



Application of Biogas in Chemical Energy Storage and Liquid Fuel Production

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ESR 5.4



Queen's University
Belfast



Funded by
the European Union

Educational Background

PhD. Chemical Engineering
Class of 2017



BSc. Chemistry
BEng. Chemical Engineering
Class of 2014



Research Experience



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the European Union

Workshops (QUB)

- Introduction to Project Management
- Intermediate Project Management
- Life Cycle Analysis workshop with Dr. Beatrice Smyth
- Data Management in Research

Post Graduate Training (QUB)

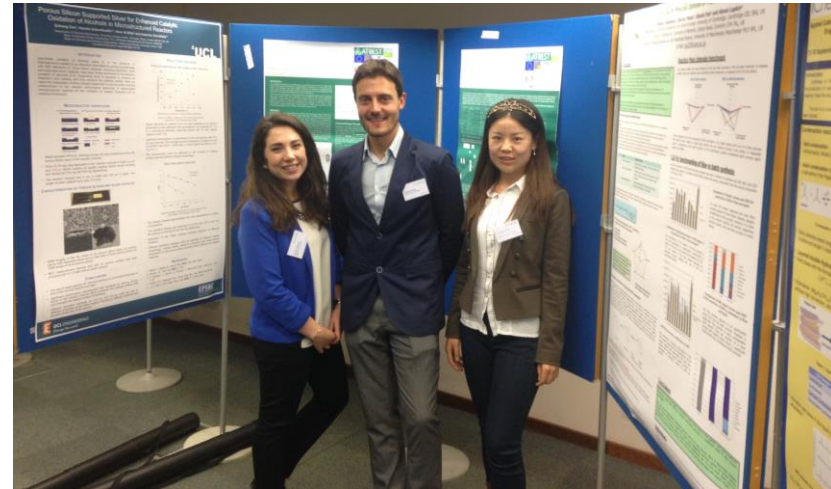
- Induction for Engineering and Physical Sciences
- Postgraduate Research Development Planning
- Refworks for Science and Engineering
- Effective Academic Application
- X-ray Safety training within the University's safety services

ATBEST

- ATBEST meeting held in QUB and UCC
- Summer school at UDE
- Researchers' workshop: Experimental design and Getting your research published, facilitated by Prof Jerry Murphy (UCC)
- First industry open day in the River Lee Hotel, Cork, Ireland

Conferences

- **17,18-September-2014** IChemE Conference about *Applied Catalysis and Reaction Engineering* in University of Cambridge, UK and presented a poster
- **20-May-2015** First student organized conference at Queen's University Belfast (QUB) titled as: *How will energy Change the Future Landscape?* on (member of the technical organizing committee)
- **8-June-2015** IChemE Conference about *Delivering Low Carbon Energy from Biomass Resources* in London-UK
- **24,25-November-2015** ICEBWE 2015 conference titled as: *XIII International Conference on Energy, Biomass and Waste Engineering taking place in Dubai-UAE*



Community Service

- **14-February-2015** Volunteered for the NI Science Festival which hosted events across Belfast

