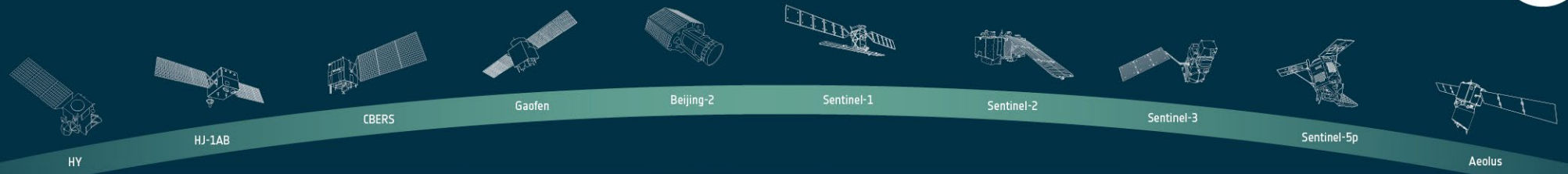


2022 DRAGON 5 SYMPOSIUM

MID-TERM RESULTS REPORTING

17-21 OCTOBER 2022

[PROJECT ID.58894]

[SEISMIC DEFORMATION MONITORING AND ELECTROMAGNETISM ANOMALY DETECTION BY BIG SATELLITE DATA ANALYTICS WITH PARALLEL COMPUTING (SMEAC)]

< Tuesday, 18/Oct/2022>

ID. 58894

PROJECT TITLE: ASSESSING EFFECT OF CARBON EMISSION REDUCTION WITH INTEGRATING RENEWABLE ENERGY IN URBAN RANGE ENERGY GENERATION SYSTEMS

PRINCIPAL INVESTIGATORS: [PROF MINGJUN HUANG, PROF XINGYING ZHANG]

CO-AUTHORS: [PROF NEIL HEWITT]

PRESENTED BY: [PROF MINGJUN HUANG]

Dragon 5 Mid-term Results Reporting

- The objectives
- Detail the Copernicus Sentinels, ESA, Chinese and ESA Third Party Mission data utilised after 2 years
- The progressed results after 2 years of activity
  - ✓ Predicting the Swarm data with the application of DL techniques
  - ✓ Investigating the longest period of time for which we are able to predict the Swarm data
  - ✓ Studying the data framing impact on predicting the Swarm data
  - ✓ Applying two conventional machine learning techniques to detect anomalies from the predicted Swarm data
- The project's schedule, planning & contribution of the partners for the following year
- Report on the level and training of young scientists on the project achievements, including plans for academic exchanges

Background: objectives

- Assess and select flux inversion systems for the project,
  - ✓ transport model used, spatial and temporal flux resolution, prior fluxes, etc. and
  - ✓ adopt two inversion modelling systems of CTE2016-FT (van der Laan-Luijkx et al., 2017) and ACTM-IEA (Saeki and Patra, 2017)
- Analyse the total renewable energy development trend in quarter and annual based Develop retrieve algorithms of CO_2 from satellite and combined measurements
  - ✓ based on 11 year renewable energy data from 2008 to 2020 cross the UK, including Wind, Shoreline wave / tidal, Solar PV, Hydro, etc
- Select CO2 retrieval algorithms from existing ones, such as from NIES v02 (the National Institute for Environmental Studies, Japan), ACOS B2.10a (the NASA Atmospheric CO2 Observations from Space), UoL-FP v3Gb (University of Leicester) and so forth
- Apply them and the IAPCAS algorithm developed to obtain XCO2 emission from measurements by GOSAT and TanSat satellites to estimate CO2 emission in the UK and regions in China.
- Provide policy makers with the evidence of CO2 reduction over regions that have integrated REs as energy suppliers.

Study Areas in the UK and China

EO Data Delivery

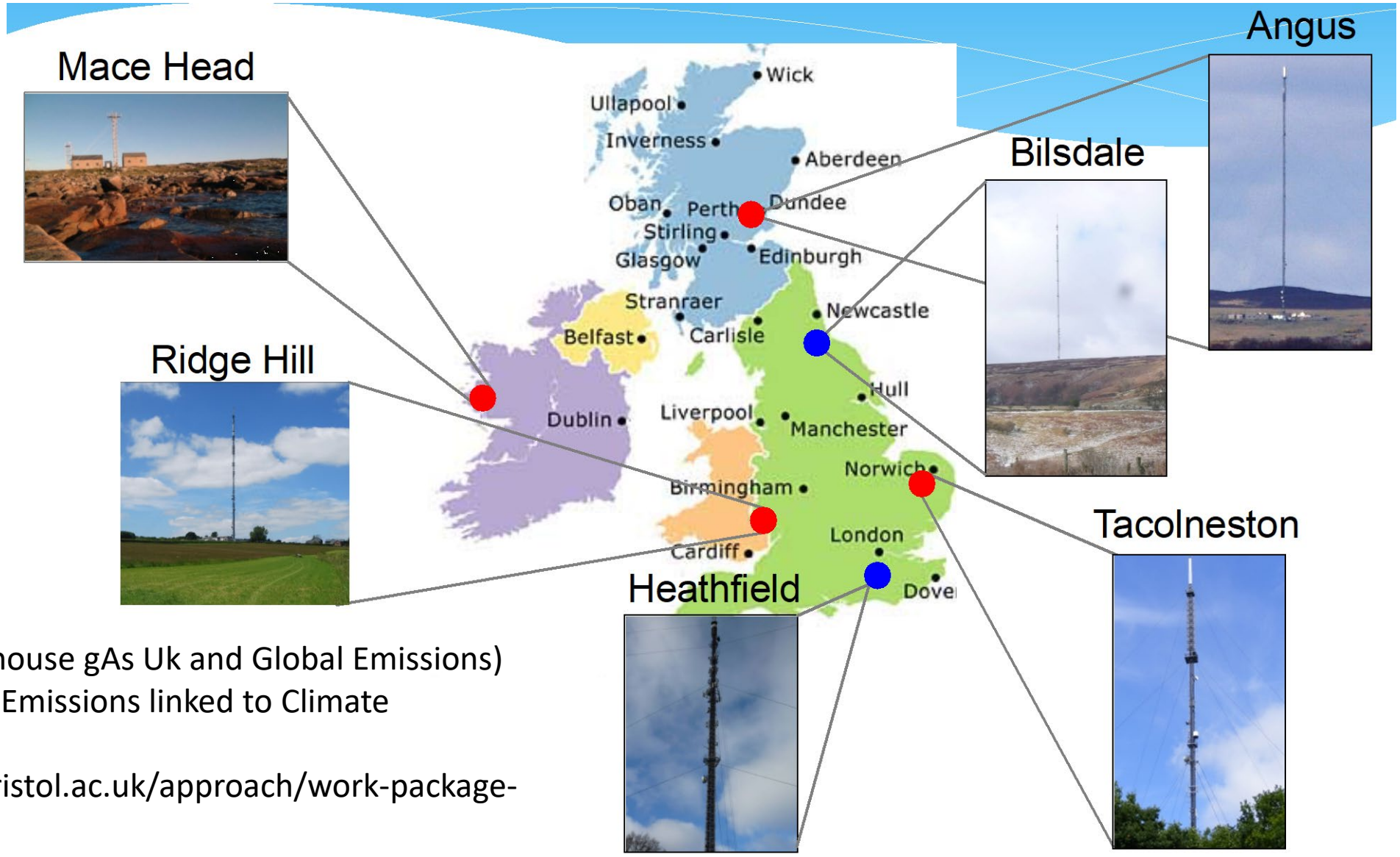
Data access (list all missions and issues if any). NB. in the tables please insert cumulative figures (since July 2020) for no. of scenes of high bit rate data (e.g. S1 100 scenes). If data delivery is low bit rate by ftp, insert “ftp”

