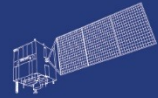


HY



HJ-1AB



CBERS



Gaofen



Beijing-2



Sentinel-1



Sentinel-2



Sentinel-3



Sentinel-5p



Aeolus

2023 DRAGON 5 SYMPOSIUM
3rd YEAR RESULTS REPORTING
11-15 SEPTEMBER 2023

[PROJECT ID. 58894]
ASSESSING EFFECT OF CARBON EMISSION
REDUCTION WITH INTEGRATING RENEWABLE
ENERGY IN URBAN RANGE ENERGY
GENERATION SYSTEMS

< Wednesday, 13/Sep/2023 >

ID. 58894

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

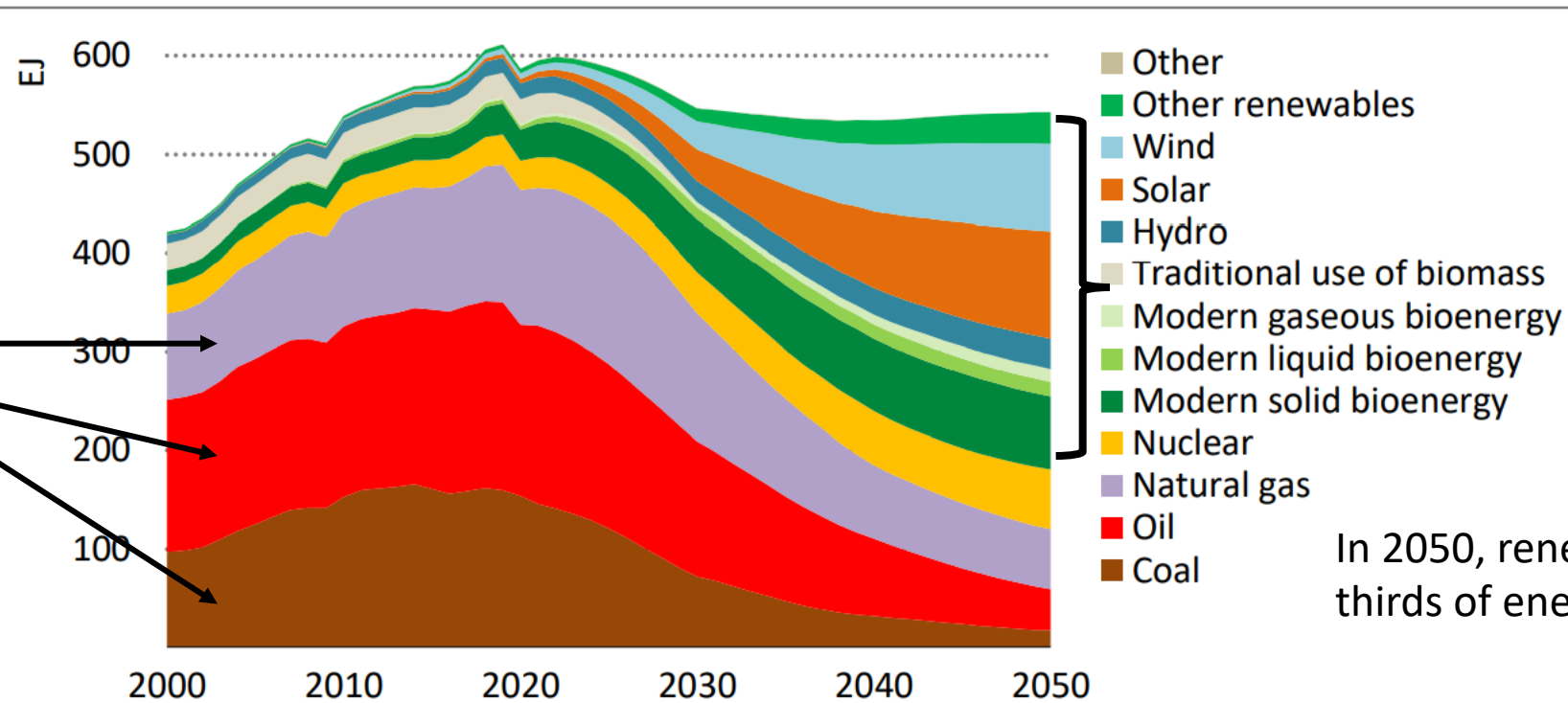
**PRINCIPAL INVESTIGATORS: PROF MINGJUN HUANG, PROF XINGYING ZHANG
UNIVERSITY OF ULSTER, UK; NATIONAL SATELLITE METEOROLOGICAL CENTER, CHINA**

CO-AUTHORS: NEIL HEWITT, Xingying Zhang, Lu Zhang

PRESENTED BY: PROF MINGJUN HUANG

- The objectives
- Detail the Copernicus Sentinels, ESA, Chinese and ESA Third Party Mission data utilised after 3 years
- The progressed results after 3 years of activity
- The planning and achievements
- Report on the training of YS/ academic exchanges

natural gas 23%
oil provided 30%
coal supplied 26%



In 2050, renewables provide two-thirds of energy use

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Renewables and nuclear power displace most fossil fuel use in the NZE, and the share of fossil fuels falls from 80% in 2020 to just over 20% in 2050

