ETP PhD Programme
Scottish Government Policy Priorities
We will provide a brief overview of the research and development priorities across the following areas:

• Heat in Buildings (Craig Frew)

• Large Scale Renewables (Neal Rafferty)

• Hydrogen (Juliet Cramb-Low)

• Industrial Decarbonisation (Stuart Watson)

• Whole System and Grid (Simon Gill)
The Journey to Net Zero - The Scale of the Challenge

• By 2045 all homes and buildings in Scotland must have significantly reduced their energy use, and almost all buildings must be using a zero emissions heating system.
• By 2030 emissions from homes and buildings will have to fall by 68% against 2020 levels. This requires:
  • Significant progress toward all homes reaching EPC C by backstop 2035
  • Reduced emissions intensity of the gas grid by blending green gas to at least 20% volume
  • the vast majority of the 170,000 off-gas homes that currently use fossil fuels switching to zero emissions heat
  • At least 1 million on-gas homes switching to zero emissions alternatives.
  • An estimated 50,000 non-domestic buildings switching to zero emissions alternatives
We need to quickly ramp up installation of low and zero emissions heating systems

- The most cost effective pathway will require **several different approaches**
- Progress in the near-term will rely on tried and tested measures where they are **no or low regrets**
- These are the technological solutions where cost uncertainty is low and we already understand the costs of installation and running costs for consumers.
- Other technologies, such as hydrogen, may develop through the 2020s but are unlikely to play a large part in reducing emissions before 2030
Heat in Buildings – Innovation Challenges

**Heat Pumps**
- Modular/pre-packaging
- Sustainable Refrigerant gasses
- High temperature

**Smart Systems**
- Flexible demand management
- Building integration
- Whole system solutions

**Energy Efficiency**
- Hard to treat building solutions
- Novel installation methods
- Sustainable materials

**Thermal Storage & Distribution**
- Low temperature distribution
- High efficiency storage
- Novel IHW approaches
- Space saving methods

**Heat Networks**
- HIU optimisation/direct HIU systems
- Trenchless technologies
- ‘Radical’ network routing
- Shared civils

**Hydrogen for Heat**
- Domestic appliances
- Skills, maintenance and servicing
- Area suitability and deployment strategies
- Costs and system benefits
Zero Carbon Electricity – Driver of Energy Transition

- Climate Change Plan targets and context – vital need for continued development.
- Onshore and offshore wind essential to deliver emissions reductions across range of sectors, most notably heat, transport and industry.
- Onshore wind:
  - Turbine lighting approaches and effects
  - Radar mitigation
  - Noise impacts
  - Blade recycling
- Offshore wind:
  - Cost reduction (materials, design)
  - Radar
  - Installation and anchoring / mooring systems
- Operability – role of renewables in providing increased system stability and services.
- BECCS and hydrogen
Scotland’s Hydrogen Ambitions

Scotland could grow a strong hydrogen economy supporting jobs and GVA growth – Value can be captured through investing in innovative technology and commitment to infrastructure and strategic development of supply chains and export plans.

Clear strategy with proposed ambitions – clear ambition of 5GW installed hydrogen production capacity by 2030. Action plan will take a twin track approach to developing an indigenous hydrogen economy, that aligns with the needs of a global export market.

Hydrogen needs to be seen within a whole energy system context – Hydrogen will complement increasing electrification, by improving system flexibility and resilience. Some of its benefits will only be understood when looking at the wider system context.