ESA Third Party Missions	No. Scenes
1. GOSAT, OCO2	
2.	
3.	
4.	
5.	
6.	
Total:	
Issues:	

ESA Third Party Missions	No. Scenes
1.Sentinel-5P Tropomi L1B, L2	
2. Sentinel-4 (O3, NO2, SO2, HCHO)	
3. Sentinel (aerosol optical depth)	
4. . Sentinel-5 UV-VIS-NIR-SWIR L1B, L2	
5.	
6.	
Total:	
Issues:	

Chinese EO data	No. Scenes
1. TanSat	
2.	
3.	
4.	
5.	
6.	
Total:	
Issues:	

DECC & GAUGE Tall Tower Network (in-situ)



GAUGE project (Greenhouse gAs Uk and Global Emissions)
The UK DECC (Deriving Emissions linked to Climate Change) Network
https://dareuk.blogs.bristol.ac.uk/approach/work-package-2/

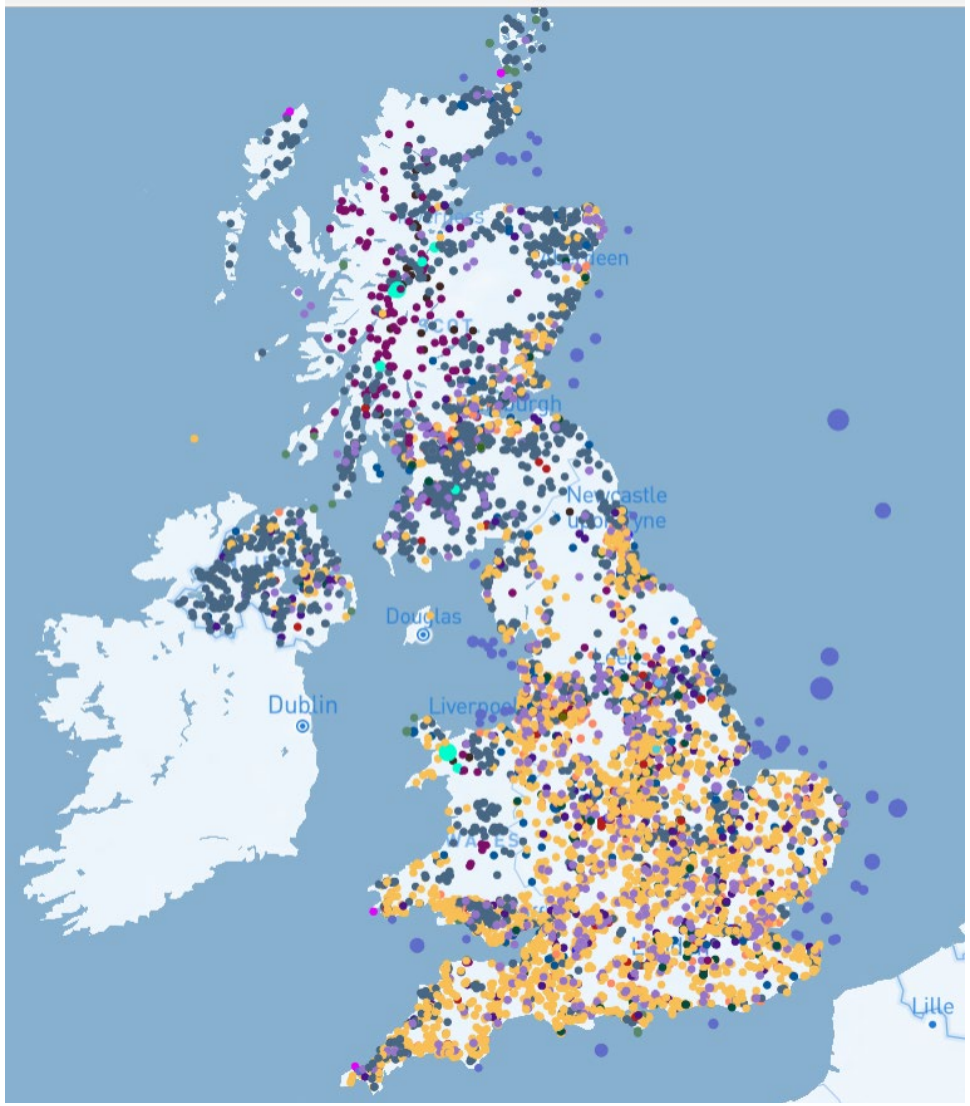
European Young scientists contributions in Dragon 5