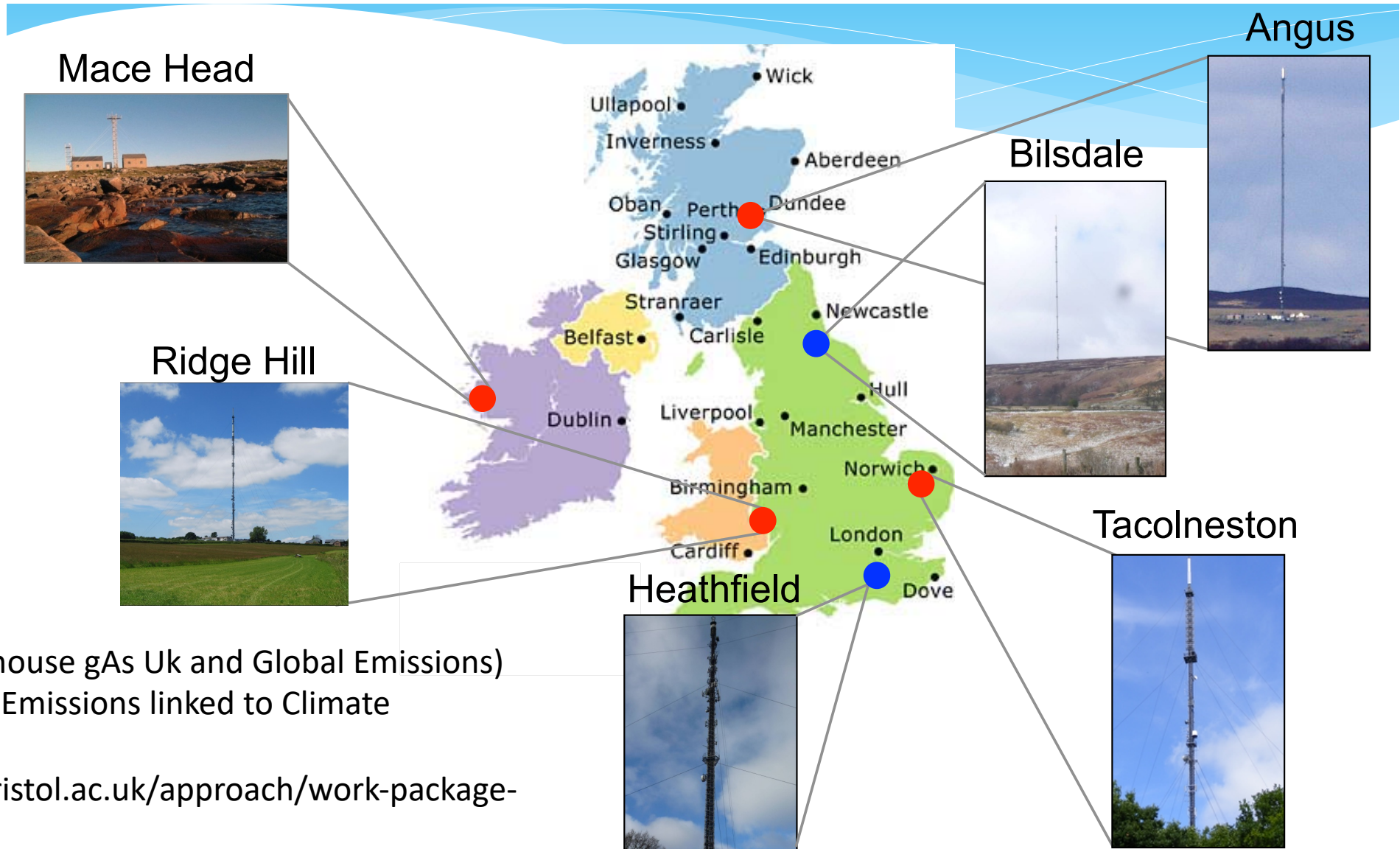
SO, WHAT'S THE PLAN?

- Tasks for the UK to meet the CO₂ emission reduction is Net-Zero by 2050.*
- Sustainability Energy***
- *Identify a suitable method of modelling the CO₂ reduction accurately from satellites with*
 - *Identify effect of different types of Renewable Energy Implementation in Urban area through the EO*

- Assess and select flux inversion systems for the project,
 - ✓ transport model used, spatial and temporal flux resolution, prior fluxes, etc. and
- Analyse the total renewable energy development trend in quarter and annual based
 - ✓ such as on 11 year renewable energy data from 2008 to 2020 (~2023) 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)
- Apply them and the IAPCAS algorithm developed to obtain XCO₂ emission from measurements by GOSAT, TanSat and AEMS 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.

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	ESA Third Party Missions	No. Scenes	Chinese EO data	No. Scenes
1. GOSAT, OCO2		1.Sentinel-5P Tropomi L1B, L2		1. TanSat	
2.		2. Sentinel-4 (O3, NO2, SO2, HCHO)		2. AEMS (2022)	
3.		3. Sentinel (aerosol optical depth)		3.	
4.		4. . Sentinel-5 UV-VIS-NIR-SWIR L1B, L2		4.	
5.		5.		5.	
6.		6.		6.	
Total:		Total:		Total:	
Issues:		Issues:		Issues:	

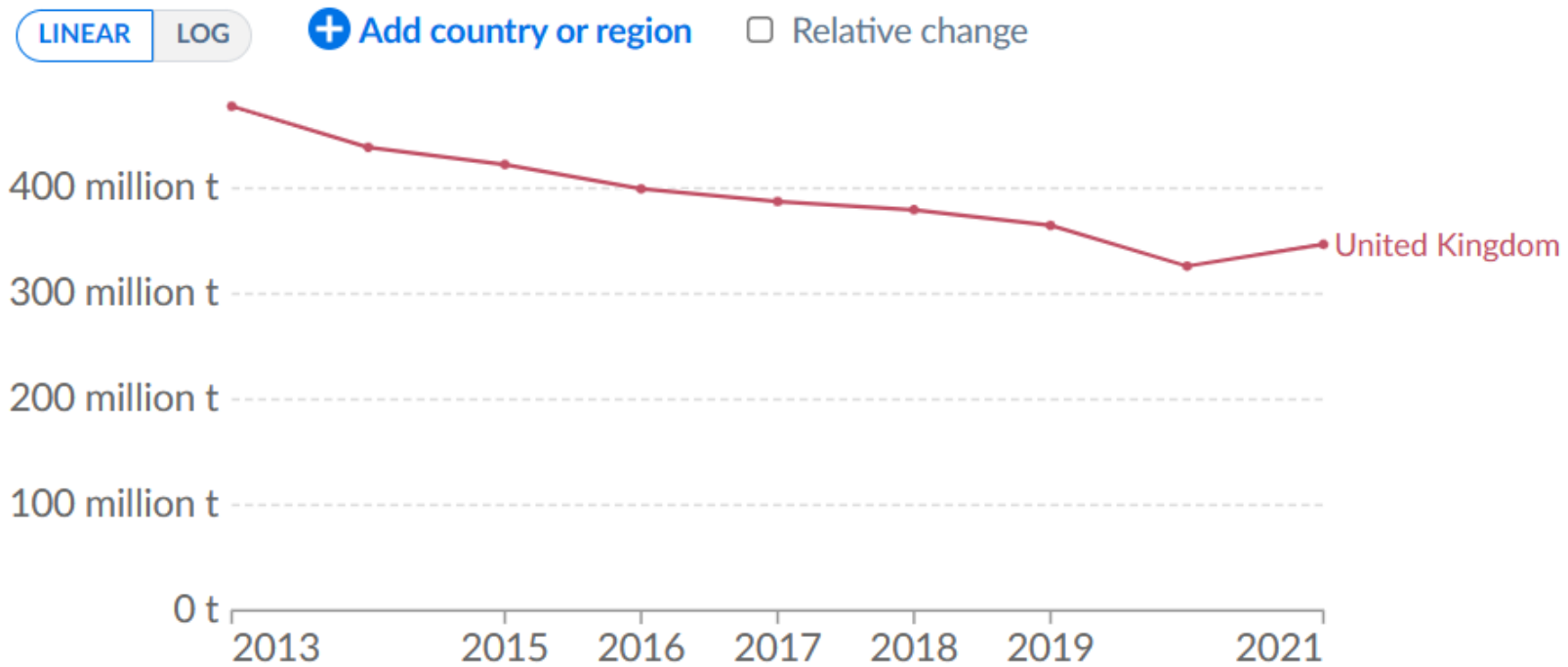


GAUGE project (Greenhouse gAs Uk and Global Emissions)
 The UK DECC (Deriving Emissions linked to Climate Change) Network
<https://dareuk.blogs.bristol.ac.uk/approach/work-package-2/>