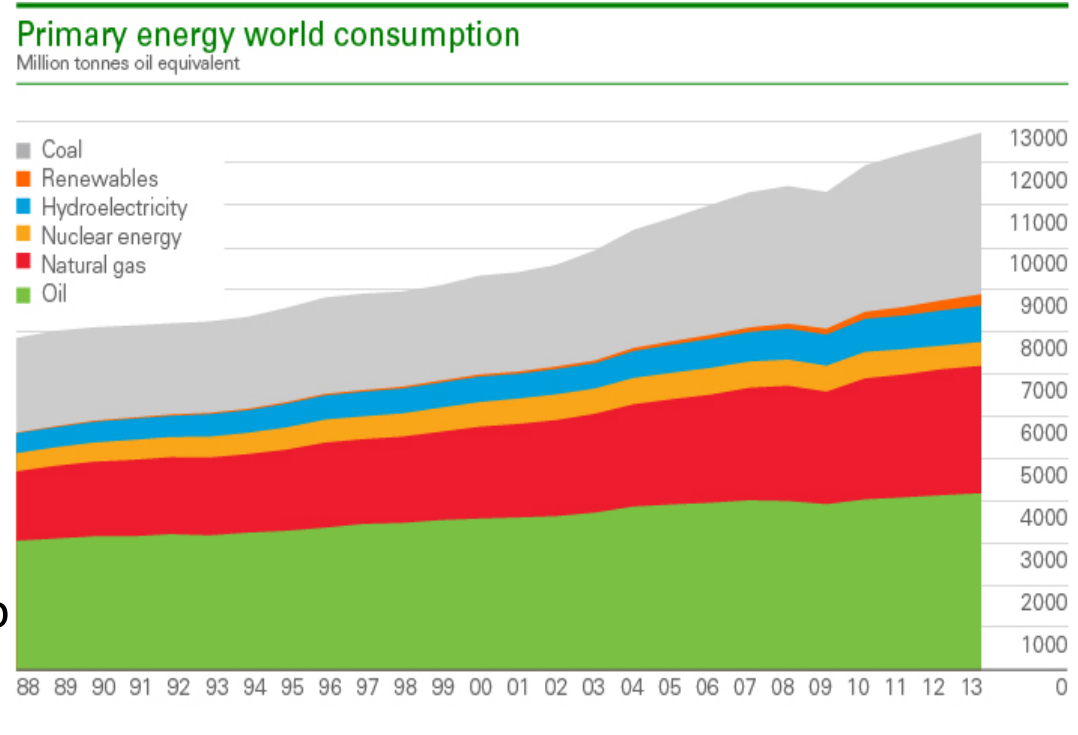
Site Visit

- **20-March-2015** Visited a 500 KW AD plant under construction located in Banbridge, County Down, Northern Ireland, owned by the directors of agriAD Ltd Thomas Cromie



Project Overview

- Increased by a factor of **~1.4** from 1988 to 2013
- Expected increase in gasoline and diesel-fuel consumption
- Total proven world oil reserves reached 1687.9 billion barrels at the end of 2013, sufficient to meet **53.3** years of global production

