

# Heat Pumping Technology TCP Application to join: Ireland

Sustainable Energy Authority of Ireland

19<sup>th</sup> May 2023

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&

Louise Campion, Programme Manager – International Energy Research

We work with Government, homeowners, business and communities to create a cleaner energy future



# The Role of SEAI

- We are at the heart of delivering Ireland's energy revolution
- We are driving the replacement of fossil fuel usage in all sectors and across society



# SEAI is the contracting party for Ireland's engagement in IEA TCPs

TCP	Number of Tasks
Bioenergy	6
Energy in Buildings and Communities	5
Energy Technology Systems Analysis Programme ETSAP	1
Hybrid and Electric Vehicles	2
International Smart Grid Action Network (ISGAN)	2
Ocean Energy Systems	5
User Centred Energy Systems (USERS)	3
Wind	17
District Heating and Cooling	TBC
Heat Pumping Technologies	TBC (application in process)
Hydrogen	TBC (application in process)

Click [here](#) for further information on Ireland's TCP task/annex participation

# Annual call for expert appointments to IEA TCPs

- SEAI coordinates Ireland's participation in IEA TCPs through an annual, competitive appointment call
- Applications are qualitatively assessed by TCP NCPs based on:
  - Alignment of the Task/Annex with Ireland's national energy & climate priorities and goals (30%)
  - Relevance to the Participants organisations' strategy and to the area of research of the proposed Participants (30%)
  - Relevant experience of the proposed Participants (30%)
  - Quality and adequacy of contribution and dissemination plans (10%)
- Next call for appointments to tasks/annexes will be launched in autumn 2023



**Sustainable Energy Authority of Ireland**

**International Energy Agency Technology Collaboration Programmes**

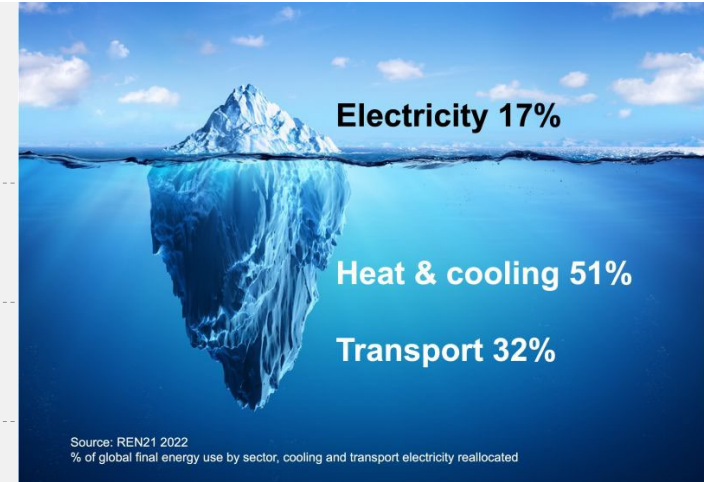
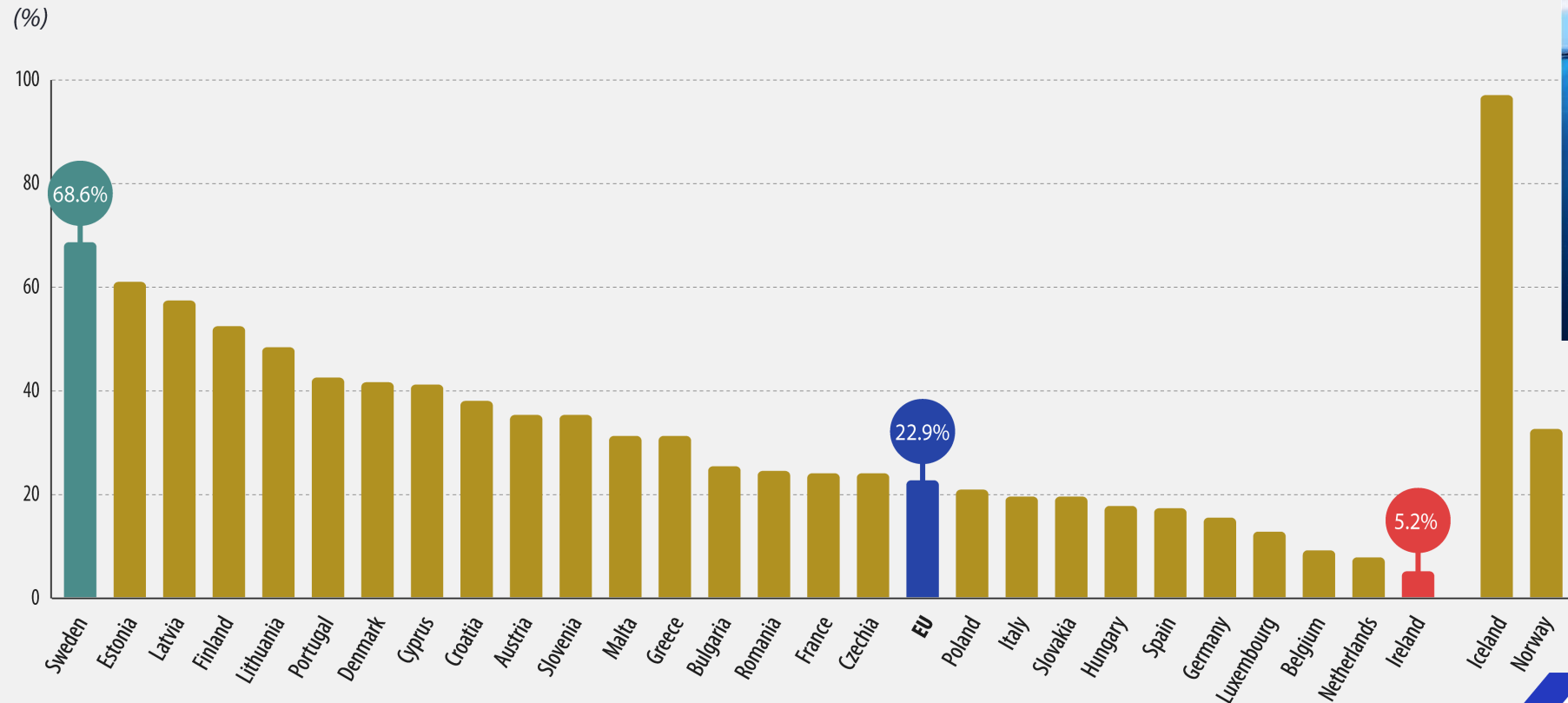
**Task/Annex Participation – Call for Applications**