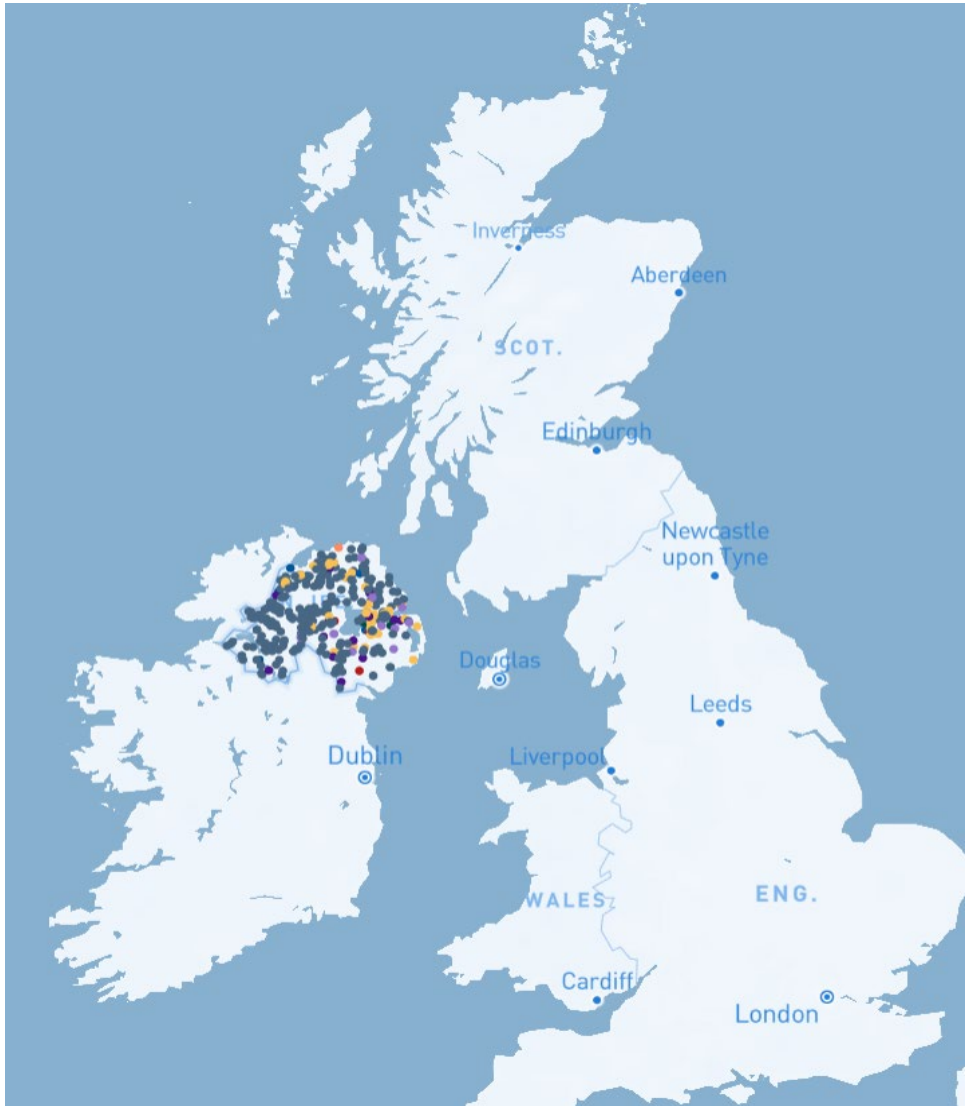
Name	Institution	Poster title	Contribution
Mr Muhammad Abid	Ulster University		
Mr Ajay Nail	Ulster University		

Chinese Young scientists contributions in Dragon 5

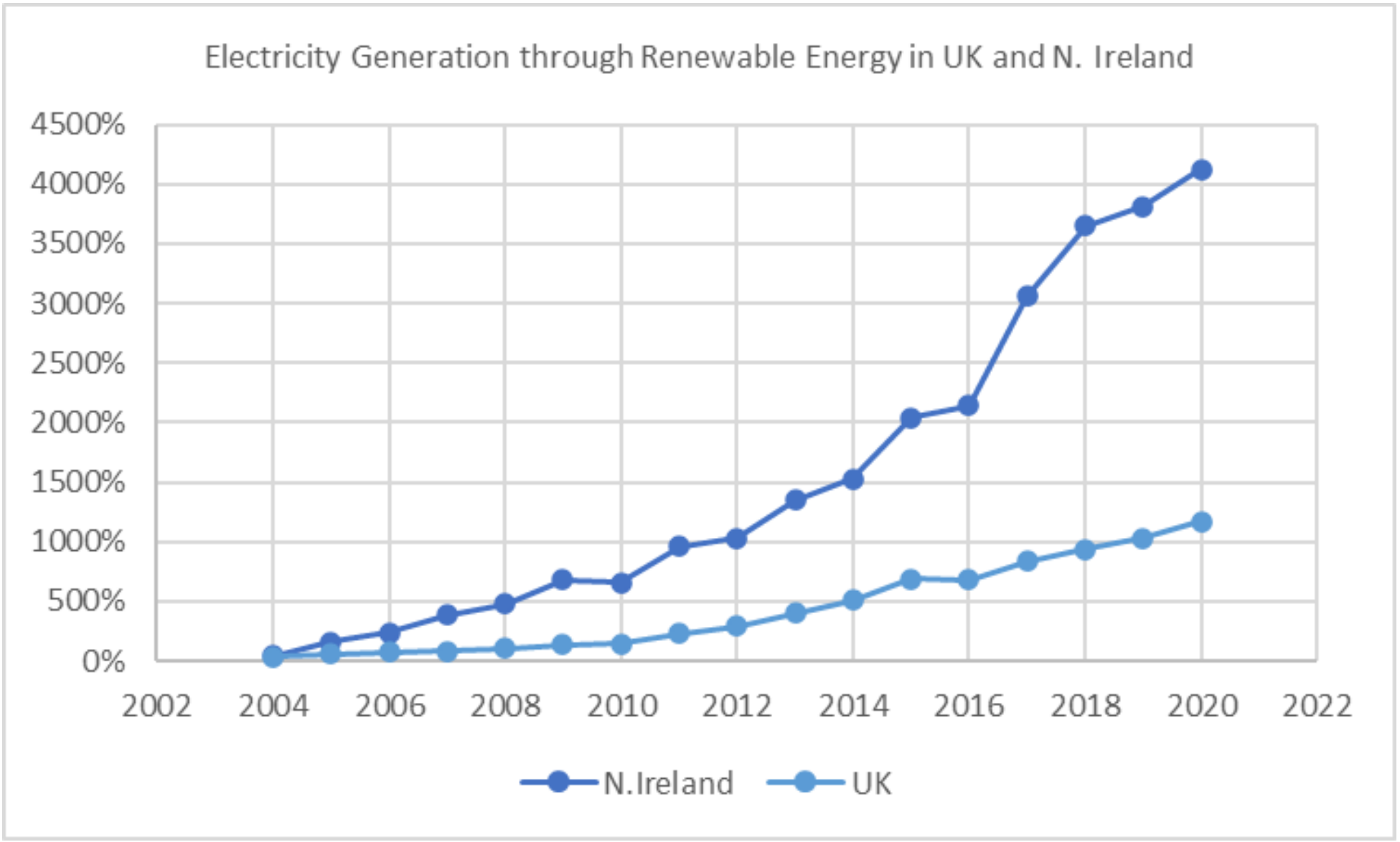
Name	Institution	Poster title	Contribution
Dr. Shupeng Wang	National Satellite Meteorological Centre, China Meteorological Administration		
Dr. Fu Wang	National Satellite Meteorological Centre, China Meteorological Administration		
Mr. Seng Yang	National Satellite Meteorological Centre, China Meteorological Administration		