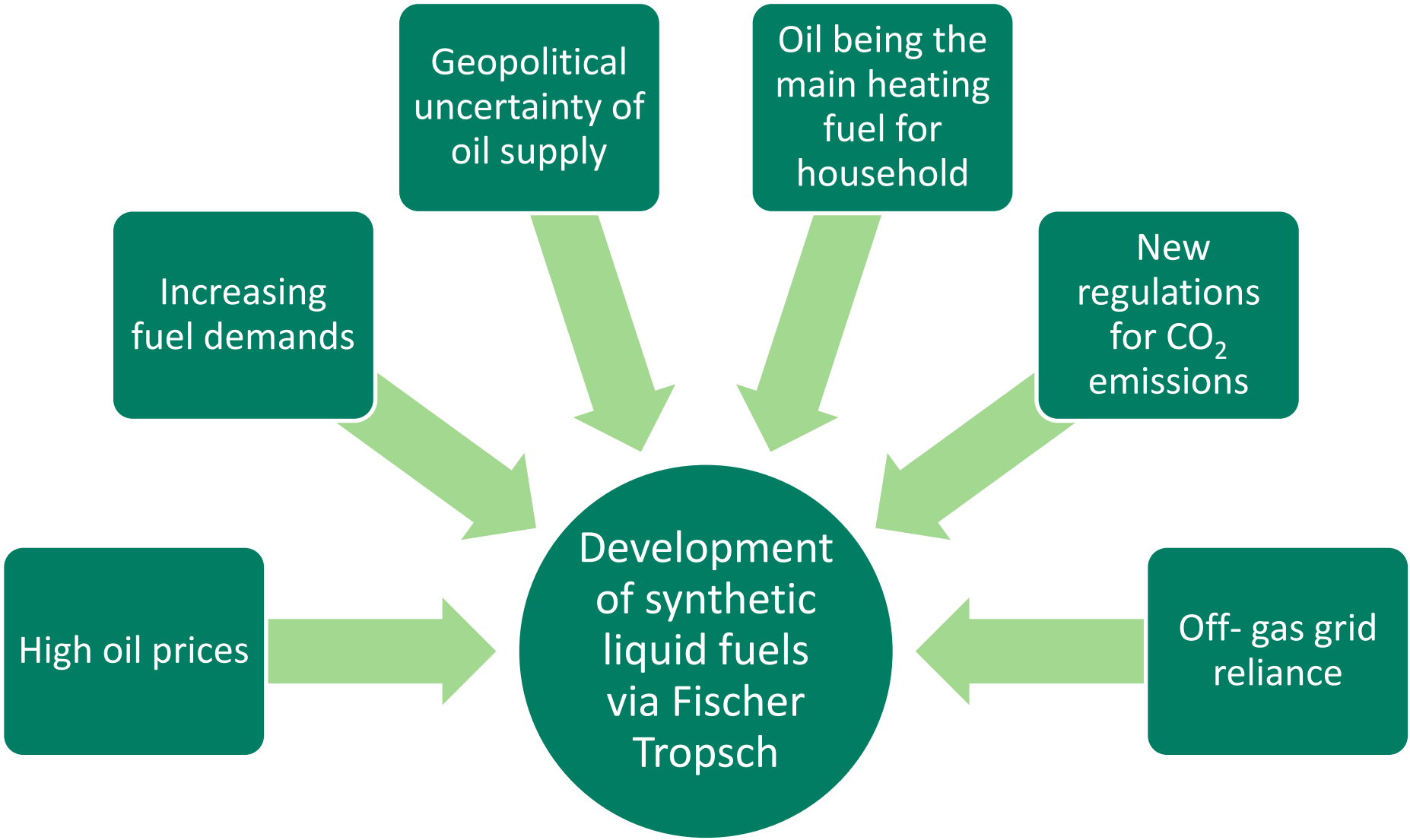


BP Statistical Review of World Energy 2014
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Project Overview

For the case of Northern Ireland

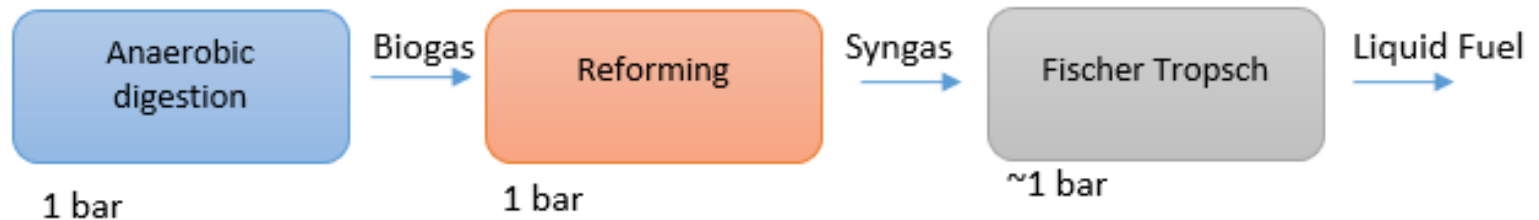
- **80%** of total households are not connected to the mains gas grid (The National Archive, 2011)
- NI has a considerable reliance on non-gas fuels
- **68%** of NI households use heating oil as their primary heating fuel (The National Archive, 2011)
- NI highly depends on imports (approximately 90%) in order to meet its energy needs



Project Aim

Investigate the applications of biogas in chemical energy and liquid fuel productions specifically via Fischer-Tropsch Synthesis (FTS) reaction

