Initial results from the CIUDEN CPU

CO_2 Capture on oxy CFB flue gas

OCC3, Ponferrada 9-13 Sept. 2013 I Fred Lockwood[a]*, Ludovic Granados[a], Vanessa Turmel[a], Pedro Otero[b]*, Miguel A. Delgado[b], Manuel Gómez[b]

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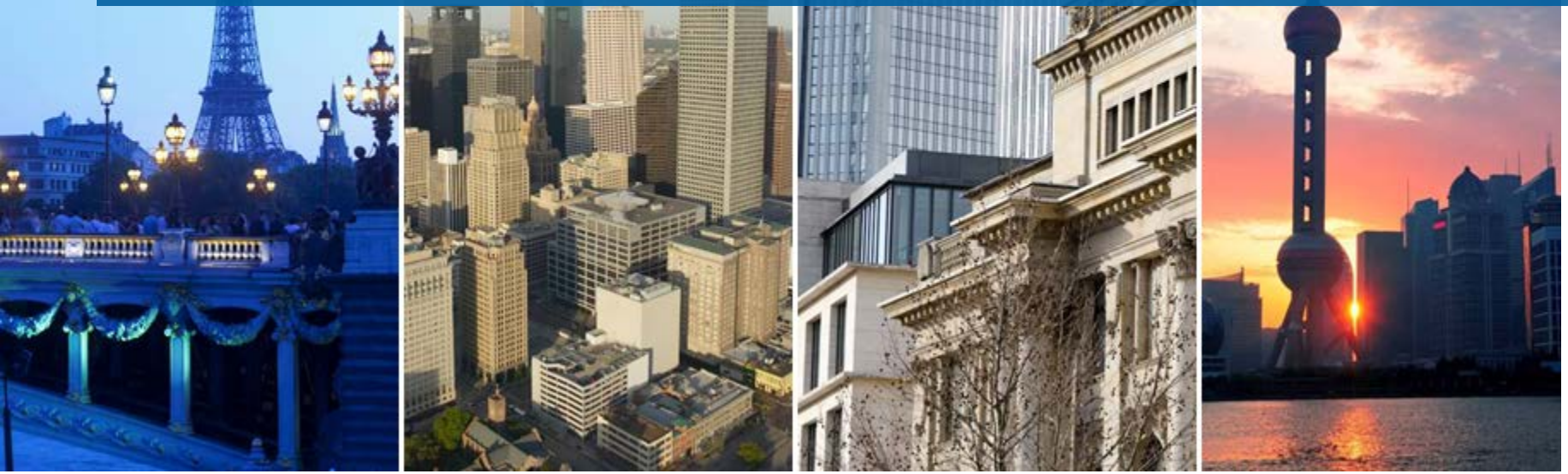

Agenda

- CRYOCAP™ OXY CPU roadmap
- CIUDEN CPU – overview
- Review of specific technologies and results
- Conclusions

