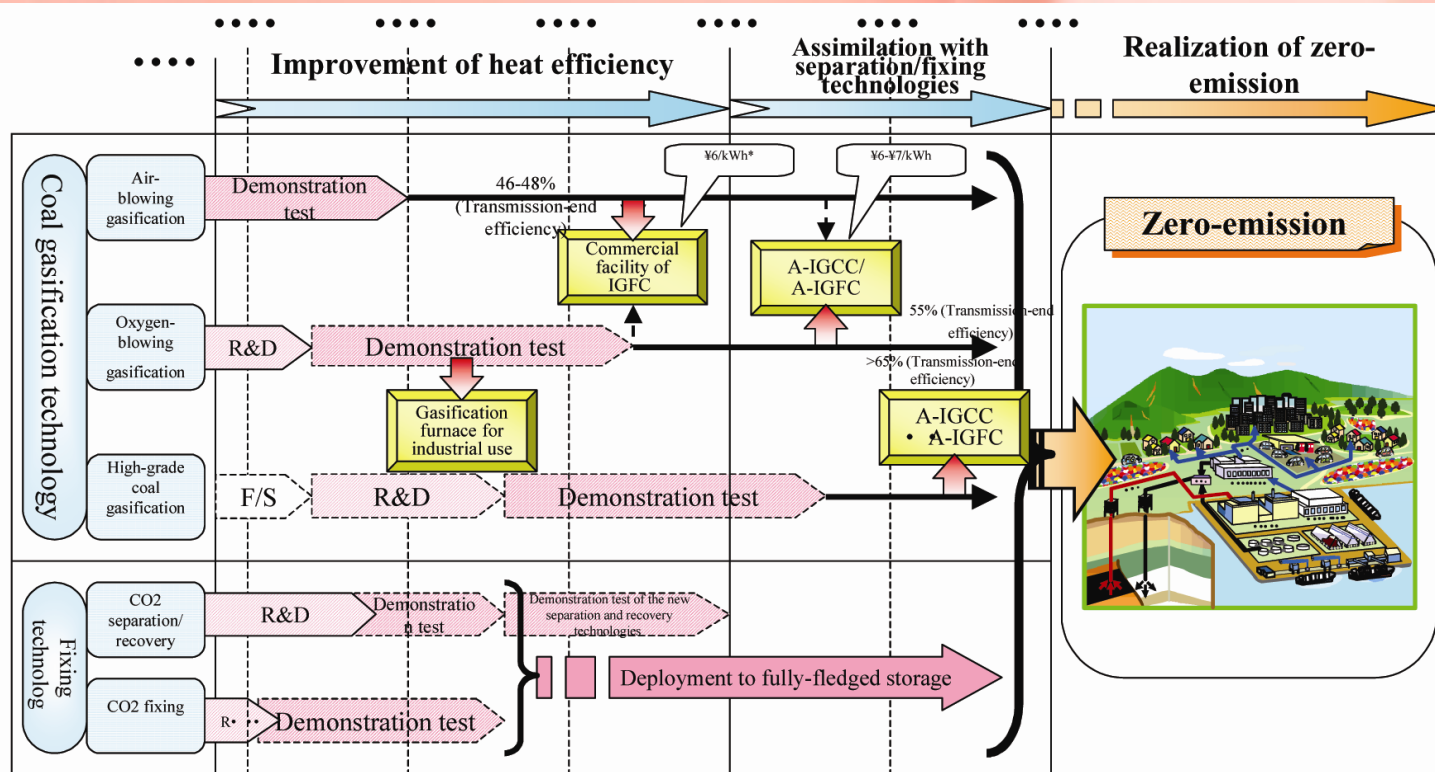


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COAL21 Action Plan



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On the assumption that the amount is the same as the current unit price of coal-fired power generation (¥5.9/kWh as calculated on a trial basis by the Federation of Electric Power Companies of Japan)