Key Dates	
Call Open:	December 22 <sup>nd</sup> 2022
Deadline for Application Submission:	February 6 <sup>th</sup> 2023 at 5pm (GMT)

It is the responsibility of each applicant to this call to ensure that they have read and fully understand all documentation associated with this call before making a submission.

# Ireland's share of renewable heat – Last place in Europe

Share of energy from renewable sources for heating and cooling, 2021



**94%**  
Fossil fuels

**24%**  
Of GHG emissions from heat

# EU Context

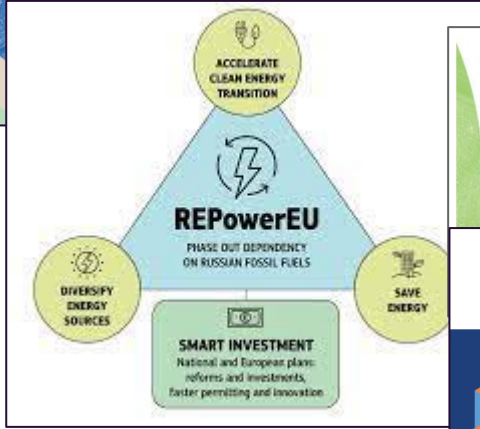
### EU Heat Pump Action Plan

There is an urgency to switch to renewable efficient heating and cooling technologies in buildings, industry, and networks. The 2022 Commission report on the [competitiveness of clean energy technologies](#) indicates that the deployment of all kinds of heat pumps (from single-family houses to large multi-apartment, tertiary buildings and heat network heat pumps to high-temperature heat pumps for industrial applications) is necessary to meet our reinforced climate objectives. However, without a dedicated EU action plan, 22 million old individual heating appliances and several thousand large old fossil-based heating units are at risk of being replaced by fossil boilers.

- 2023 - 28 April: Launch of a call for evidence
- 2023 - June: Launch of a public consultation
- 2023 - Q4: Adoption of the Action Plan

## The European Green Deal

#EUGreenDeal



### Renovation Wave Priorities

Modernisation of heating and cooling

### A EUROPEAN INDUSTRIAL STRATEGY

## A new Industrial Strategy for a globally competitive, green and digital Europe

March 2020 #EUIndustrialStrategy

## FIT FOR 55

A broad legislative package to align existing EU policy with the new emissions reduction goal of 55% by 2030.