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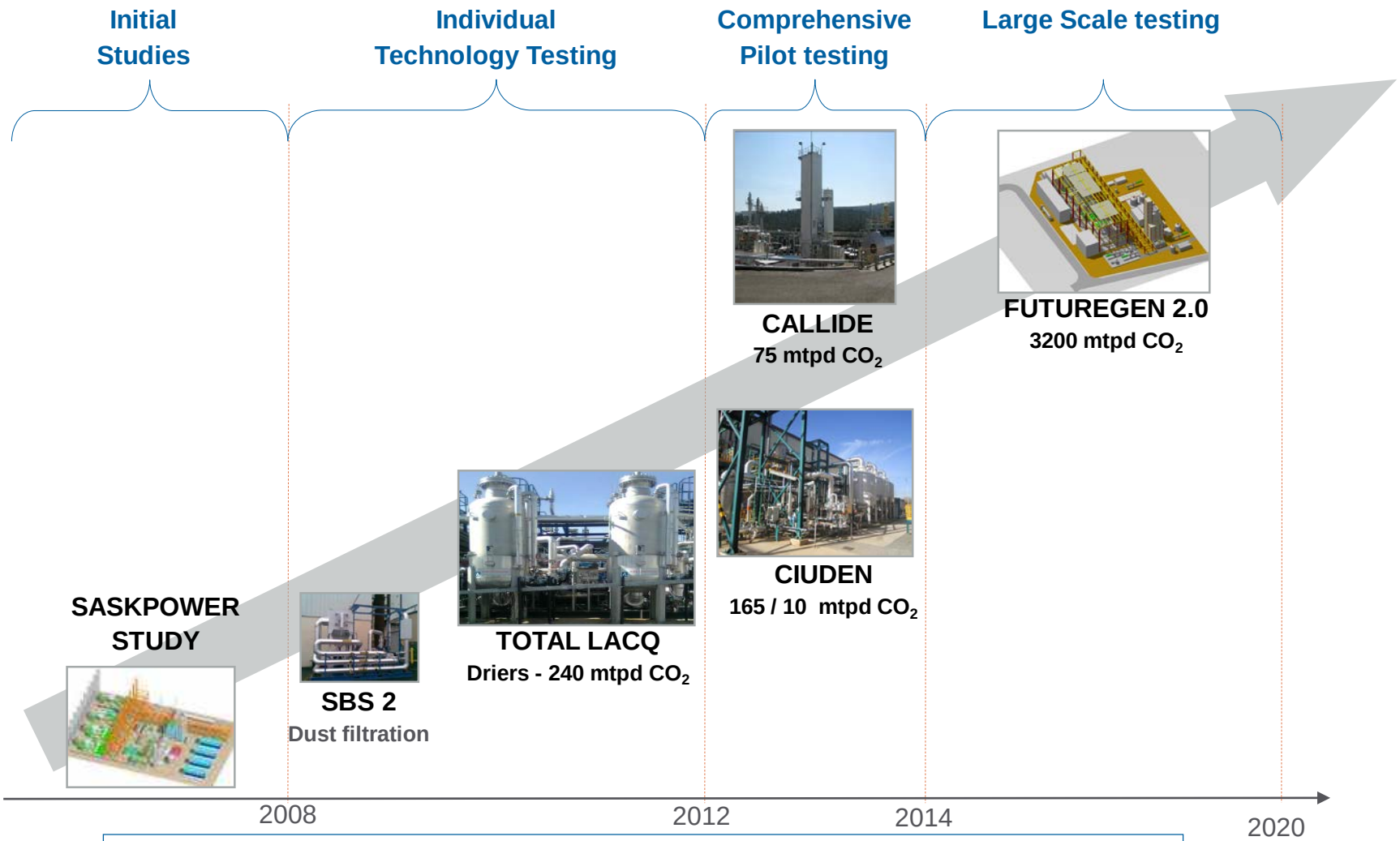
CRYOCAP™ OXY CPU roadmap



Step-by-step approach with **extensive pilot testing**