Going beyond the pilot project stage and into commercial scale projects – The next important step is to move beyond the small pilot stage and into large scale commercial projects.
## Hydrogen – Innovation Challenges

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Research/Innovation Need</th>
</tr>
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<tbody>
<tr>
<td>Cost-effective green hydrogen production</td>
<td>• Optimisation of electrolysing systems</td>
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<tr>
<td>Integration of hydrogen into the energy system</td>
<td>• Explore the role of hydrogen as an energy store</td>
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<tr>
<td>The role of hydrogen in hard to decarbonise sectors</td>
<td>• Evaluate the use of hydrogen as a feedstock for green synthetic fuels</td>
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<tr>
<td>Effective, low cost bulk storage of hydrogen</td>
<td>• Optimisation of storage technologies</td>
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<tr>
<td>Efficient, low cost distribution of hydrogen</td>
<td>• Optimisation of distribution technologies and infrastructure</td>
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</tbody>
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Conditional for decarbonising industrial manufacturing

- Fostering Partnership with Scottish EII
- Driving efficiencies
- Learning from, and influencing others
- Incentivising demand for low-carbon products

- Structured engagement
- Energy and material efficiency
- Supply chains
- Circular economy
- Influencing buyer demand
- Regulating energy or emissions
- Trading emissions
- International networks
- Academic networks
- Low-carbon challenge

- NZTM - Skills and capacity
- ITP - Transition Planning
- SIDP - Enabling Infrastructure
- SIETF - Conditions for decarbonising industrial manufacturing
- Market-benefits research
- Hydrogen economy and CCUS
- Sequencing
- Sharing heat or energy networks
- Attracting investment
- SIETF - deeper role
- ITP - hydrogen economy and CCUS
- Academic networks
- International networks
- Academic networks

ID team mission

Framework of policy for creating conditions for decarbonising industrial manufacturing, in Scotland

Thematic of activity

06.04.21
A coherent framework of policy that improves the conditions for energy-intensive industrial (EII) manufacturers to invest in reducing process emissions.

**Primary drivers**

- To reach emissions reductions targets – interim and 2045 net-zero, as described in Scotland’s Climate Change Plan
- To sustain Scottish EII and supply chains therefore avoiding carbon leakage with associated risk to skilled jobs
- To promote opportunities for Scottish industrial manufacturers (or clusters) to decarbonise within an economy undergoing a Just Transition

**Secondary drivers**

- Energy bills reductions for energy-intensive industries
- Invest to decarbonise production lines with varying existing degrees of energy/material efficiency
- Corporate social responsibility. Example: commitment to science-based targets
- Ensure Scottish firms benefit from market-demand for lower-carbon products
- Raising skills/capacity to identify/deliver opportunities
- Fostering long-term partnership to build trust and improve policy delivery opportunities
- Supporting ‘Scottish Net Zero Roadmap’, led by NECCUS
- Repurposing infrastructure
- Carbon management opportunities (export service to others, e.g. Germany)

**Change ideas or policies/proposals**

(* = liaise with UK gov + on traded emissions and regulation)

- Scottish Industrial Energy Transformation Fund (SIETF)*
- Incentivising market benefits of low-carbon Scottish products*
- Net-Zero Transition Managers (NZTM) Scottish Industrial Decarbonisation Partnership (SIDP)
- Supporting consistent and meaningful ‘transition planning’
- Building/updating the evidence base
- Deep Decarbonisation Pathways research
- Ensuring ID is part of delivering the Infrastructure Investment Plan*
- CCUS and Hydrogen economy policy areas*
- SDI and trade opportunities*
Whole System and Grid – Simon Gill

How can zero carbon sources deliver **ancillary services** which support a grid that remains operable?

**How people behave**: the way use new technology is used, how that is influenced, and how that effects the network infrastructure?

**The engineering of the electricity system** in a decade could be more different from today than today is from a century ago? Is this true if so how do we deliver.

**Integrating** heat, transport
And hydrogen

**Energy storage** including batteries and thermal energy storage: use cases

**Big data** to manage big networks

**How to delivery Sustainable Security of Supply?** Stability, fault current, blackstart, response and reserve, reactive power, inertia

Where will **Scotland** need these answers first?

**Transmission network**

**Distribution network**
What will the energy system look like in the future?

1. What will the energy system look like in the future?

2. What interfaces do we need between sectors?

3. How do infrastructure groups, institutions, regulations and market designs interact across the energy system?

4. How do we quantify and define risk across the energy system?

5. How do we design change over time?
Questions