



TCM

A general presentation

Roy Vardheim
Managing Director TCM



TCM: One of the key components in the Norwegian route to CCS implementation



TCM – new partnership until 2020

Has become an international competence center with three industrial owners.



TCM – an arena for training, problem-solving and development

Has qualified several companies to participate in full-scale CCS projects

- Reduce the cost and risks of CO₂ capture technology deployment
- Providing an arena where vendors can test, verify, and demonstrate proprietary CO₂ capture technologies



Unique flexibility for testing at Industrial scale

(NGCC)

4 operational areas:

Test bay for modules

Future test area

Amine plant

Chilled Ammonia
plant (CAP)

Refinery

RFCC

We have two base sources of flue gas:

- Flue gas from the NGCC unit (**3,5 % CO₂**)
- Flue gas from catalytic cracking RFCC (**13% CO₂**)

The three main activities at TCM

Competence development for our owners

Test campaigns with
technology vendors

Develop a global competence center
for CO₂ capture technologies and support
international networking

Scientific “open” test campaigns



The TCM offer to technology vendors

An opportunity to get technology to market faster and cheaper

- Large scale 24/7 testing on real industrial flue gas (10 MW)
- Scientific support, test design and trouble shooting
- Emission control and environmental chemistry
- Support on approval processes with environmental authorities
- Analytical methods
- Operator training facilities for full scale capture operations



Continuous testing since inauguration in 2012

Five companies have validated their technology at TCM.

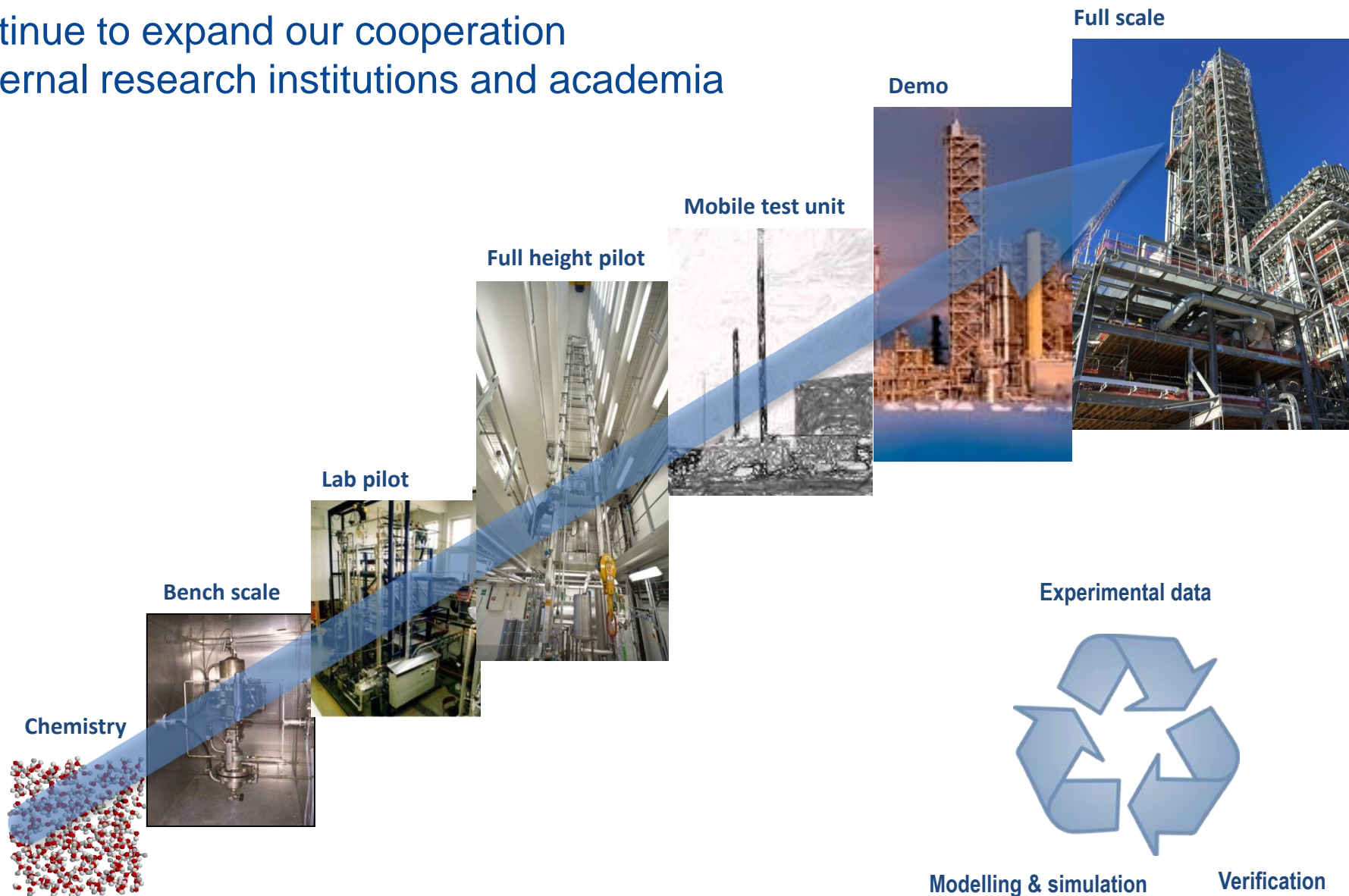
Completed test campaigns:

- Aker Solutions (Norway)
- Alstom/GE (USA)
- Cansolv Technologies (Canada)
- Carbon Clean Solutions (UK/India)
- ION Engineering (USA)



TCM and the «Research world»

We continue to expand our cooperation with external research institutions and academia