Annual CO₂ emissions

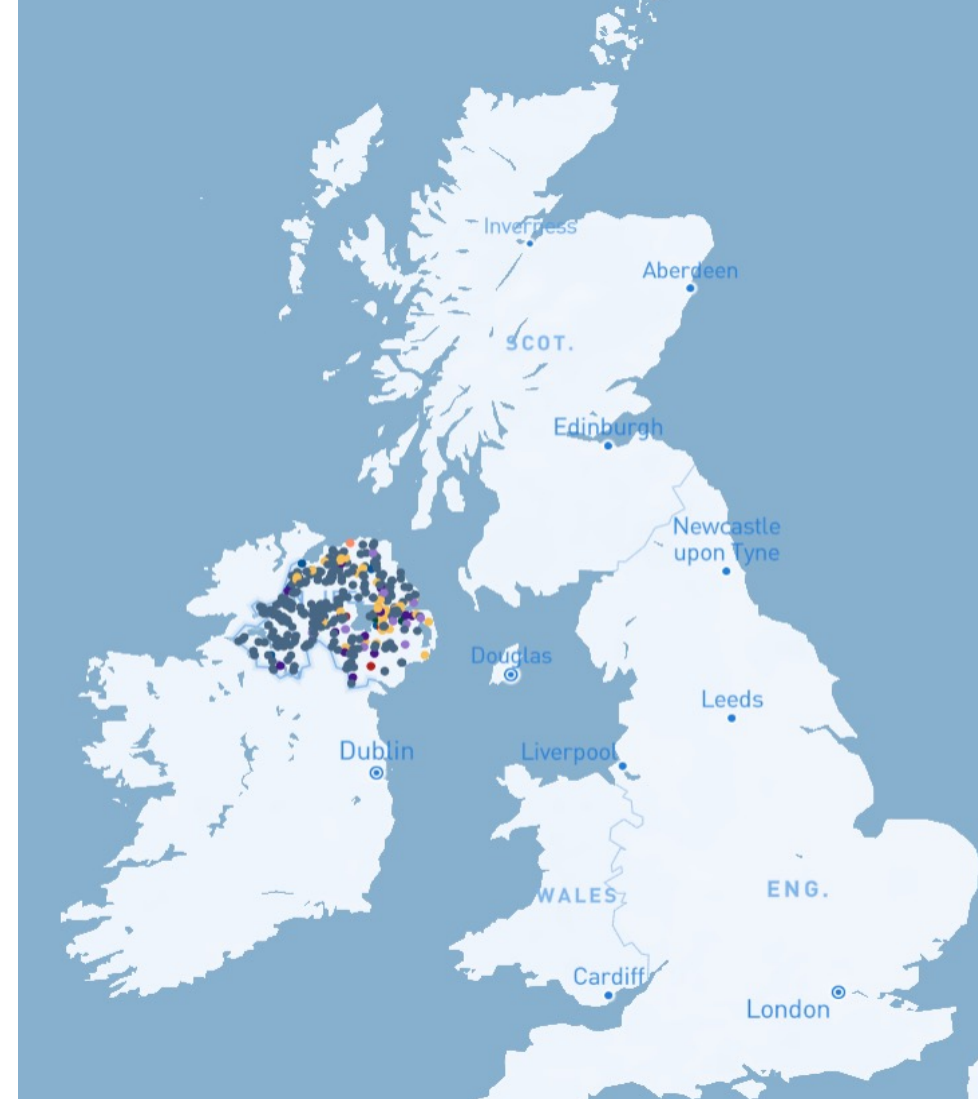
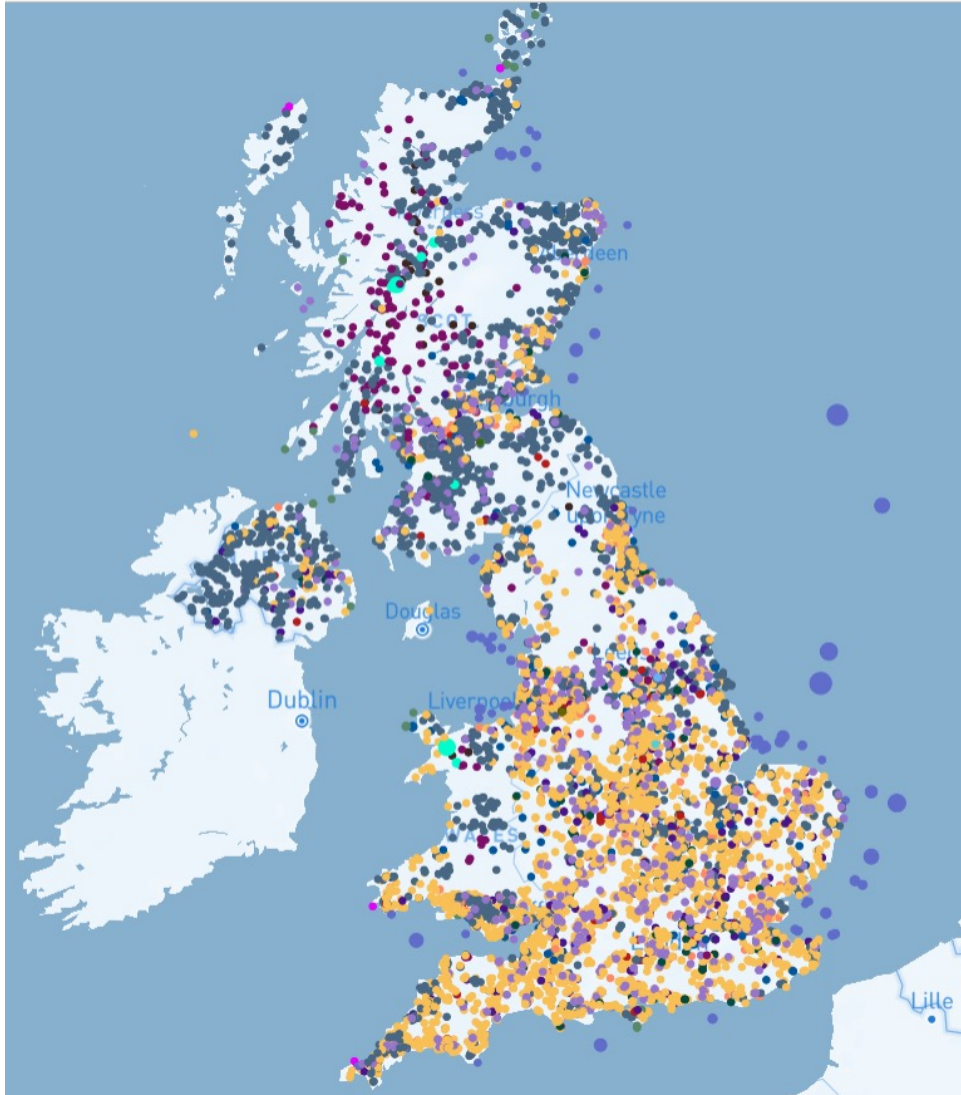
Carbon dioxide (CO₂) emissions from fossil fuels and industry. Land use change is not included.