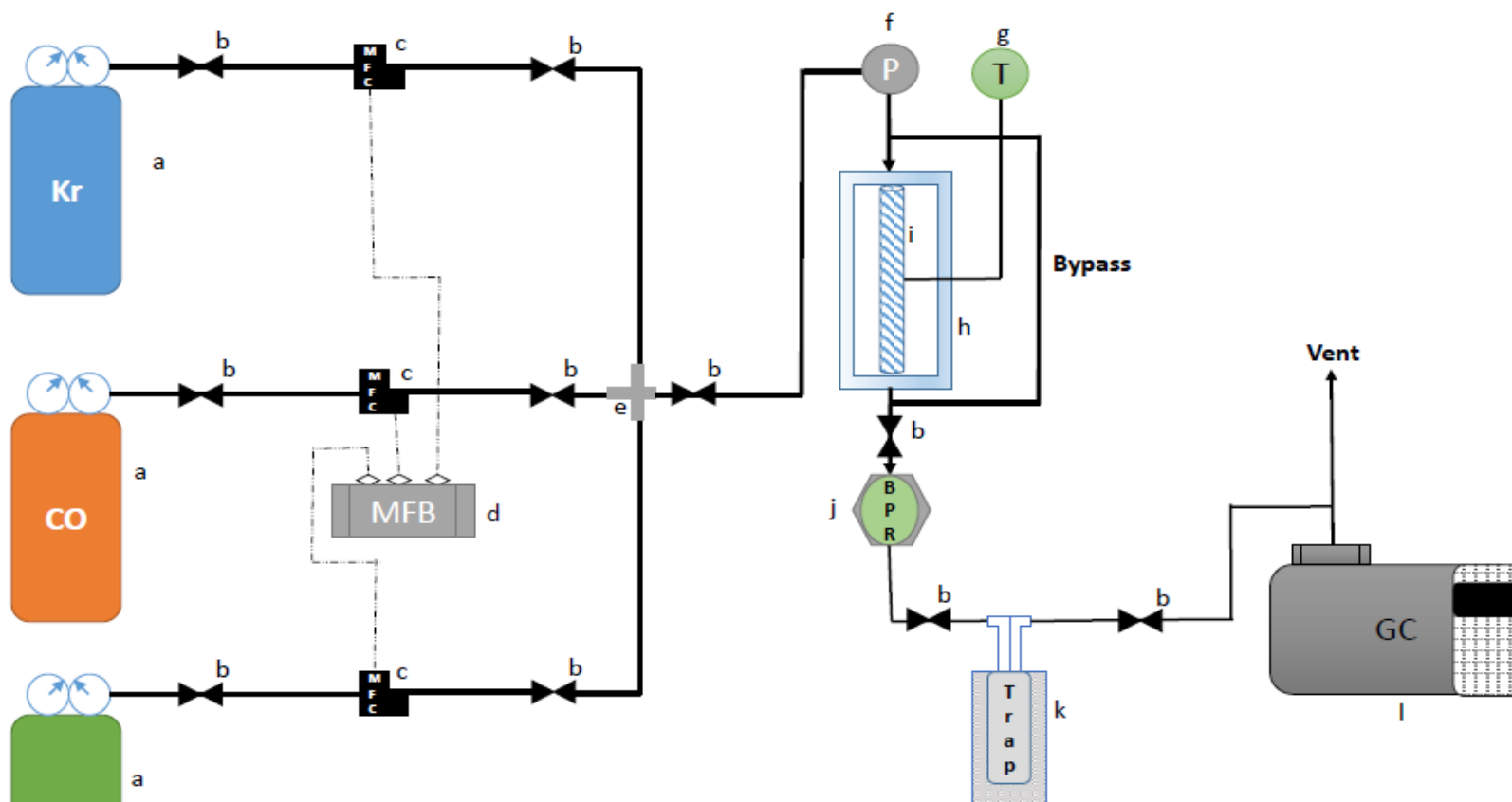
- FT fuels have **high energy content**
- Ensure maximum energy recovery



Objectives

1. Conduct a thorough literature review on FTS
2. Identify possible improvement in FT in terms of operating conditions
3. Design suitable experimental set-up
4. Test experimentally the FTS reaction at specified operating conditions
5. Analyse the results in a well-defined analytical method
6. Make recommendations for the applications of improved FT
7. Investigate applicability of FT fuels in Northern Ireland

Rig Set-up Diagram



a:Gas tanks
 b: on/off valve
 c:Mass flow controller
 d:Mass flow controller box

e:Three way
 f:Pressure gauge
 g:Temperature gauge
 h:furnace

i:Reactor
 j:Back pressure regulator
 k:Trap
 l:Gas Chromatography



Thanks for listening



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Project coordinated by the QUESTOR Centre
at Queen's University Belfast
www.qub.ac.uk/questor