Renewable energy sites on the UK and N. Ireland

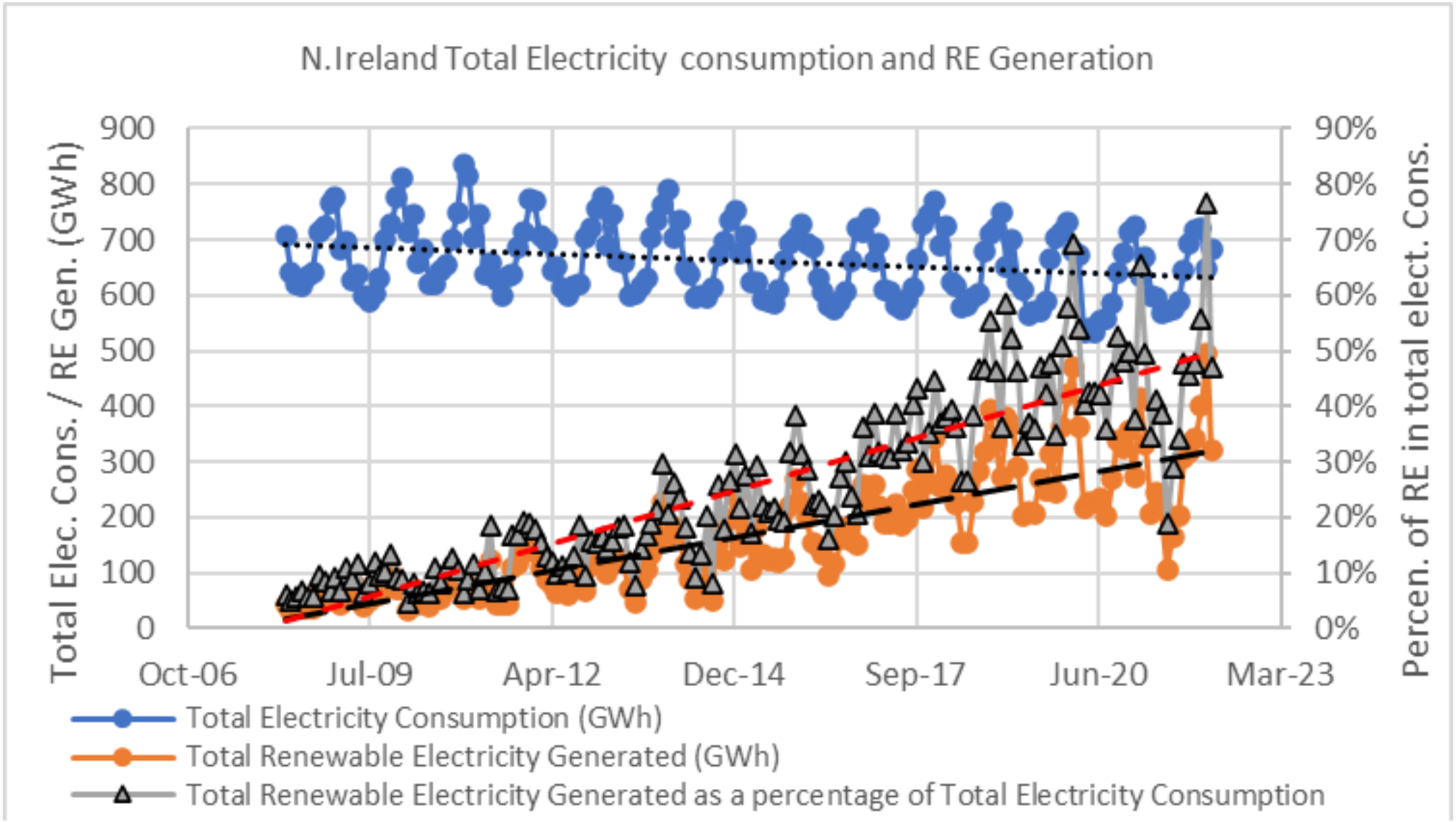




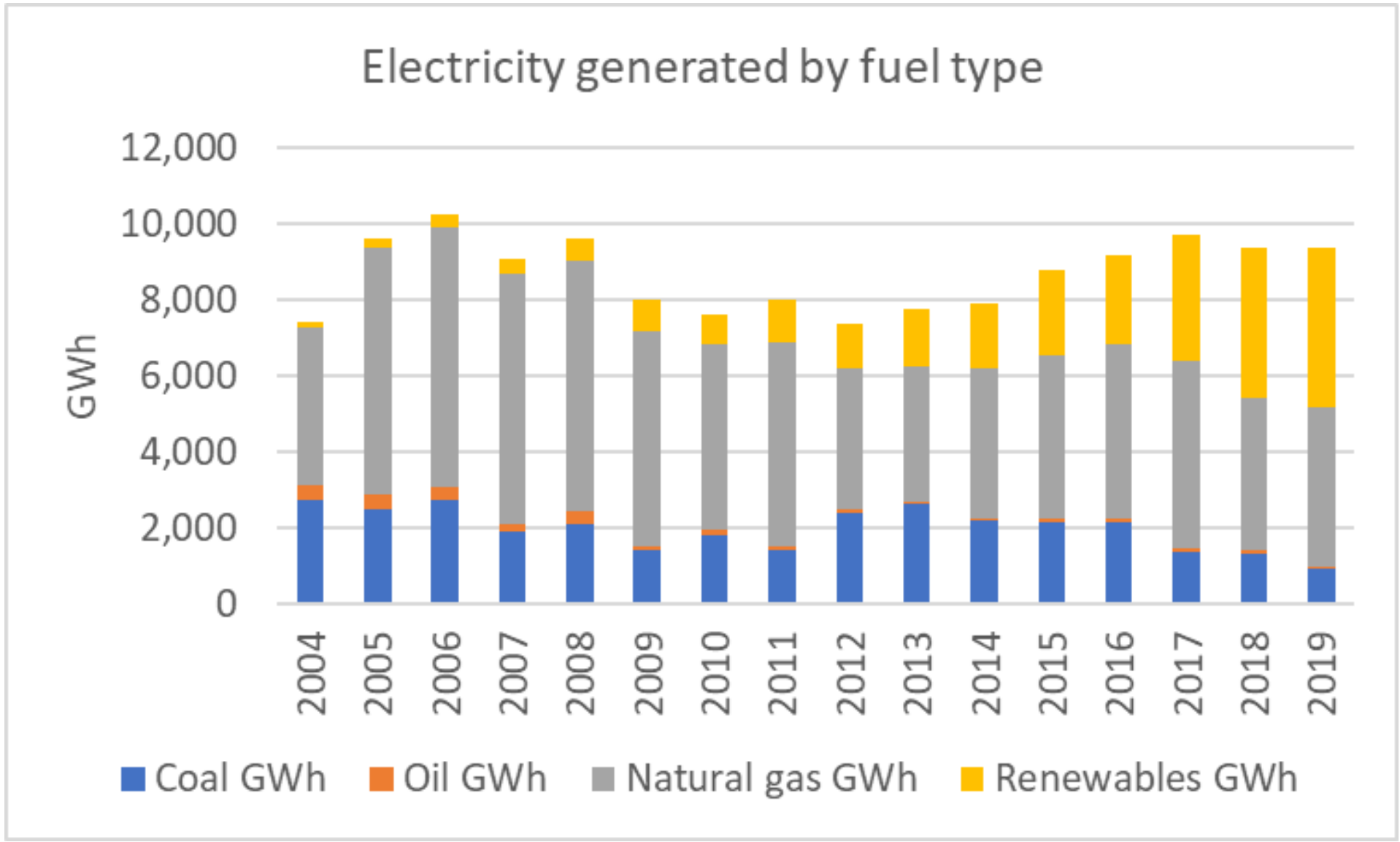
Electricity generation by the renewable