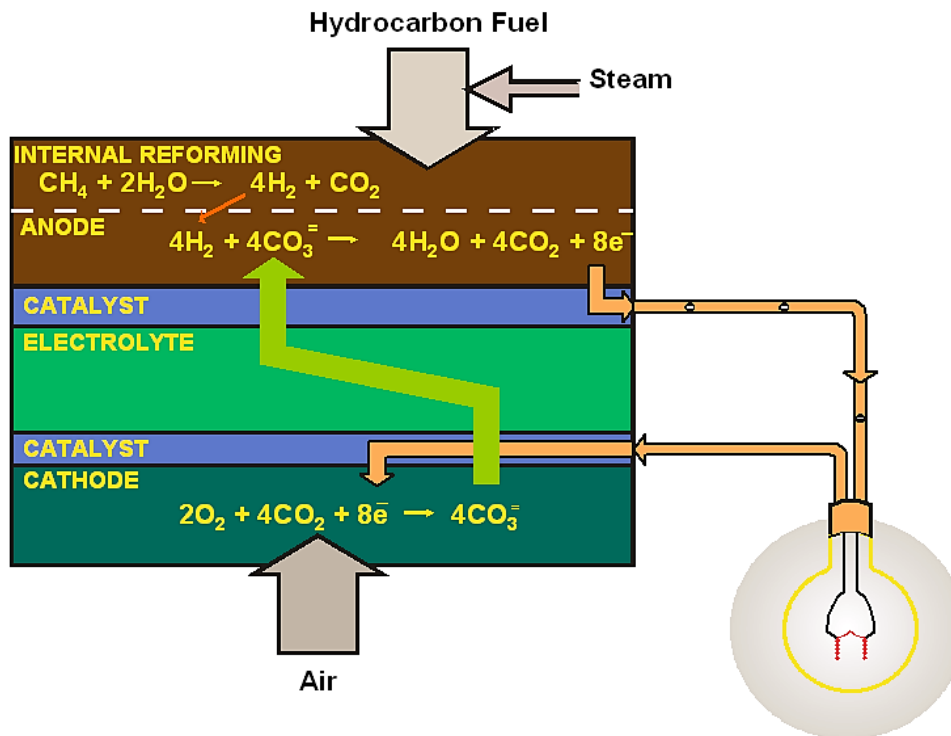




Carbon Capture with Molten Carbonate Fuel Cell Powerplants

ARB CCS Workshop

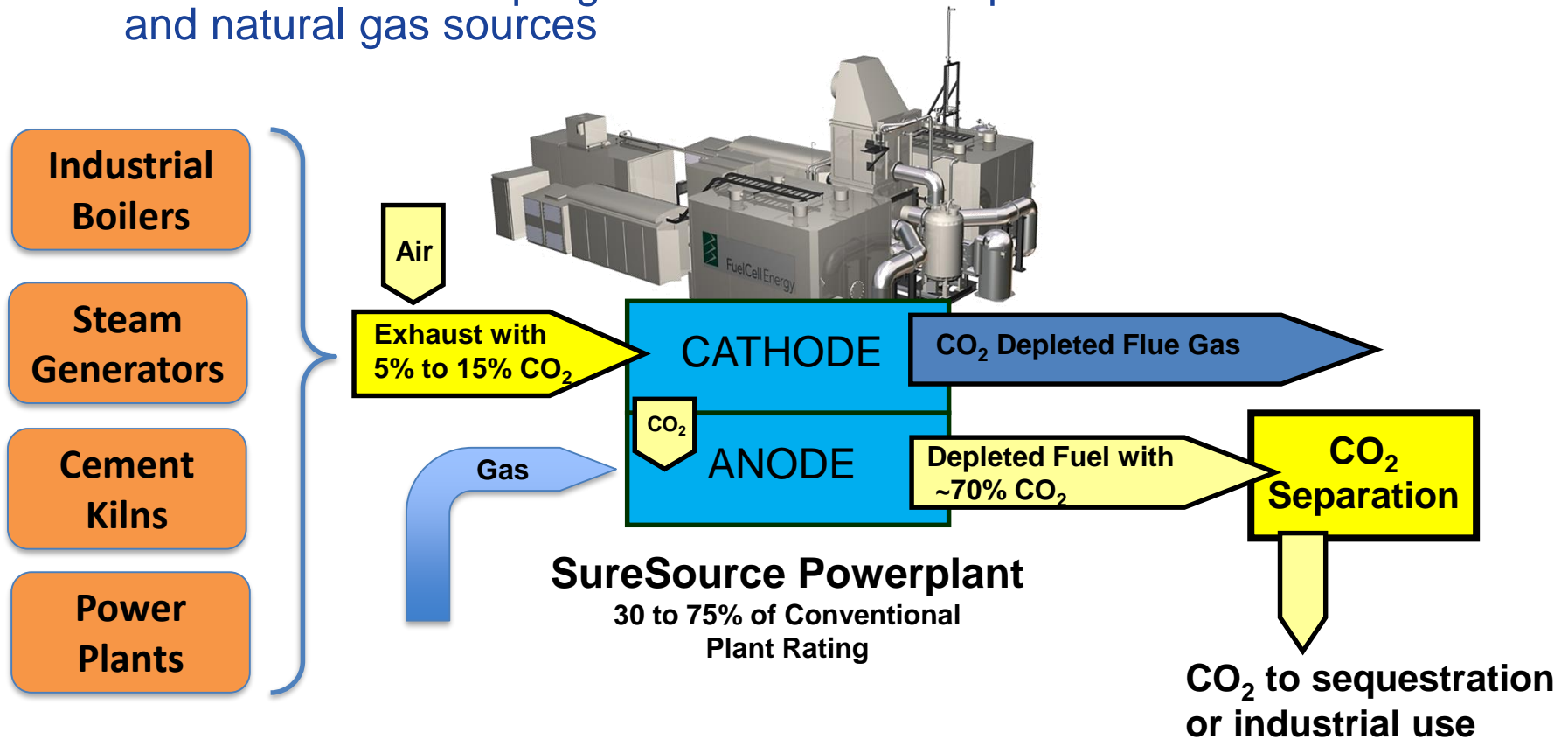
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- MCFC Chemistry involves transfer of CO_2 from cathode to anode
- This attribute enables effective CO_2 separation with existing MCFC stack technology
- CO_2 concentrated in anode gas allows for easy capture and use or sequestration

SureSource Carbon Capture uses the same electrochemical process that has generated over 6 billion kWh worldwide

- Carbonate electrochemical process transfers CO₂ from Air Electrode (Cathode) to Fuel Electrode (Anode)
- CO₂ is easily separated from anode exhaust gas since it is no longer diluted with air
- Two demonstration programs focused on capture from coal sources and natural gas sources



Multiple co-products: Power, NO_x reduction and excess H₂O

- CO₂ Capture scale:
 - Base system size captures CO₂ from 40 – 65 MMBtu/hr boiler flue gas
 - 50 – 90 tonnes/day
 - Capture rate: controllable 5% to 90%
- Power Output (~1 MW to >2 MW)
 - CO₂ purified to >99% and processed to 1450 psi ready for delivery/injection
- Minimizes NO_x
 - Flue gas NO_x reduced by 70%
- Excess water
 - Available for site processes



**Carbonate Fuel Cell
Powerplant**

Regulations, tariffs and permitting need to account for CO₂ Capture with these additional environmental benefits

CO₂ Captured but not Ideally Located Needs to be Included

- Smaller CO₂ sources must be included
 - Annual emissions and multiple sites add up

CO₂ Utilization Needs to be Included in Addition to Sequestration and EOR

- Captured CO₂ potentially displaces other, more polluting sources of industrial CO₂
 - Significantly reduces delivery distances if local flue gas resources tapped

Water utilization and NO_x reduction

- Produced excess water recirculation eases stress on local water supply
- 70% NO_x reduction improves local air quality
 - Reduces emissions not adding chemical pollution
- Energy produced can improve economics
 - Limiting operations (curtailment/export) significantly reduces CO₂ capture and NO_x reduction (additional payback mechanisms)

Avoid situation where a cluster of sites are prevented from reductions, due to remoteness from CO₂ injection sites