### ENER/C1/2018-494 – Renewable Space Heating under the Revised Renewable Energy Directive

# Irish Context

## National Heat Study

Rialtas na hÉireann  
Government of Ireland

## Ireland Renovation Wave

2020

Rialtas na hÉireann  
Government of Ireland

## CLIMATE ACTION PLAN 2023 CAP23

Changing Ireland for the Better

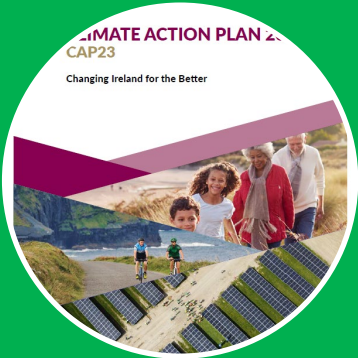
## National Retrofit Plan

Rialtas na hÉireann  
Government of Ireland

# Climate Action Plan (CAP) 2023 – Heat Pump Related Targets

CAP 23 Heat Pump related Ambitions	2025	2030	2050
<b>Heat Pump Installation</b>	45,000 existing dwellings 170,000 new	400,000 existing 280,000 new	
<b>Eliminating fossil fuel heating</b>	<p><i>“To end new gas connections or the installation of new fossil heating systems in new or refurbished buildings. Where heating systems are being upgraded, this should be to non-fossil fuel systems ”</i></p> <p>Switch all buildings to heat pumps or district heating by 2050</p>		
<b>Supply Chain Development</b>	<p><i>“We will continue to drive the development of the supply chain to support the achievement of our heat pump targets so that this technology will become the <b>default solution</b> for householders outside of a district heating network in choosing a new heating system in the coming years”</i></p>		
<b>Skills</b>	<p><i>“Ongoing efforts to <b>scale up and upskill our workforce</b> to meet our climate ambitions for the built environment will require skills in areas such as retrofit, heat pumps, district heating, and solar PV”</i></p>		
<b>Commercial and Public Sector</b>	<p><i>“Technologies such as heat pumps in the residential sector are <b>also suitable for commercial buildings</b>”</i></p>		
<b>Technology and Innovation</b>	<p><i>“Technological innovation will be required across a wide range of areas, including in the ongoing <b>development of heat pump technology</b>”</i></p>		
<b>Electricity Grid Capacity and manufacturing</b>	<p><i>“Investment in our electricity grid capacity and generation will further facilitate up <b>to 3.5 TWh of new industrial heat pumps</b> to provide for the decarbonising of manufacturing processes.”</i></p>		
<b>Industry</b>	<p><i>“Government support is required to <b>reduce high upfront investment costs and improve access</b> to low carbon technologies. These technologies include commercial heat-pumps”</i></p> <p><i>“Low and medium temperature heating can be provided through high efficiency heat pumps powered by renewables.”</i></p>		

# Heat Pumping Technology – where SEAI currently operates



## Policy Support

Delivering key Climate Action Plan targets and identifying opportunities to accelerate deployment of heat pumps in Ireland



## Research, Innovation and Technology Development

Investing in innovative energy development and demonstration projects to accelerate and inform.



## Leading demonstration projects and standards

Primary grant giving body and decarbonisation partner for residents, public sector and businesses,



## Collaboration and Networks

Representing and connecting key international and national stakeholders

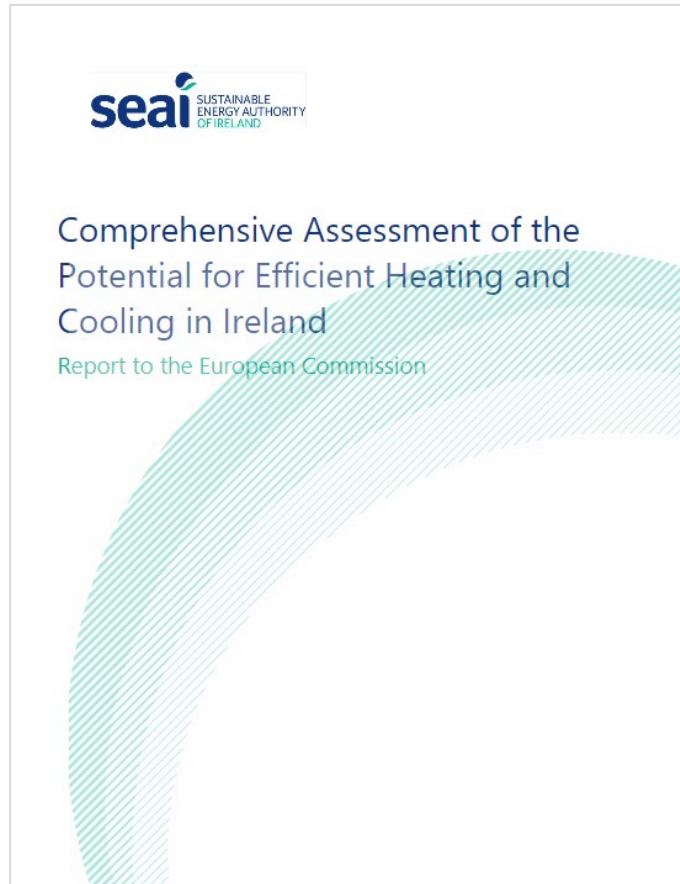


## Heat decarbonisation – national approach

Integrated approach to deployment of heat pumps from a national perspective, building on the National Heat Study