energy increasing in the UK and N. Ireland



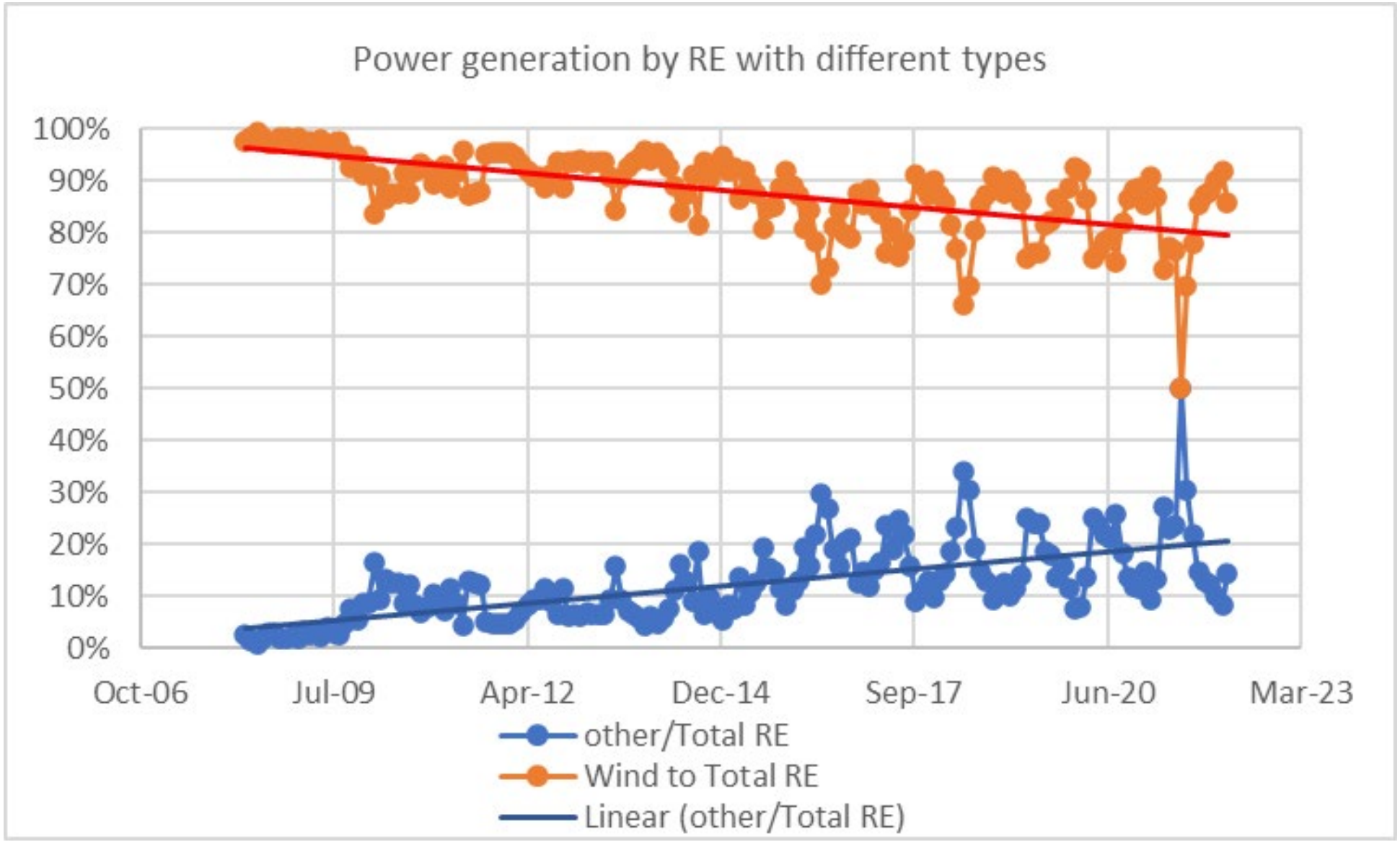
Total electricity consumption and generated by renewable energy monthly in N. Ireland



