APGTF 2013

CCPilot100+ Progress Update

21st Feb 2013

SSE

DOOSAN Doosan Babcock Energy

VATTENFALL

DEPARTMENT OF ENERGY & CLIMATE CHANGE

Technology Strategy Board

Driving Innovation

Moving Forward:
The Northern Way

one NORTH EAST

Northwest REGIONAL DEVELOPMENT AGENCY

Test Programme

Parametric + exposure testing to:

- Assess the **durability** of the solvent.
- Permit **process optimisation**.
- Provide data on **plant design** and **scale-up**.

  - CO_2 capture rate
  - CO_2 composition
  - Steam, Power, Water consumption
  - Atmospheric emissions
  - Column profiling. [CO_2] and Temp
  - Solvent Comparison MEA vs RS2
  - Material Degradation
  - Benchmarking vs other plant

Measurements and Instrumentation

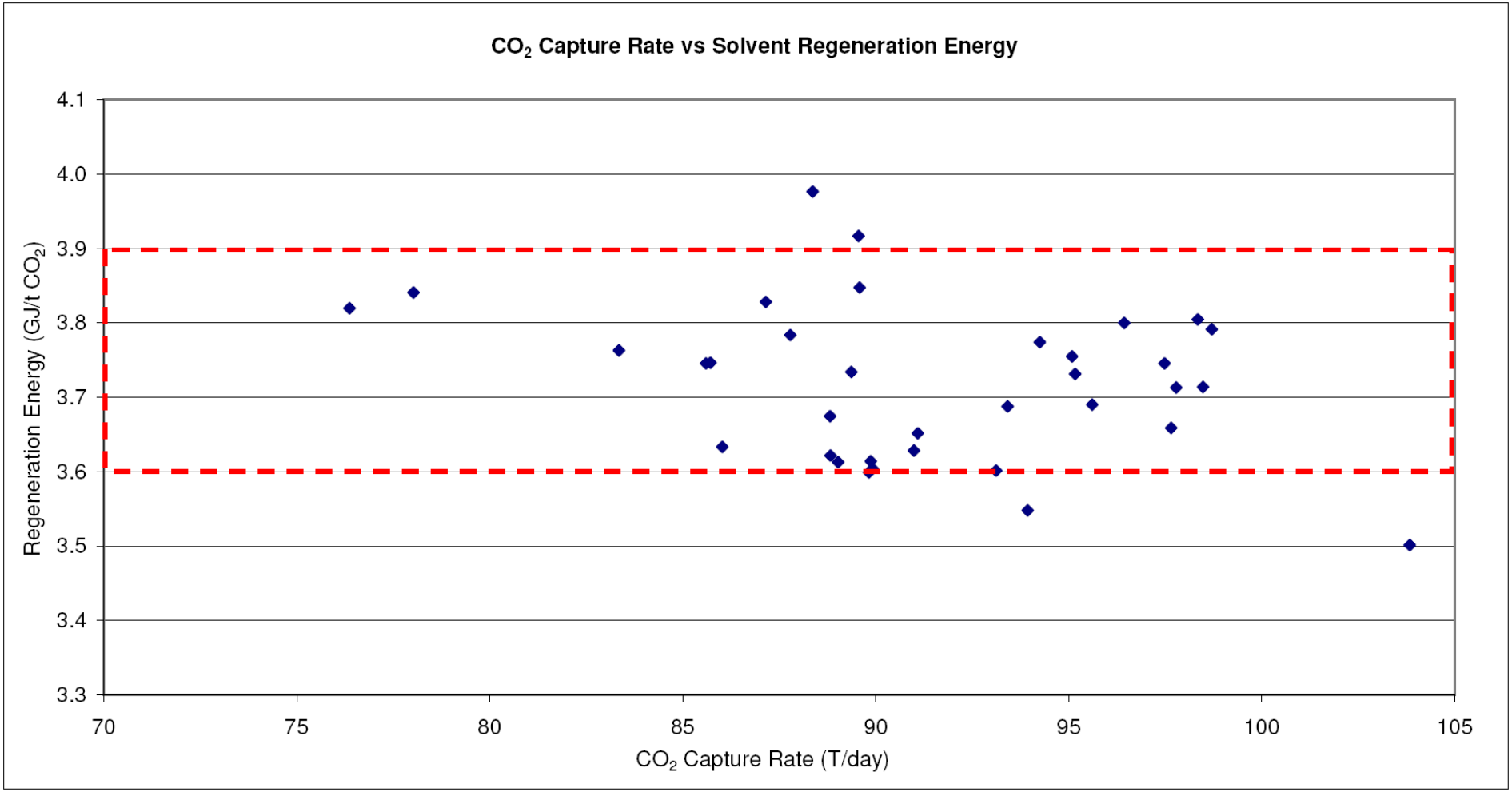
Liquid Analysis

- **On-Line Liquid Analysis**
  - Solvent Concentration, CO_2 Loading
- **Solvent**
  - Concentration, Conductivity, Density, pH
  - Heat Stable Salts (HSS) Concentration
  - Bound Amine
- **Water** (Ion Chromatography)
  - Cooling Water, Waste Water