Our World
in Data

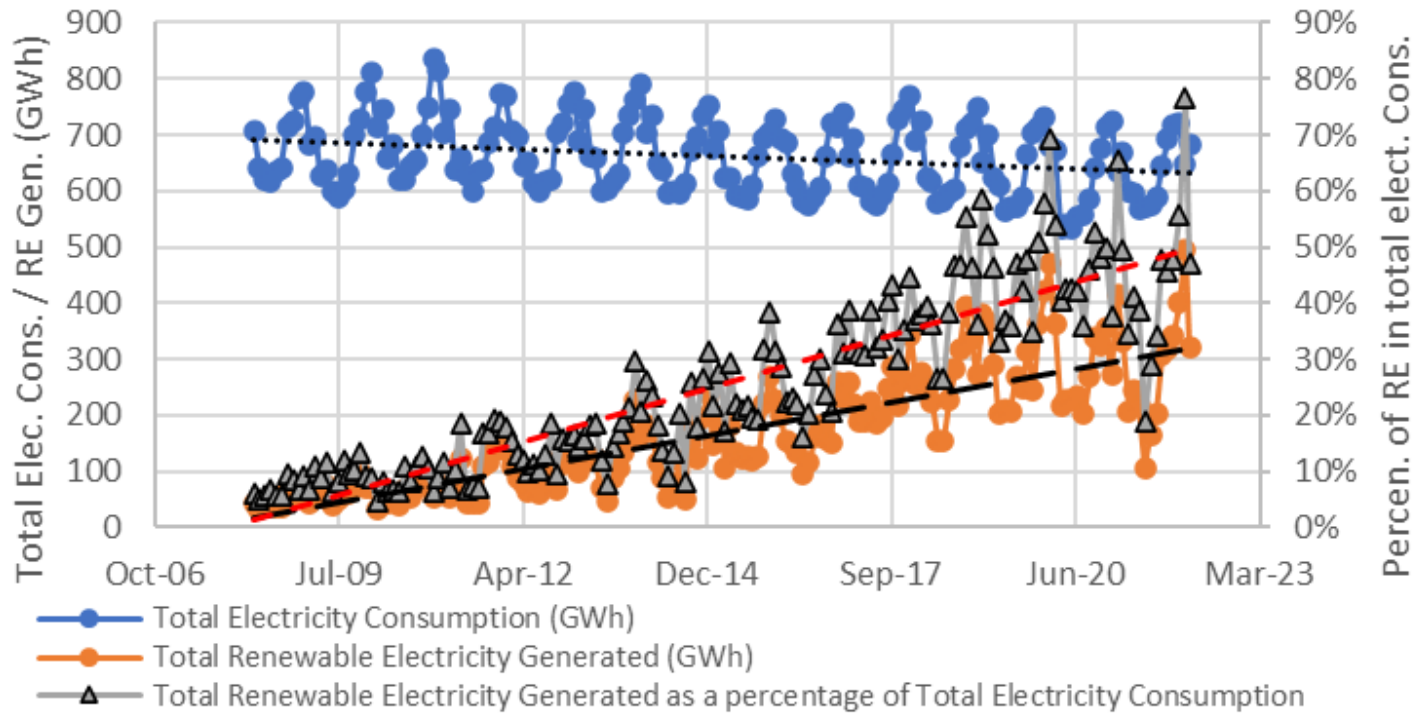


Source: Global Carbon Budget (2022)

OurWorldInData.org/co2-and-greenhouse-gas-emissions • CC BY



N.Ireland Total Electricity consumption and RE Generation



In comparison to the rest of the United Kingdom, Northern Ireland has relatively high percentages per capita emission in the agricultural, transportation, residential, LULUCF (land use, land use change, and forestry) and power sector. The electricity generated by the renewable energy is increasing since 2003 significantly. The increasing rate is nearly three times for the N. Ireland than the UK. In the year 2021, the electricity generated by the wind has increased to 47%

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





Isolate the impact from different type of RE resources

Year	Proportion of solar (PV) energy in total renewable energy production
2013 – 2014	<1%
2014-2015	<1%
2015-2016	<1%
2016-2017	<1%
2017-2018	<1%
2019-2020	3.3%
2021-2022	3.8%

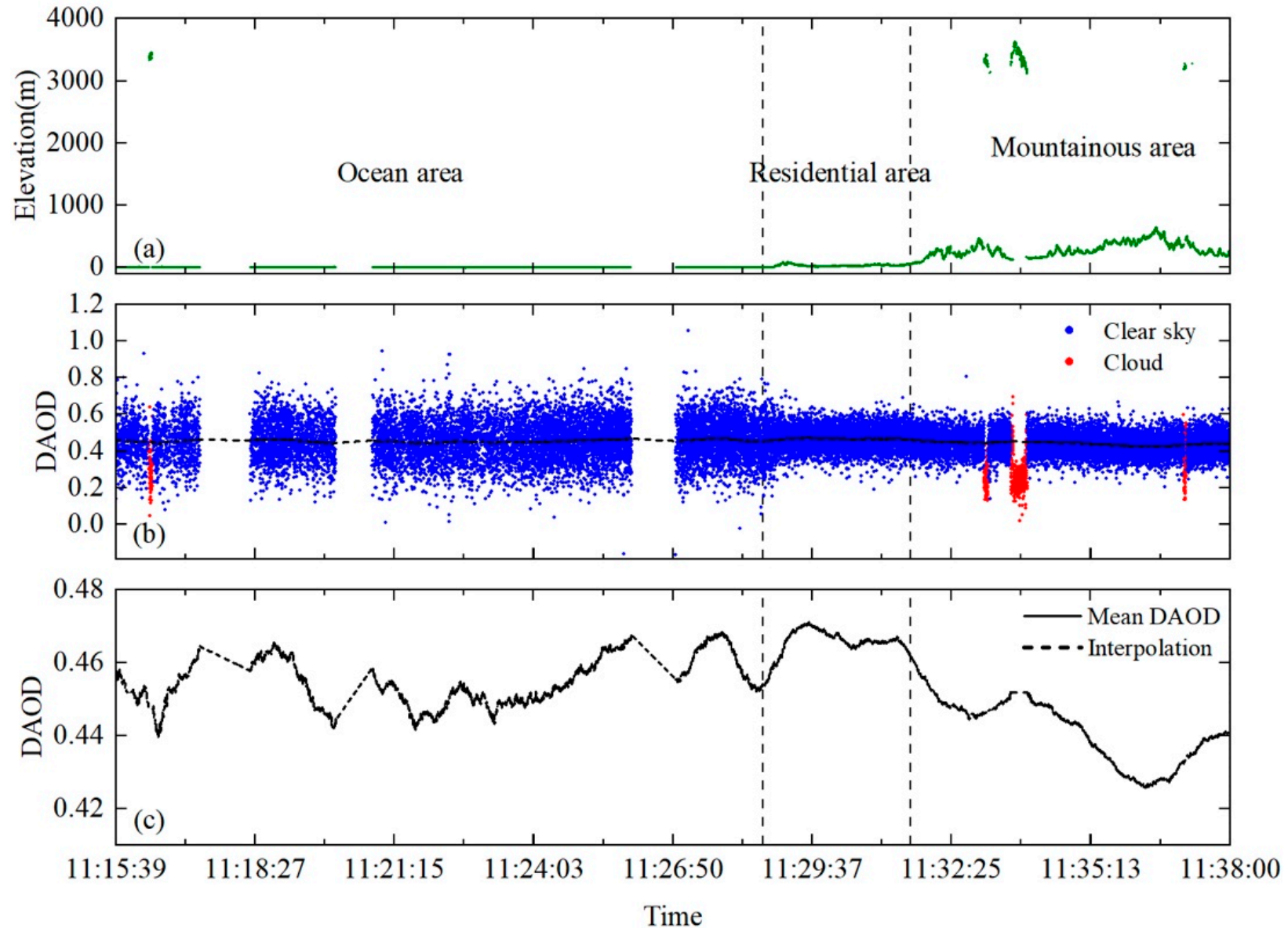
Several satellites were designed for atmospheric CO₂ measurements:
Tansat (Chinese Carbon Dioxide Observatio Satellite Mission (Dec 2016)
OCO-3 (May 2019)