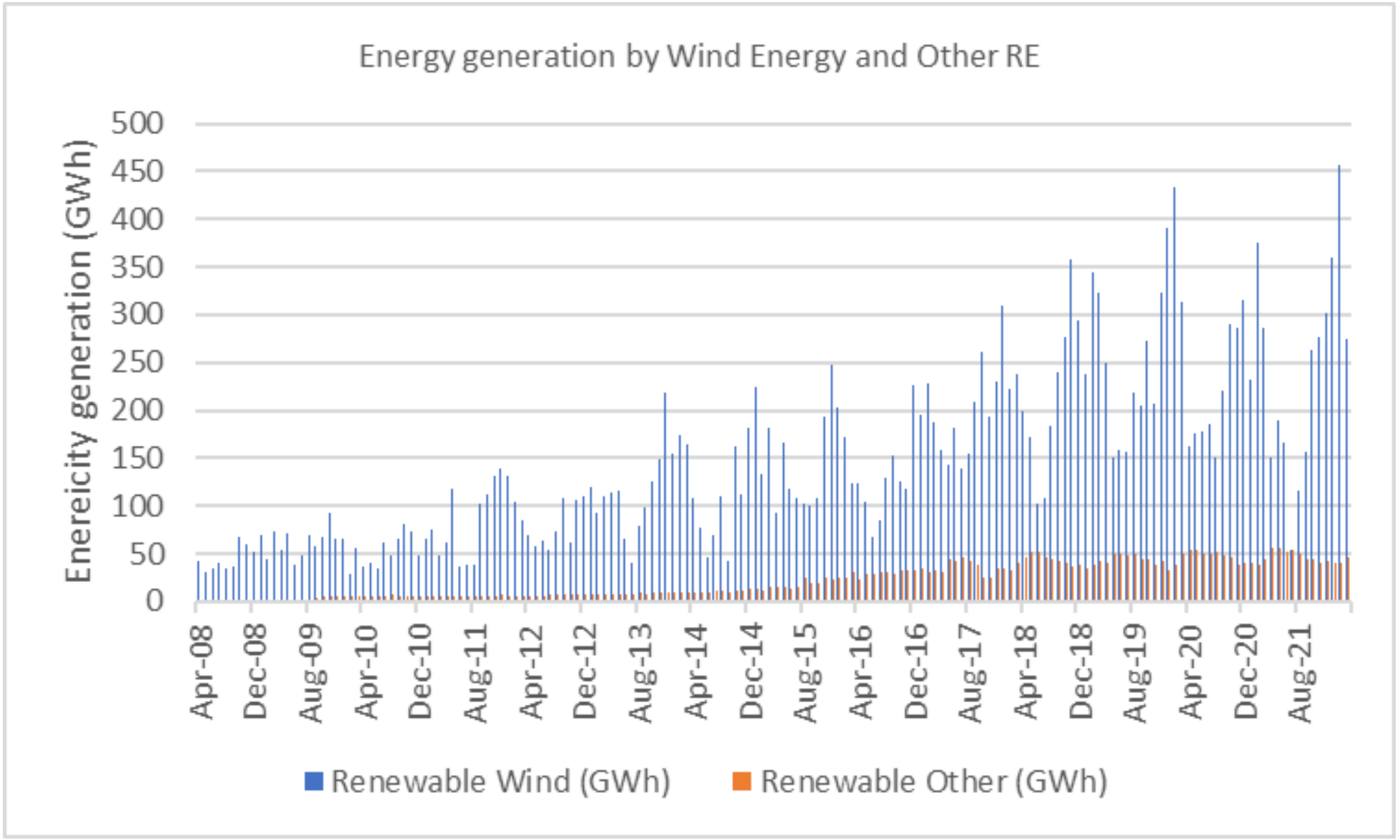
Electricity generation in each year from different resources in the N. Ireland since 2004



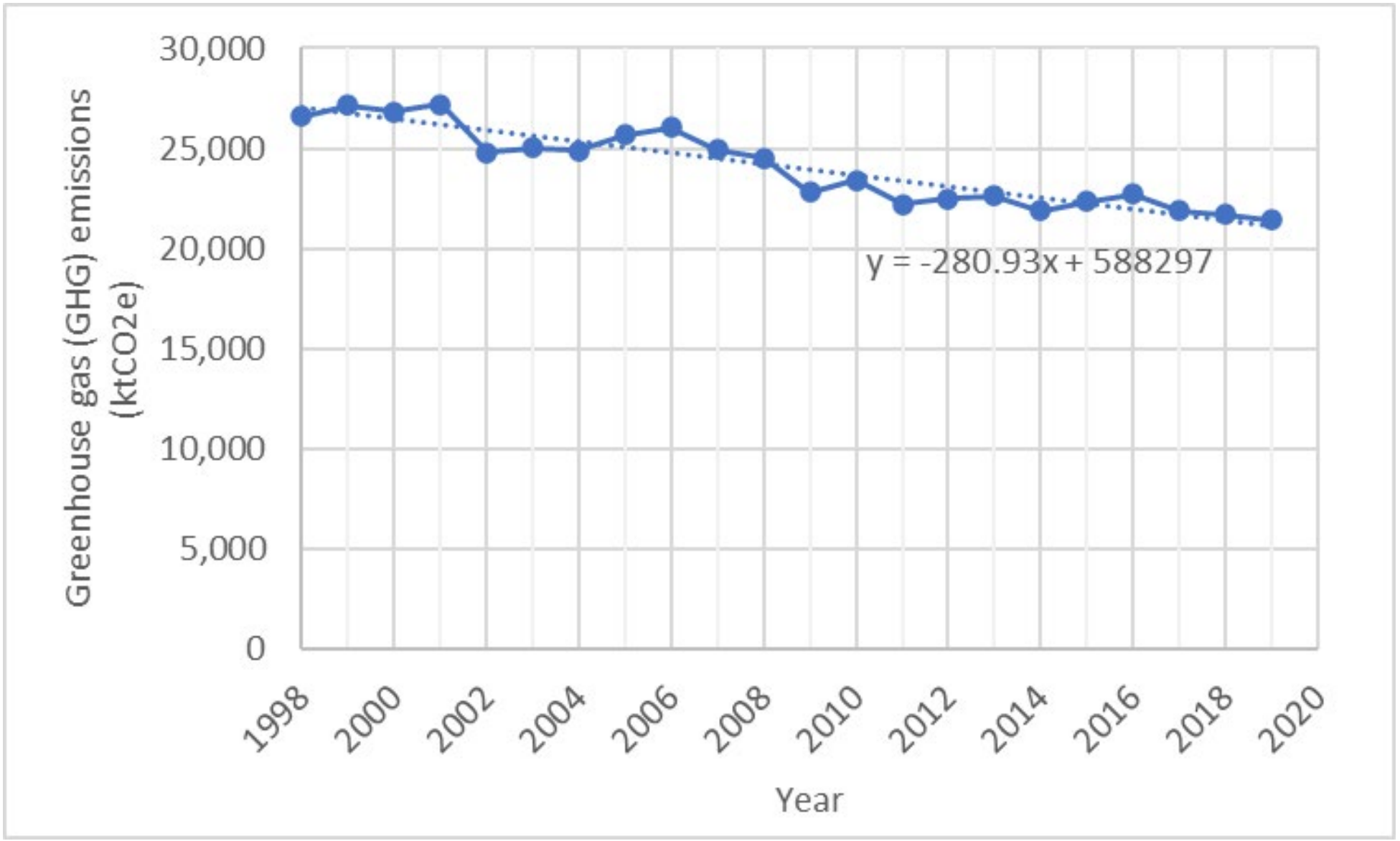
The distribution of the power generated through the Wind and other Renewable Energy