*Support and collaboration*

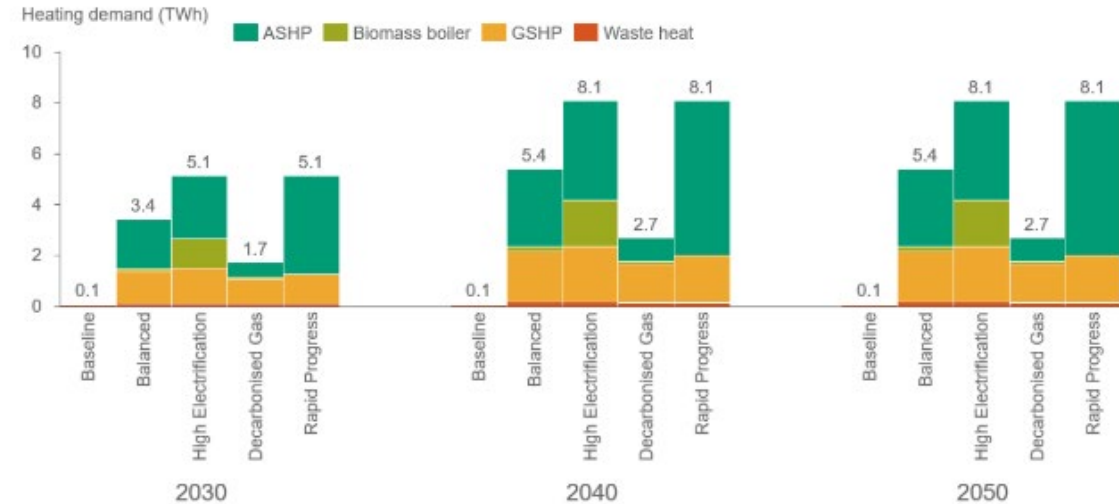
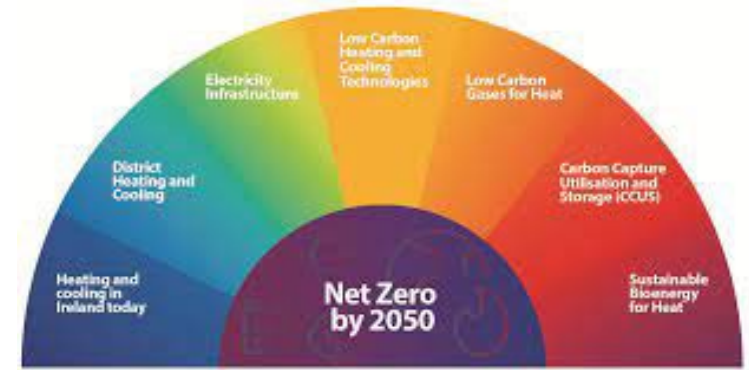
# SEAI National Heat Study 2022



Significant move towards Heat Pumping Technology and District Heating

# SEAI National Heat Study 2022

- **Ireland has abundant potential** for renewables that could be used to electrify heat.
- **District heating and heat pumps** play a significant role in all modelled scenarios.
- **Proven technology** elsewhere-ready to go
- **Efficient district heating** could meet around 50% of heat demand.
- **Heat pumping technology will play a key role**
  - ASHP
  - GSHP (Significant potential of geothermal energy to provide baseload heat identified)