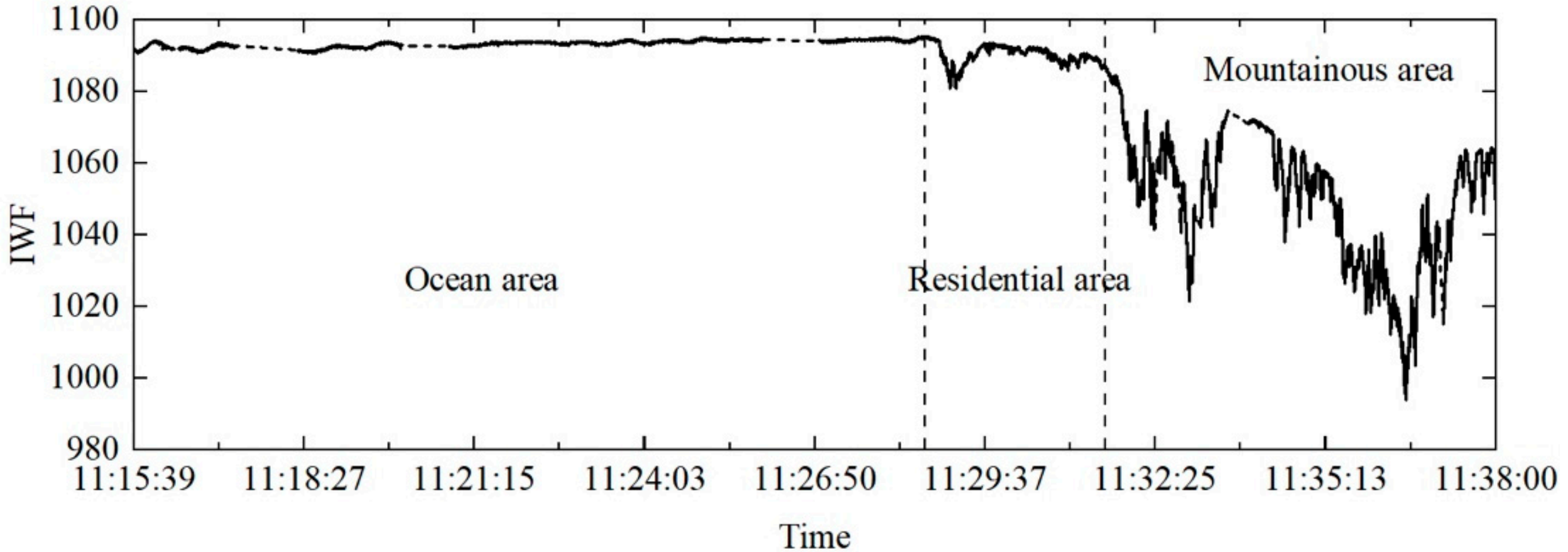
Disadvantage: passive measurement technique affected by clouds etc.

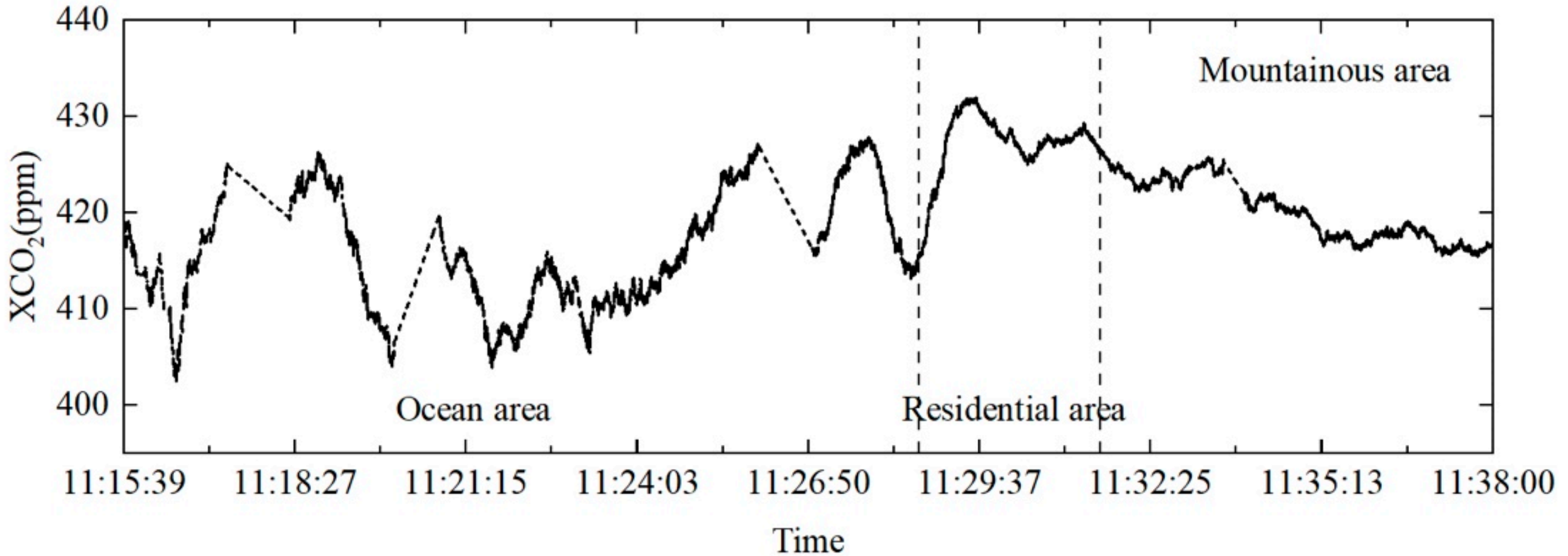
Active space sensors enable observations to be taken at all latitudes and all times of year.

AEMS (Atmospheric Environmental Monitoring Satellite), can provide more accurate CO₂ sources and sinks.

Chinese partner has developed ACDL system for measuring the XCO₂ accurately.







Northern Ireland Latitude and Longitude

The latitude for **Northern Ireland, UK** is: 54.787715 and the longitude is: -6.492315.