 Timing of commercialization

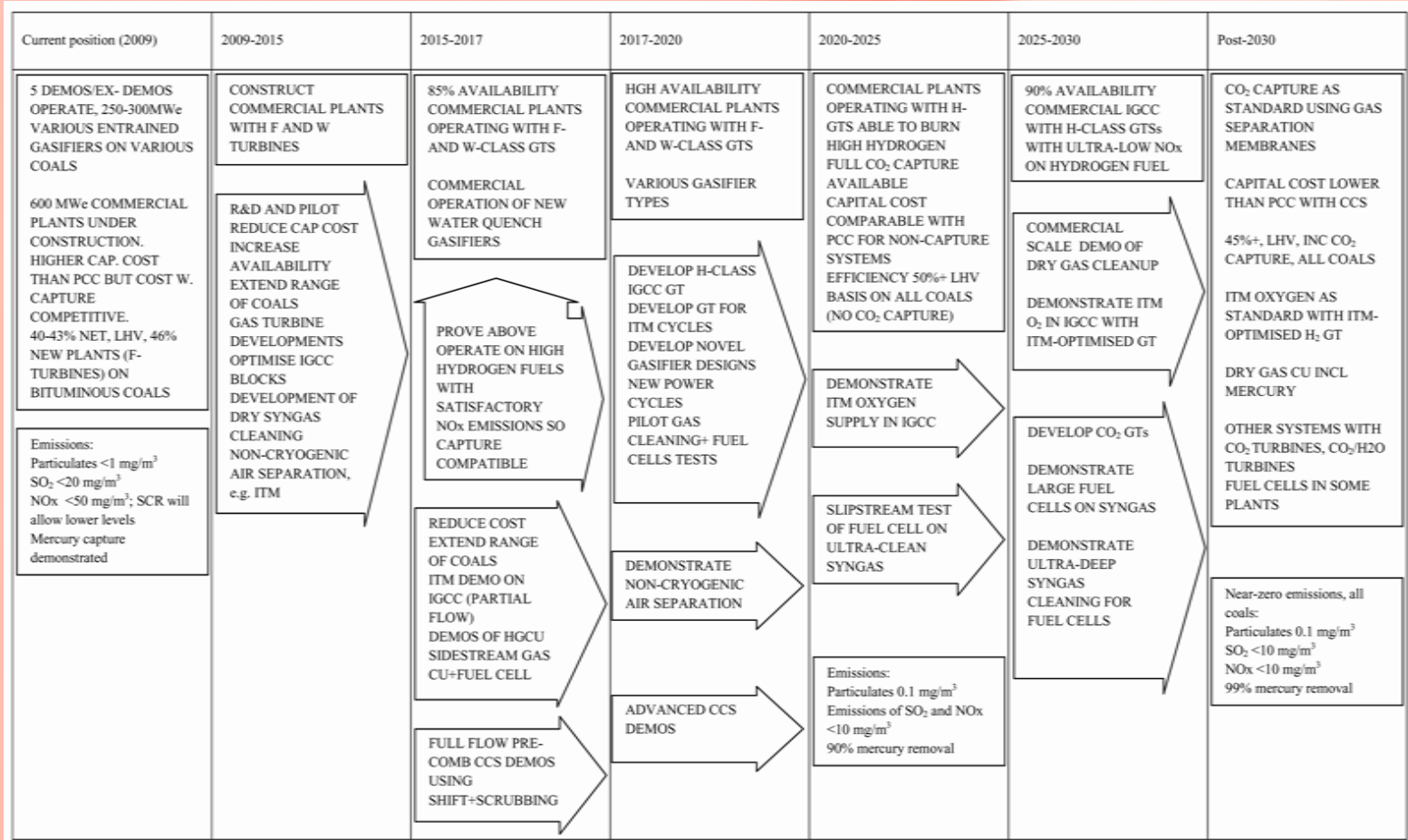
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Regional APP country roadmaps

- **Technical issues**
 - **Draw on work being undertaken on IEA Working Party on Fossil Fuels (WPFF) roadmaps (report due June 2009)**
 - **Separate IGCC and CCS issues**
 - **Accompanying issues**
 - **Economic - Financing IGCC Development**
 - **Policy and Public Attitudes**
 - **Skills and Resources**