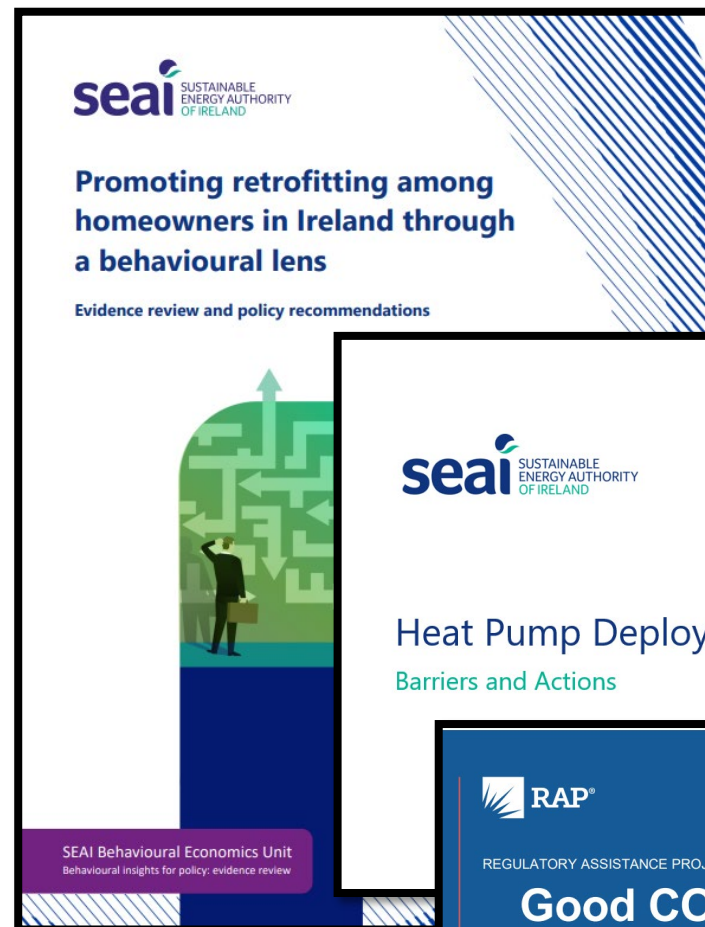


## AIM:

*“Further the ambition and utilise international co-operation to utilise experience and best practise”*

# Policy landscape

- Net-zero energy system by 2050 & a 51% in GHG emissions from 2018 levels by 2030
  - RES-H : 30% renewable heat by 2030
  - 600k heat pumps (retrofit is the challenge)
  - 10% district heating by 2030 (2.7TWh)
  - By 2050 – HP/ DH primarily.
- “Greening the grid”
- Increase in offshore renewable energy to 7GW by 2030
  - Gross theoretical potential of more than 700 GW of offshore renewable energy in Irish maritime area
  - Electrification of heat and district heating utilising renewable/ recovered heat the pathway



# Research landscape

Title	Institution	Funding	Year
MacAirh: Monitoring and Comparing of Air Source Heat pumps	UCD	€663,681	2021
ShallowTHERM	GeoServ	€61,584	2019
Exploration of Air Source Heat Pumps for Ireland's Residential Heating Needs	UCD	€70,290	2018
Exergyn Heat Pump	Exergyn	€126,940	2018
FactHP - In Use Factors for Heat Pumps and other energy technologies in Residential Buildings	LIT	€77,637	2018
DesignForU: Comparison of certified versus operational performance of energy efficient technologies	CIT	€66,218	2018
Methods for improved collector design & completion - Irish Ground Thermal Properties	GeoServ	€49,751	2018
Encouraging heat pump installations in Ireland	SEAI		2020
nZEB_101	UCD	€321,011	2018
<i>Decarbonising heat through electricity: costs, benefits and trade-offs for the Irish power system.</i>	ESRI		2022
HEAT CHECK (Heating and Temperature Characteristics in Irish Buildings)	NUIG	€345,975	2020

## Large Industry Energy Network (LIEN)

The members of LIEN, supported by SEAI, work together to improve their energy performance and inspire others to follow.



196

of Ireland's largest energy users are members of LIEN



140,000

people are employed by LIEN members



18%

of Ireland's Total Primary Energy Requirement is accounted for by LIEN members

The benefits from commissioning the electric boiler are economic for both the company and the local electricity supply chain: it will (1) operate during times of high renewable generation (i.e. when wholesale prices are low); (2) reduce the need for wind generation curtailment (i.e. the wind farms located in the same grid constrained area as Aughinish will operate at higher output levels); and, (3) offer demand response services to the grid operator (reducing the need for peak electricity generation from fossil fuel generators).

### Large scale-up potential within industries with high-pressure steam needs

The project has good potential for further on-site expansion, based on the on-site demand for steam. There is also a large potential for transferring the innovative solution to other sites of the aluminium production company that operates in 13 different countries.

The technology is not associated with any significant resource constraints, making it easily replicable in other industrial sectors requiring high-pressure steam to reduce their reliance on natural gas (e.g. dairy, food, beverage and pharmaceutical). In those sectors in Ireland only, electric boilers operating 33% of the year could save 1.4 million tCO<sub>2</sub> per year.