Gas Analysis

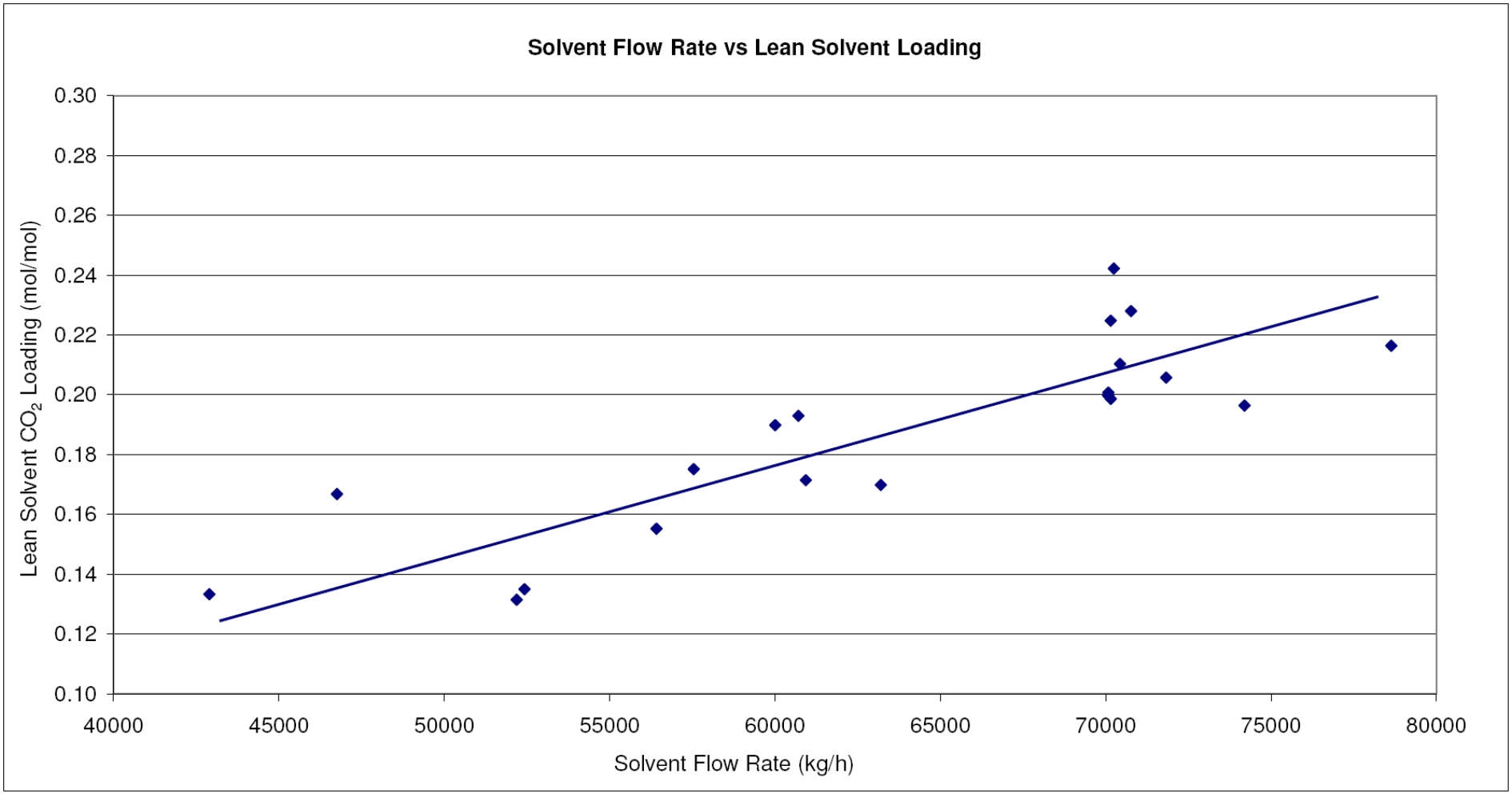
- **On-Line Gas Analysis**
  - FT-IR – Extractive multi-point heated sampling system
  - Ammonia Tuneable Diode Laser – Cross-duct, non-extractive
  - ppm Oxygen Micro-Fuel Cell – Extractive, cold sampling system
- **Manual Gas Analysis**
  - FGD Polisher Performance
  - PCC Based Emissions: Solvent Carryover, Degradation Products

MEA Benchmarking – Regeneration Energy



Regeneration Energy as expected – Plant is 'representative'

MEA Benchmarking – Flow vs. Lean Loading



Plant Behaviour as Expected

Academic Engagement

- **Complementary Research Projects**
  - Edinburgh, Leeds, Nottingham and Sheffield
- **1 Month Secondments**
  - ~20 Students have each spent a month full time at the plant
- **Day Visits**
  - ~250 students have already visited the plant and Ferrybridge
  - Also open to rest of the “N8” academic group
- **Industrial Awareness Modules**
  - 1 week (3 days Renfrew, 2 days FB)
- **CPD Course**
  - Contribution to CPD Course on CCS

Key Lessons Learned

- Unknown Unknowns!
- Academic Partnership
- Design, Source, Construct
- SSE experience of novel process
- Environment Agency experience of novel process
- Adapted Instrumentation and analytical Protocols
- Public Reaction

Progress Summary and Next Steps

Key Achievements

- MEA benchmarking successfully completed
- 100t/day CO_2 capture achieved at 90% capture efficiency
- >100 starts
- >1000 hours cumulative operation

Next Steps

- RS-2™ testing (Started…)
- Process Modelling Validation
- Detailed Data Analysis
- Advanced materials testing
- Solvent Reclaimer Operation
- Analysis of Solvent Degradation
- Atmospheric Emissions