IGCC Roadmaps for the APP - IGCC

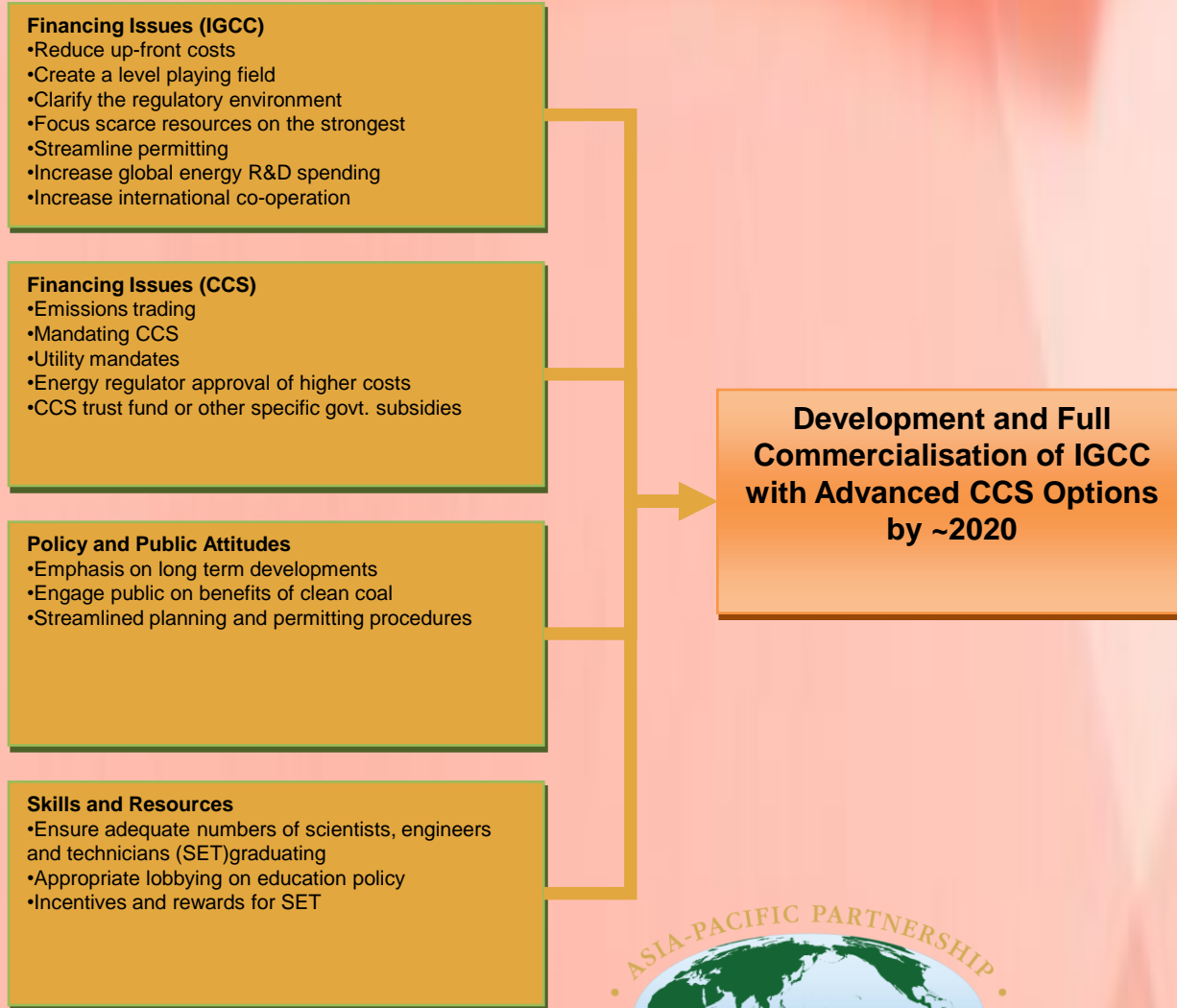


IGCC Roadmaps for the APP - CCS

| Current position (2009) | 2009-2015 | 2015-2017 | 2017-2020 | 2020-2025 | 2025-2030 | Post-2030 |
|--|--|---|--|---|--|---|
| <p>LARGE SCALE CAPTURE AND STORAGE DEMONSTRATION ON NON-POWER PLANTS</p> <p>CAPTURE EXPERIENCE IN CERTAIN INDUSTRIES</p> | <p>IGCC R&D NEW SOLVENTS, MEMBRANES, ADSORPTION SYSTEMS GENERAL: ENERGY EFFICIENT COMPRESSOR DESIGNS</p> | <p>LARGE DEMOS 85% CAPTURE PHYSICAL AND CHEMICAL SCRUBBING SLIPSTREAM TESTS ON MEMB SEPARATION H₂ COMBUSTING GT</p> <p>IGCC: LAB TEST MEMBRANES MEMBRANE REACTORS ADVANCED GASIFIERS NOVEL IGCC CYCLES</p> | <p>ADVANCED DEMOS >85% CAPTURE IGCC: ADVANCED GASIFIERS</p> <p>IGCC: DEV AIR-EXTRACTABLE GTS FOR HYDROGEN REDUCE SHIFT STEAM REQUIREMENT PILOT MEMBRANES, MEMBRANE REACTORS GASIFICATION FUEL CELL CYCLES NOVEL IGCC CYCLES</p> | <p>COMMERCIALY AVAILABLE SYSTEMS, >85% CAPTURE</p> <p>IGCC: PHYSICAL AND CHEMICAL SOLVENT SCRUBBING H-CLASS GTS FOR HIGH H₂ FUELS PILOT MEMBRANE REACTORS</p> | <p>COMMERCIAL SYSTEMS 90% CAPTURE: IGCC WITH H-CLASS GTs WITH ULTRA-LOW NOX ON H₂</p> <p>REDUCED ENERGY USE OF CO₂ CAPTURE AND COMPRESSION</p> <p>IGCC: DEMO MEMBRANE REACTORS DEMO GASIFICATION FUEL CELL CYCLES FOR CCS DEMO NOVEL GASIFICATION-BASED CYCLES DEMO ITM IGCC CCS</p> | <p>COMMERCIALY AVAILABLE SYSTEMS, 90% CAPTURE:</p> <p>IGCC: HIGH SPEC GTs ROUTINELY USED TO BURN HIGH H₂ WITH ULTRA-LOW NOX ADVANCED IGCC CYCLES INCL FUEL CELLS</p> |



IGCC Roadmaps for the APP - CCS



Thank You Questions?

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