# High temperature Industrial Applications

**INNOVATION FUND**  
Driving clean innovative technologies towards the market

**AAL SEB: Using flexible electrical demand to facilitate higher levels of renewable energy**

The Innovation Fund is 100% funded by the EU Emissions Trading System

### Project summary

The AAL SEB project aims to partially decarbonise the production of high-pressure steam used in Aughinish Alumina's aluminium refinery, by substituting existing gas-fired boilers with an electric boiler powered during peak renewable production. The project will enable the use of renewable electricity that would otherwise be constrained or curtailed. The 25 MW high pressure electric boiler will replace close to 10% of the current demand for steam at the site and avoid 5% of GHG emissions compared to a conventional technology.

#### COORDINATOR

Aughinish Alumina Ltd

#### LOCATION

Ireland Aughinish Island, Askeaton, Co. Limerick

#### SECTOR

Non-ferrous metals

#### AMOUNT OF INNOVATION FUND GRANT

EUR 4 238 896

#### RELEVANT COSTS

EUR 7 064 827

#### STARTING DATE

01 January 2022

#### PLANNED DATE OF ENTRY INTO OPERATION

Q3 2023

### The choice of electrification over alternative fuels

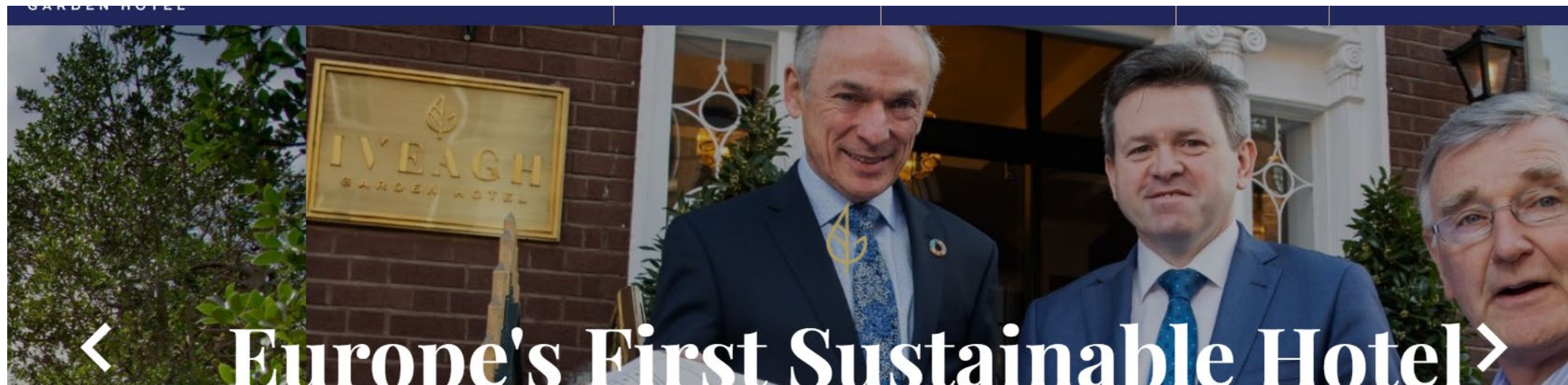
The project will be the first application of a high-pressure electric boiler within an energy intensive industry. Whilst to date the operating limit of electric boilers has been 30Barg<sup>1</sup>, the high pressure and high voltage boiler used in this project will operate at 62Barg. Electrification is the most convenient of all the alternative options for replacing the gas-fired boiler and to produce high-pressure steam. The electric boiler will offer larger power capacity than current hydrogen-based technologies, will not rely on raw material availability that usually constrains bio-methane and will avoid the logistical challenges of biomass.

The plant's constant steam demand will be guaranteed by using already proven smart controls, enabling the interaction of the electric boilers (operated by a non-constant supply of renewable energy) with the existing CHP steam generation.

### Supporting larger renewable penetration through dispatchable demand

The AAL SEB project will deliver zero-carbon heat, representing close to 10% of the current demand for steam of the alumina plant, thereby avoiding 5% of GHG emissions.

# Supports for businesses to invest in energy efficiency and renewable heating.



## Hotel supported by SEAI to retrofit and decarbonize its heat

Ground source heat pump  
Advanced heat recovery technology

- Energy use decreased by 78%
- Carbon footprint decreased by 82%
- Building Energy Rating improved E1 – A3

## EXEED Process – Energy Efficiency and Excellence in Design

- Provides support to over 200 companies — equating to a total committed support of €15.6 million.
- 190GWh in primary energy savings, 34.7 ktCO2 savings and €8.5 million in annual cost savings.
- The programme has engaged with a variety of sectors including pharmaceuticals, food and drink, retail, hospitality, agriculture, mining/quarrying and manufacturing

## SSRH – Support Scheme for Renewable Heat >€500, 000 for HP projects

- 40% of costs to install
- Includes support for heat pumps utilising waste heat sources, high temperature applications, and opening support to the wider application of heat pumps in buildings and district heating schemes;
- Support for additional upgrade measures in buildings to facilitate the installation of heat pumps.