Northern Ireland Latitude:	54.787715
Northern Ireland Longitude:	-6.492315
Latitude DMS:	54°47'15.77"N
Longitude DMS:	6°29'32.33"W
UTM Easting:	661,241.52
UTM Northing:	6,074,052.65
UTM Zone:	29U
Geohash:	gcersmb3w474
Position from Earth's Center:	N
Elevation:	12 Meters (39.37 Feet)
Type:	GB Province

The coordinates of Northern Ireland can be described in different geographic coordinate systems. The following tables summarize both formats, to locate Northern Ireland in Degrees and UTM:

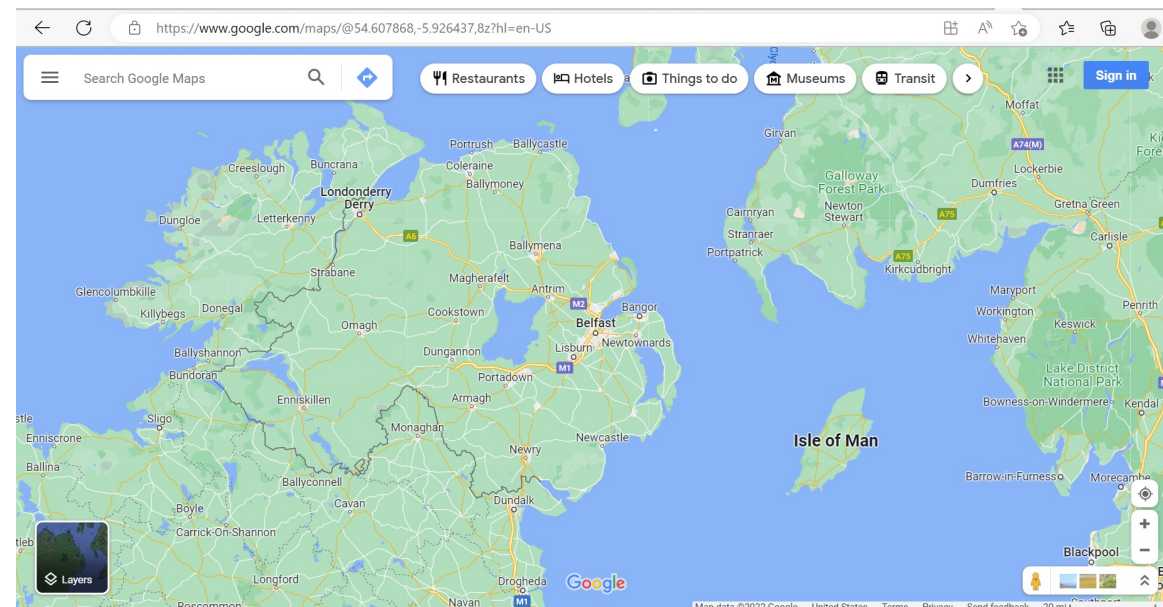
Coordinates of Northern Ireland in Degrees

Format	Latitude	Longitude
Decimals	54.5859836	-6.9591554
Decimal Degrees (DD)	54.5859836° N	6.9591554° W
Degrees and Decimal Minutes (DDM)	54° 35.159016' N	6° 57.549324' W
Degrees Minutes Seconds (DMS)	54° 35' 9.5409" N	6° 57' 32.9594" W

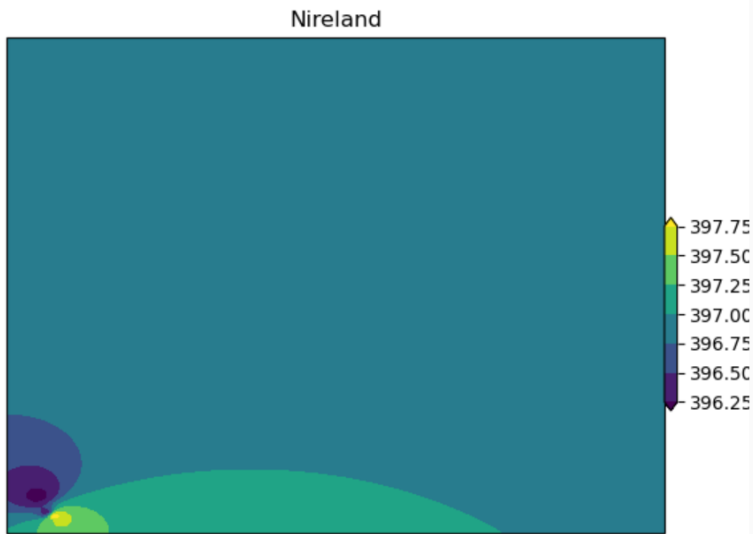
Coordinates of Northern Ireland in UTM system

Following the **Universal Transverse Mercator** (UTM) geographic system, the UTM coordinates of Northern Ireland can be described as:

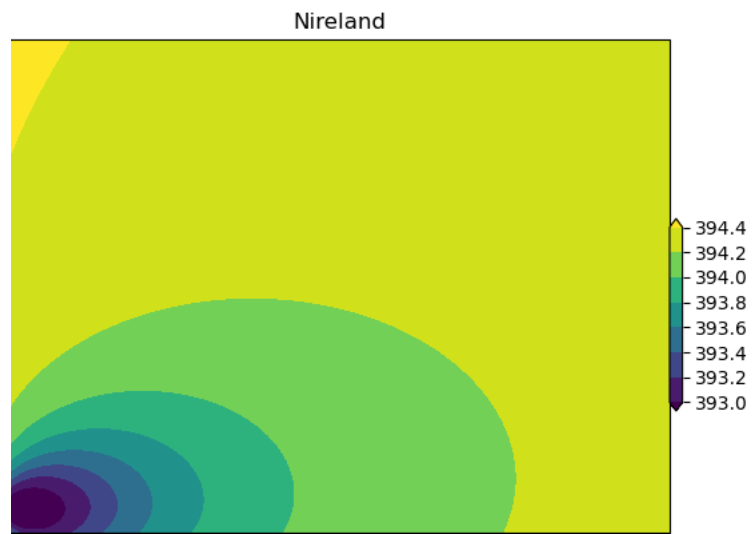
UTM	Value
UTM Easting:	631881.48871601
UTM Northing:	6050636.226998
UTM Zone:	29U



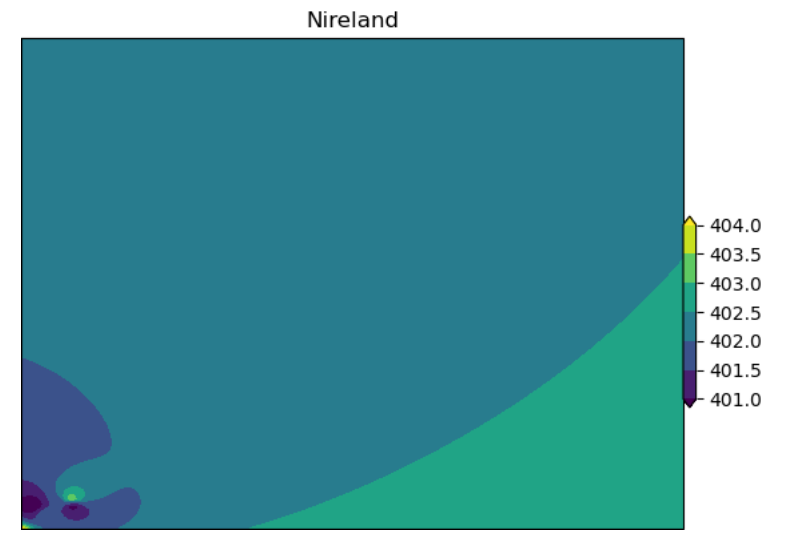
Mirror image of the CO₂ distribution from the GHGSat observation in the N. Ireland in the past ten years