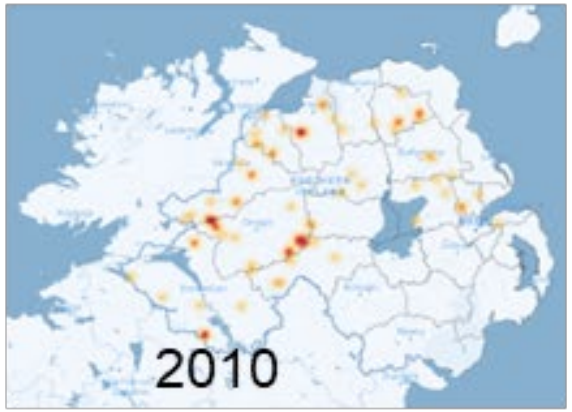
Comparison of the electricity generated by the Wind and other Renewable Energy

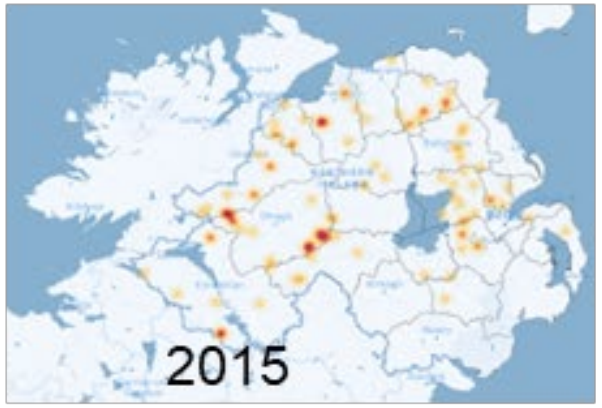


CO2 emission reduction throughout years in N. Ireland

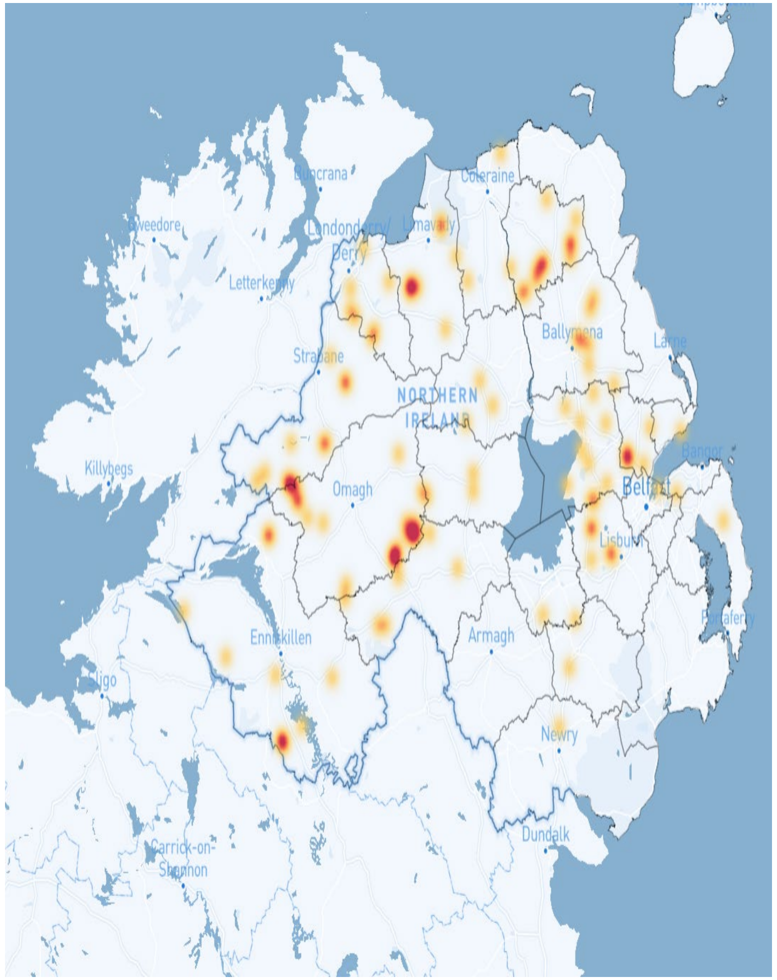


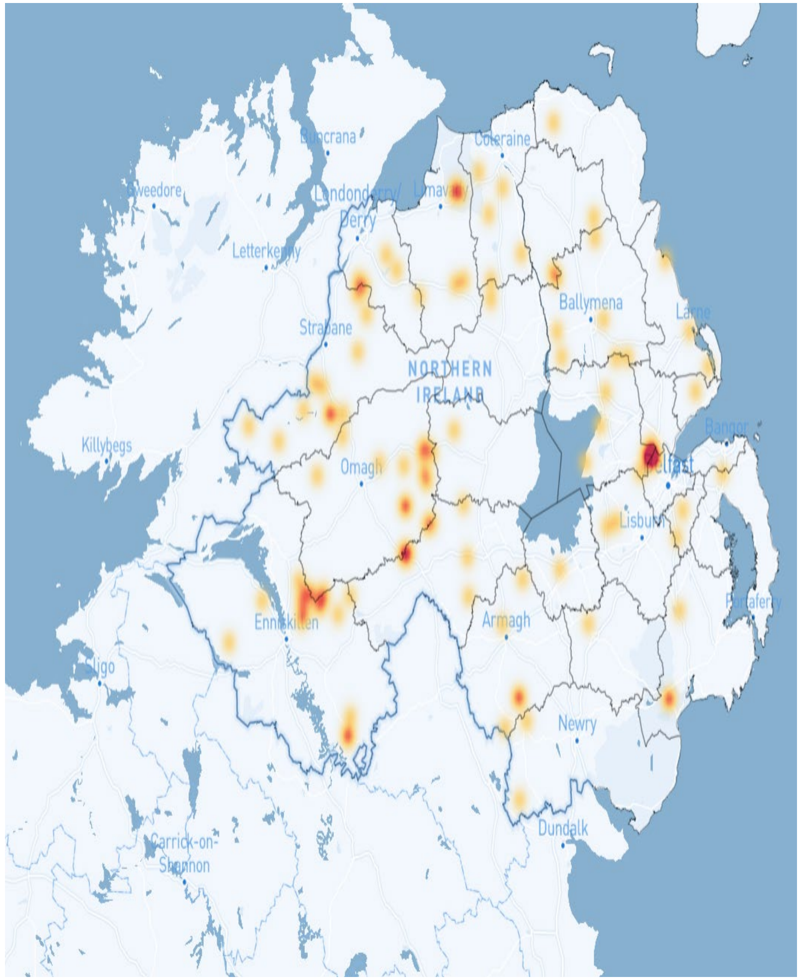
Renewable energy applications since 1990 to 2021 with total capacity up to 48MW

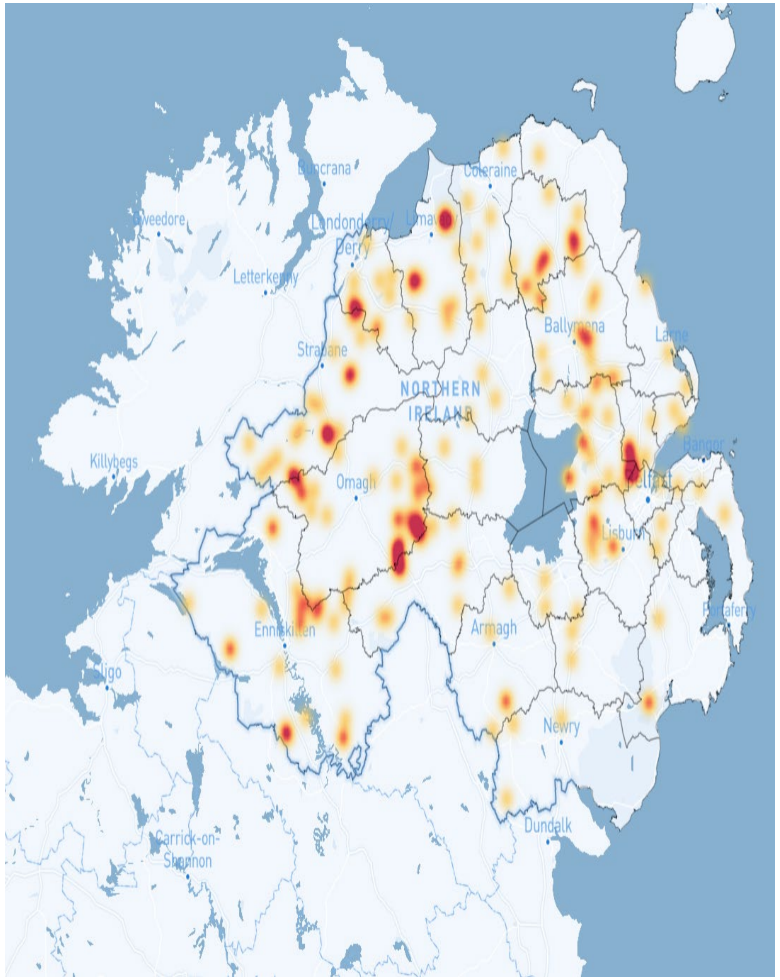




Operational and waiting construction renewable energy sites in N. Ireland







Application locations with the different type of renewable energy

Anaerobic

Biomass(dedicated)

Landfill gas

Solar Photovoltaic

Wind onshore

Results and discussions

- The study has found that the total emissions 22 MtCO2e in 2013 across the NI was approximately 4% of the total greenhouse gas emissions in the UK, however NI accounts for 2.8% of the UK population and 2.1% of the UK GDP, hence it was concluded that the total emission of NI was more than the rest of the UK.
- The further results show that the NI has relatively high percentages per capita emission in the agricultural, transportation, residential, LULUCF (land use, land use change, and forestry) and power sector.
- The commitments set in Energy Strategy ‘Path to Net Zero Energy’ for Northern Ireland is to meet 70% of electricity generation from diverse renewable sources by 2030.

Results and discussions (cont'd)

- The study details the percentage of electricity generated in the NI from renewable sources as well as information about the types of these renewable sources.
- A further study will be conducted on the relationship between the CO2 emission reduction with the power generated by renewable energy with different types of renewable energy in the NI, possible approaches of capturing CO2 emission by GHGSat.

Planning and achievements

- The project's progress has been slightly delayed due to the recruitment of a new young scientist
- The recruitment of a new young scientist is on way
- Planning for next year
  - ✓Develop XCO2 retrieval algorithms along with simulation of the radiance transfer in atmosphere.
  - ✓Investigate the relationship between the CO2 emission reduction
- Mutual academic exchanges have been planned, which is subject to the restriction policy of Covid-19 in China

Thanks for your attention!