# Public sector supports



## Public sector programme

- Energy management & Leadership engagement
- Strategic planning & project pipelines
- Monitoring Performance

## • Pathfinder programme

- €33m in 2022, Similar 2023, More in 2024
- Accelerate building retrofits – High BER, decarbonised heating solutions
- Prime / mobilise large scale approaches

## EU and public sector targets –2020/2050

2020	2030	2050
<ul style="list-style-type: none"> <li>- 20% GHG Emissions</li> <li>+20% renewable energy</li> <li>+20% energy efficiency</li> </ul>	<ul style="list-style-type: none"> <li>- 55% GHG Emissions</li> <li>+32% renewable energy</li> <li>+32.5% energy efficiency</li> <li>Recast EED – 1.7% kWh, 3% area to nearly zero annually</li> <li>Recast EPBD – minimum BER ratings (to be rescaled)</li> <li>Recast RED – what is renewable</li> </ul>	<p>Climate neutral </p>
2020	2030	2050
<ul style="list-style-type: none"> <li>+ 33 % energy efficiency performance improvement</li> </ul>	<ul style="list-style-type: none"> <li>+ 50% energy efficiency</li> <li>- 51% GHG Emissions (absolute)</li> <li>+ 50% space heating to be renewable</li> <li>'B' Rating ambition</li> </ul>	<p>Net zero emissions </p>

## Creating positive impact

The programme's impact can be felt across the public, public sector, industry, academia, and the non-domestic supply chain. They include:



Reduced energy and CO2 emissions



Increased comfort and indoor air quality



Enhanced understanding of retrofit solutions



Upskilling professionals and contractors in retrofit



Peer-to-peer best practice exchange



Lessons learned through pioneering approaches



Strategic plans which scale ambition



Testing innovative procurement and finance

# District Heating Example using Waste Heat

- 1<sup>st</sup> in Ireland utilising waste heat
- Waste heat from the local Amazon data centre will be upgraded by a 3MW heat pump
- Heat supplied to 32,500 sq m of new and existing Council buildings, library and the university campus.
- Next phase – residential customers
- 1500tonnes equivalent CO2 saved per annum



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Climate Crisis

## Excess heat from Dublin data centre to warm local buildings in first for Ireland

Network to be extended to local apartments and houses in coming years

Expand

Minister for Climate Eamon Ryan with South Dublin County Council mayor Cllr Emma Murphy marking the opening of Tallaght District Heating Network. Photo: Rian Ryan

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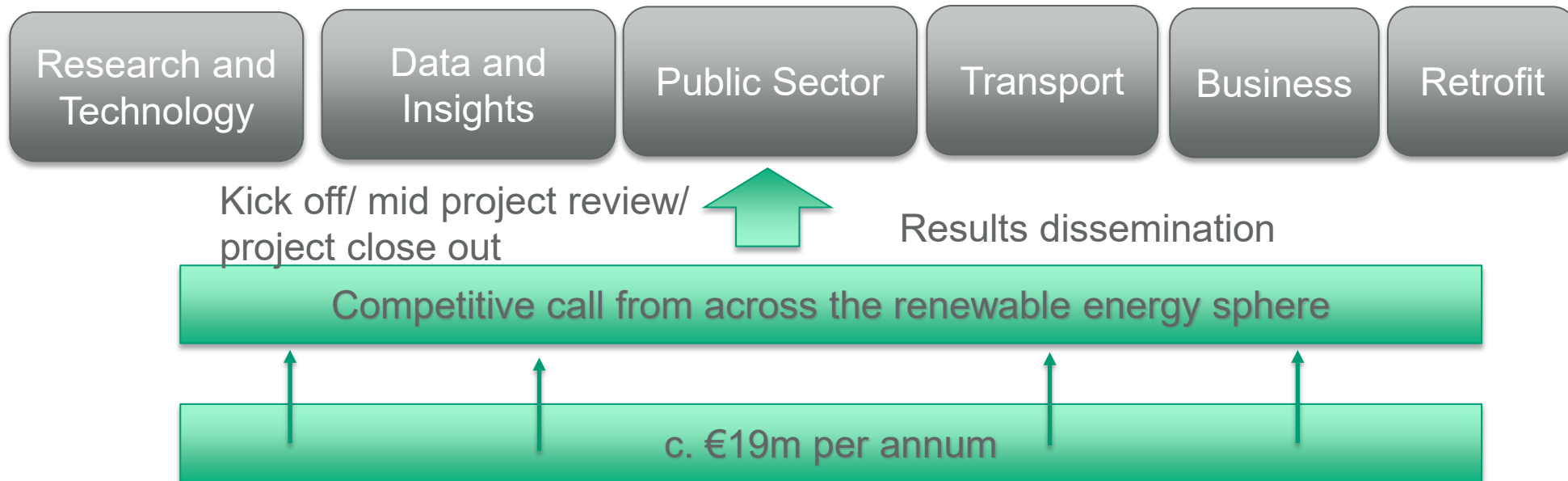
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Funded by the European Union's NWE Interreg HeatNet programme/ climate action fund/ south Dublin county council