May 2013



September 2014



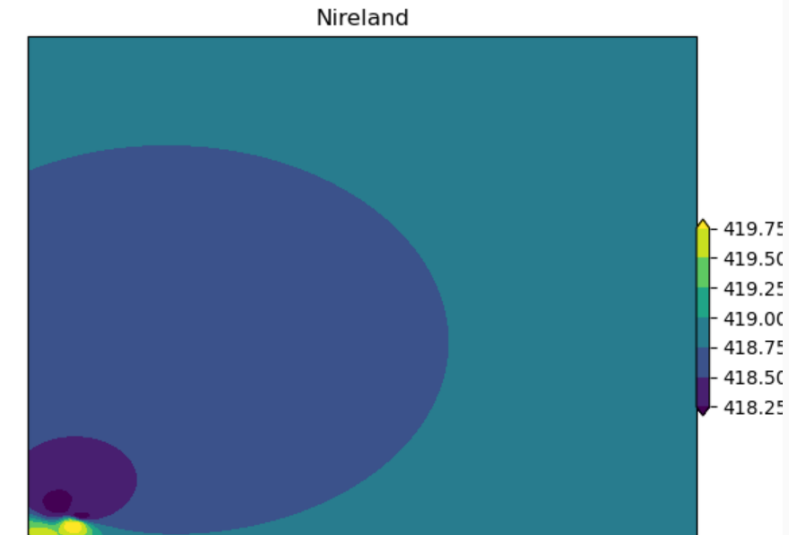
April 2015



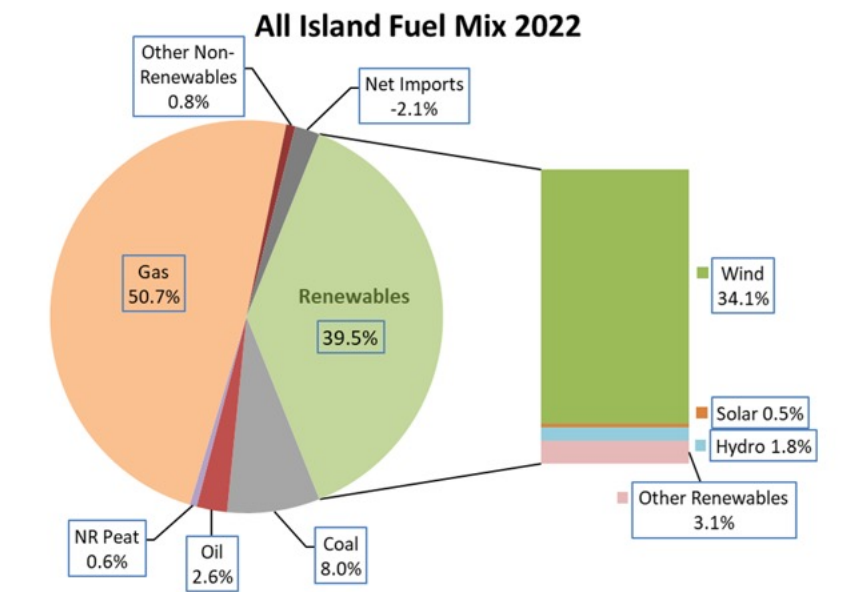
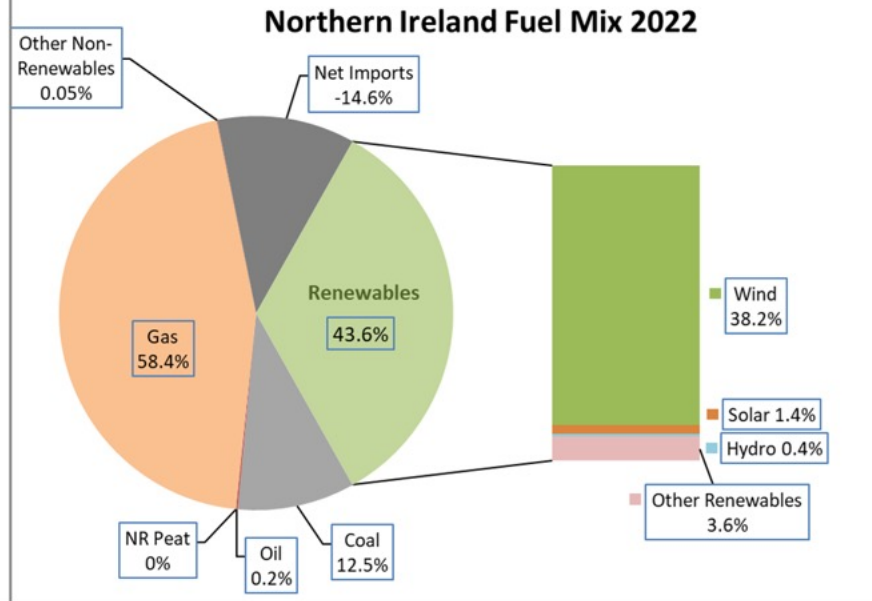
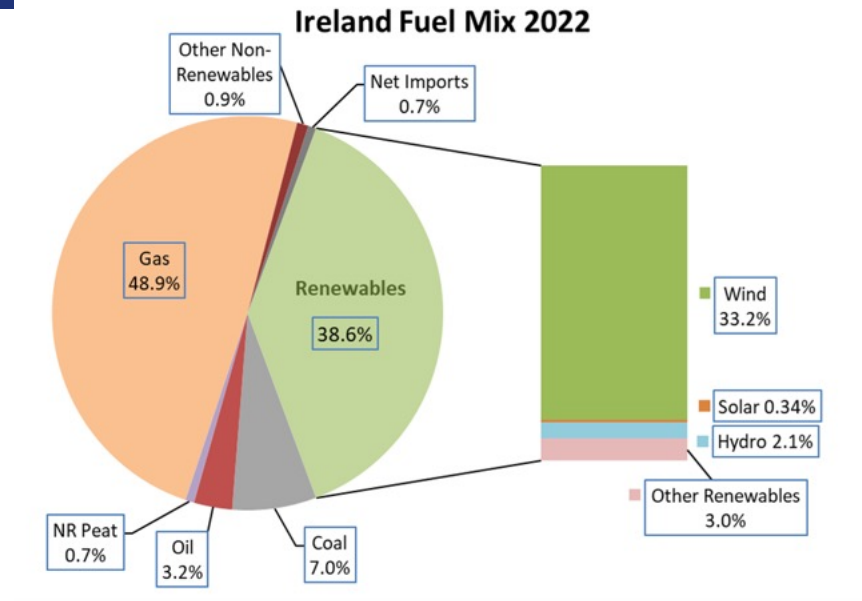
April 2017



April 2019



April 2022



Updated: May 2023

Notes:

All figures represent net exported energy.
Negative net imports indicate net exported energy.