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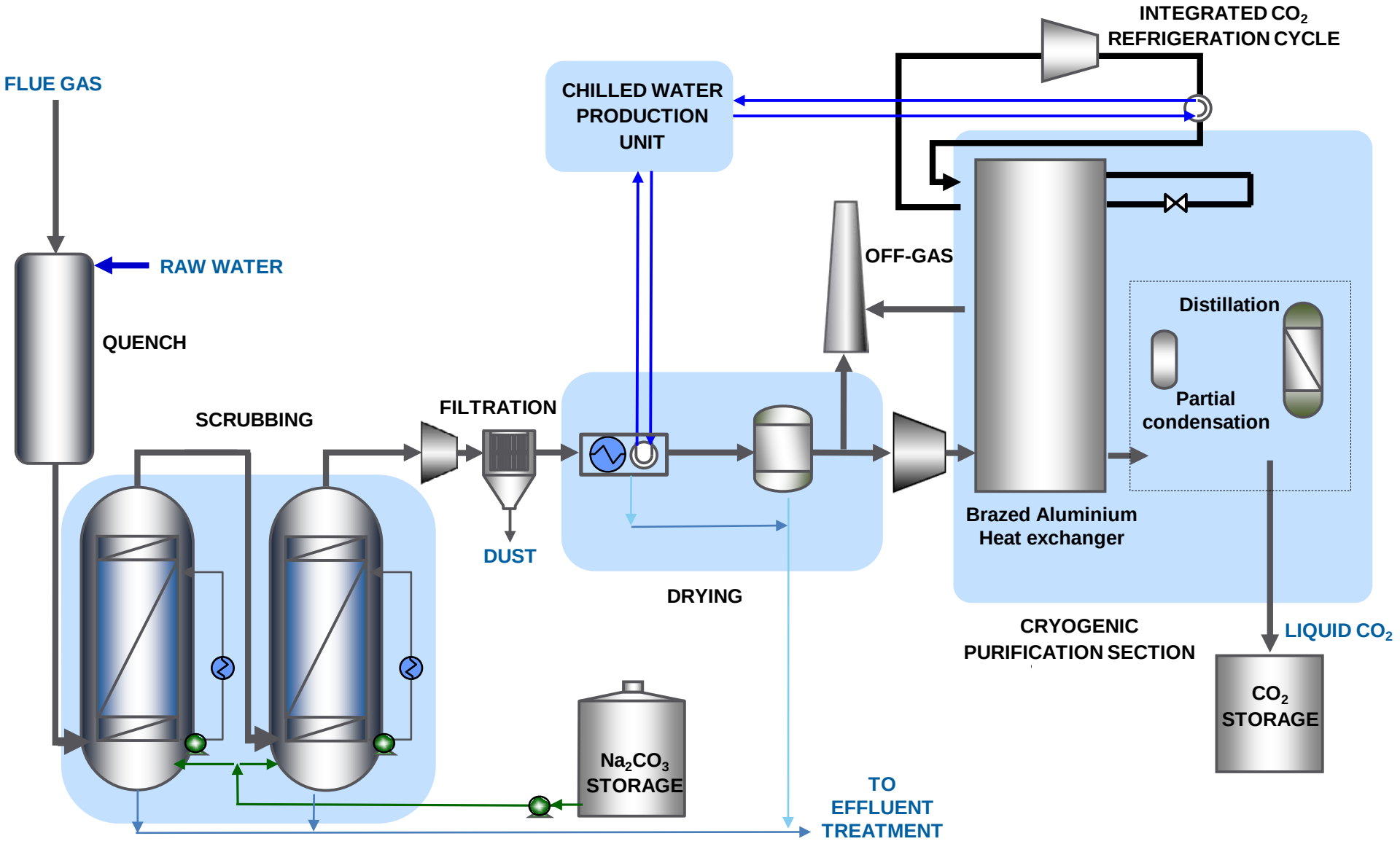
CIUDEN CPU Overview – key facts & figures