# Tasks of interest to Ireland in Heat Pumping TCP

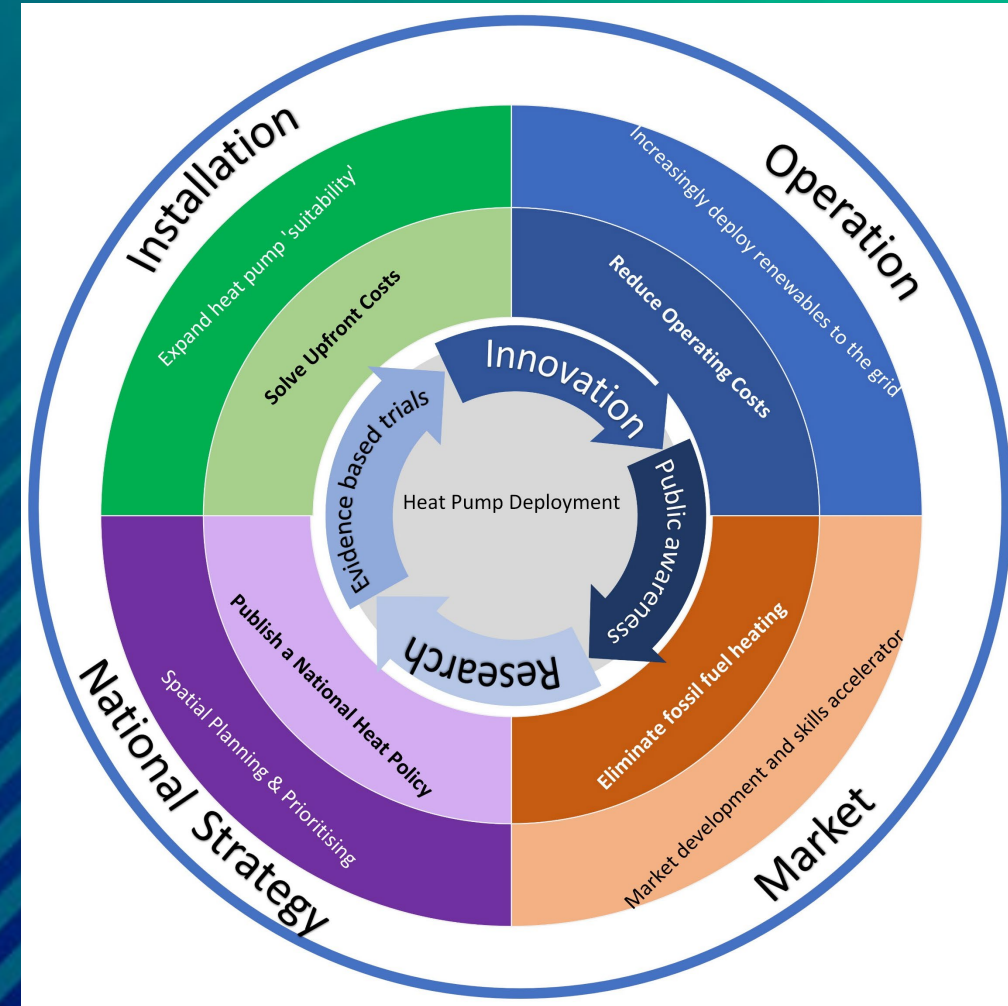
<b>Annex 58</b>	<u>High-Temperature Heat Pumps</u>
<b>Annex 60</b>	<u>Retrofitting Heat Pump Systems in Large Non-domestic Buildings</u>

## SEAI National Annual Energy Research Call



*SEAI uniquely positioned to facilitate collaboration and dissemination of research activities to inform and accelerate the energy transition*

Heat pumping technologies will play a significant role in the decarbonisation of heat across all sectors in Ireland, and access to leading, transdisciplinary research will uniquely place us to leap ahead from heat laggards to heat champions



# Thank you for your attention.

# Questions.