Data Sources:

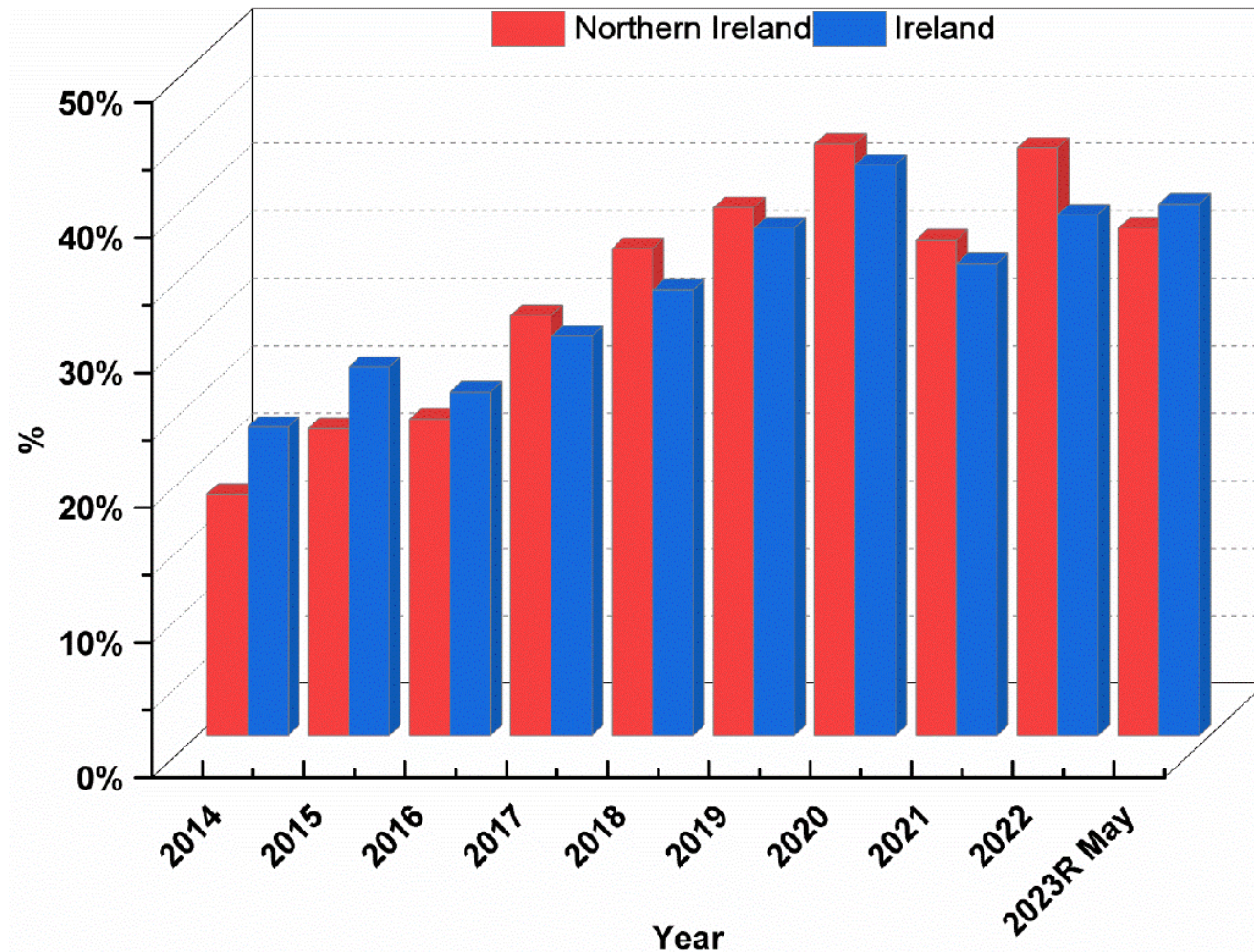
Ireland:

Final calendar year figures are provided by SEAI in May/June of the following year. Until then provisional figures are provided by EirGrid. SEAI's figures are comprised of EirGrid's provisional figures plus other small scale and micro generation data compiled by SEAI. EirGrid provisional figures consist of: EirGrid/SEMO metered data + ESBN/MRSO metered data for distribution-connected generation. EirGrid and SEAI may publish future updates to fuel mix figures as more data is collected throughout the year.

Other Non-Renewables include: non-renewable waste energy, non-renewable CHP and Diesel.
Other Renewables include: renewable CHP, bio energy (biomass, biogas, LFG) and ocean energy (tidal and wave). Pumped hydro is not included. It is considered storage or delayed output rather than primary production.

Northern Ireland: Fuel mix figures are based on latest metered data provided by SONI.

Other Non-Renewables include: DSO CHP and Diesel.
Other Renewables include: Biomass, Biogas, LFG, Renewable CHP and Hydro.



a positive shift towards higher utilization of renewable electricity sources in both Ireland and Northern Ireland

Name	Institution	Poster title	Contribution including period of research
Gerard Obasi	University of Ulster		Starting from August 2023 who has carried on the renewable energy generation for electricity in the Island

Name	Institution	Poster title	Contribution including period of research
Dr Lu Zhang	National Satellite Meteorological Centre, China Meteorological Administration		Production of the data collection from Sat with CO2 emission on the N.Ireland and Ireland.
Xifeng Cao	National Satellite Meteorological Centre, China Meteorological Administration		Study on the Impact of the Doppler Shift for CO2 Lidar Remote Sensing

- The study has found that the total CO₂ emission in N.Ireland 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.
- The power generation by RE has been investigated in the UK and N.Ireland. N.Ireland has been decided to be used to analysis the contribution of CO₂ reduction by integrating the different types of RE: wind, Solar PV, biomass etc.

- Model development
 - ✓ Develop XCO₂ retrieval algorithms along with simulation of the radiance transfer in atmosphere.
 - ✓ Investigate the relationship between the CO₂ emission reduction with different sources of renewable energy utilisation in the past ten years in N.Ireland. There is no significant changes with CO₂ emission reduction.

- 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 Ireland and NI, and verify the developed approaches of capturing CO₂ emission by GHGSat and AEMS.
- Study the impact of different type of RE to the CO₂ emission in the Island and impact with technical-economies. Extend the approach to the UK.
- Mutual academic exchanges have been planned.

- Xifeng Cao, Lu Zhang, Xingying Zhang, Sen Yang, Zhili Deng, Xin Zhang and Yuhan Jiang. Study on the Impact of the Doppler Shift for CO₂ Lidar Remote Sensing. Remote Sens. 2022, 14, 4620

Thanks for your attention!