- Supplied by ISOLUX using **Air Liquide** design and technology
- Warm part capacity: **160 mtpd CO_2**
- Cold part capacity: **10 mtpd liquid CO_2**
- Warm part accumulated operating hours: ~**2500**
- Cold part accumulated operating hours: ~**1500**
- A range of **'upscalable'** technologies

CIUDEN CPU Overview – Process

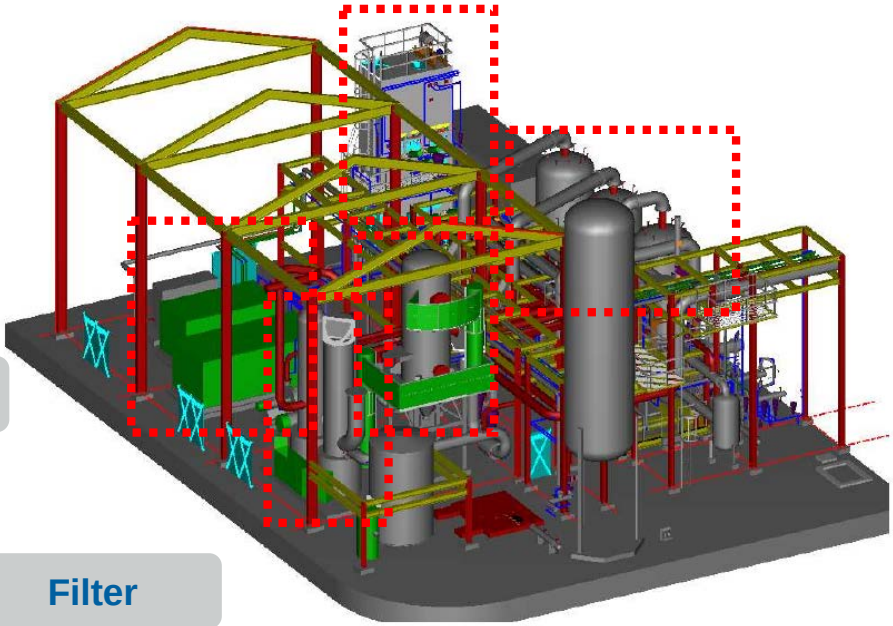


AIR LIQUIDE

CIUDEN CPU Overview – Views

Cold Box

Dryer vessels



Compressors

Flue Gas Scrubber

Filter

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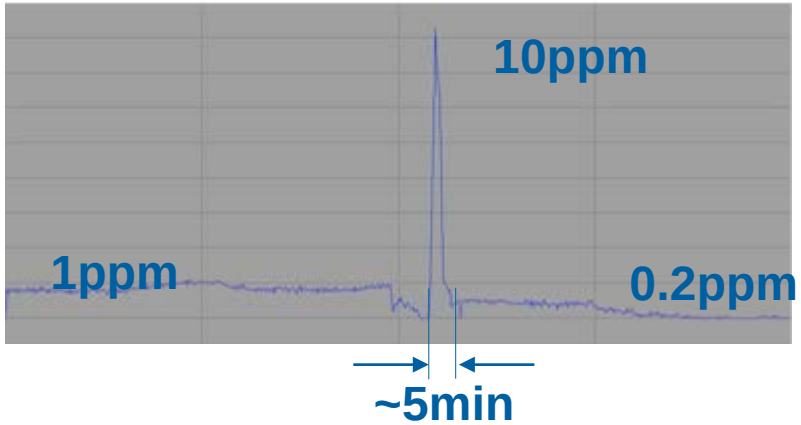
Flue Gas Quench and Scrubbing - process

Technology

- Initial column for quench
- Scrubbing with Na_2CO_3 solution
- Double plastic column for scrub

Results

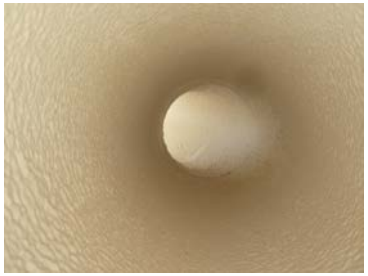
- <1ppm SO_2
- Short spikes when inlet SO_2 rises



- Significant dust removal
- Very low CO_2 loss
- Waste pH : ~6-7
- Reagent solution pH : ~11-7

Flue Gas Quench and Scrubbing - materials

Technology



- Corrothane™ XP coating on flue gas inlet
- Hastelloy for quench
- Plastic for scrubbing towers

Results

- Acid condensates in inlet during transients
- No materials degradation on inlet/quench/scrubber and downstream due to effective scrubbing

Filtration

Technology

- Regenerable pleated cartridges
- Regenerated by back-pulsing
- Target of ~10µg/Nm^3 at outlet

Results

- Negligible dust build up
- Dust almost 100% removed by quench and scrubber

- Care must be taken in transient phases to avoid condensation

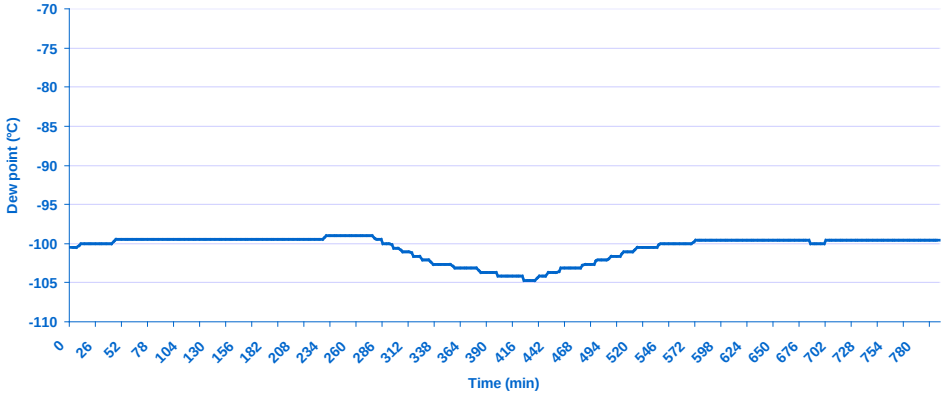
Dryers

Technology

- 3 vessels cycle
- Regeneration using dried gas
- Relatively low pressure
- Inexpensive materials

Results

- Dew point ~-100°C



- Condensates upstream: low acidity (pH ~3-4) due to limited NO to NO_2 conversion at low pressure
- Condensates in dryers: similar pH

Cold Box

Technology

- CO_2 recovery by partial condensation
- O_2 and NO_X removal by distillation
- Cold from separate CO_2 cycle
- Operation close to CO_2 triple point

Results

- No issues with CO_2 freezing
- CO_2 purity >99.9%
- Very low NO_X and SO_X content

Compound	Purity
CO_2	**>99.9%vol.**
SO_2	<0.1ppmv
NO_x	<10ppmv
H_2O	<1ppmv
O_2	<10ppmv

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Conclusions

- **Significant operating hours** accumulated
- High level of **dust** and **SO_2** removal by scrubber

- **High purity liquid CO_2** production from oxycombustion gas
- **Optimal operation** close to **CO_2 triple point**

An important step in **qualifying CPU technology**

End of presentation

Thank you for your attention