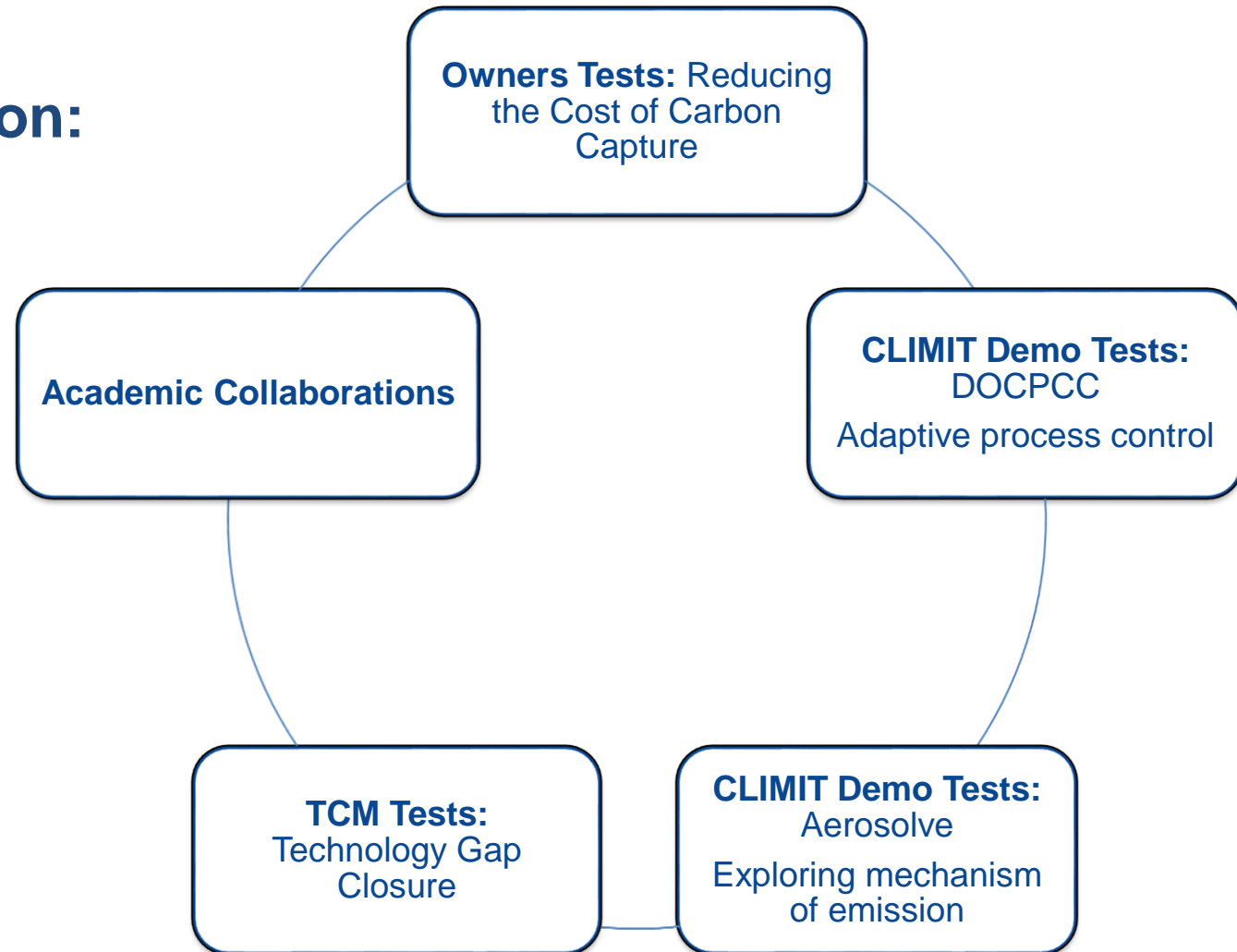


TCM's third scientific "open" campaign will be conducted later this year

The campaign has several sponsors, including industry, scientific institutions and public funding

A very broad collaboration:

Statoil (Industry)
Shell (Industry)
Gassnova (Public)
SINTEF (Research)
TNO (Research)
NTNU (Academia)
Imperial College (Academia)
DTU (Academia)
Cybernetica (Industry)
The ROAD project
Engie (Industry)
Uniper (Industry)



TCM has developed a broad competence portfolio

Our intention is to share this competence!

- Analytical methods
- Online measurements
- Scientific test design
- Surveillance schemes for monitoring post-combustion capture processes
- Operator training facilities for full scale capture operations
- Emission control and environmental chemistry
- Approval processes with environmental authorities
- Simulation and modelling of capture processes



Networking and competence sharing is essential

Also a crucial part of developing and implementing CO₂ capture technology

- **Bilateral US/Norway agreemeent**
 - **Participation in the International test center network (ITCN)**
 - **Collaboration agreements with academia and research institutions (eg. SINTEF/TCM)**
 - **Support agreements with CCS projects**
 - **Dedicated conference sessions (eg. GHGT-13)**
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- A stylized image of a globe showing the continents of North and South America. Overlaid on the globe are numerous glowing blue lines that arc across the sky, connecting various points on the globe. These lines represent global networking and communication. The lines are thicker and brighter at the points where they connect to the globe, which are marked with small, bright blue star-like lights. The background is a deep blue, suggesting a night sky or a digital space.



THE WAY FORWARD

New business strategy in progress

We are currently developing our business strategy in cooperation with our owners.

- Further development of the amine technology
- Explore emerging technologies
- Expand the concept of scientific campaigns
- Expand geographical and industrial focus
- Explore CO₂ utilization possibilities
- Develop the competence center concept and increase further networking activity.
- Support the Norwegian fullscale projects in cooperation with Gassnova

THANK YOU!

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