OES OCEAN ENERGY SYSTEMS ANNEX IV

Ocean Energy orjip working to accelerate offshore consenting

OES Annex IV and ORJIP Ocean Energy Workshop

23rd April 2018, Kirkwall Orkney

Case Studies on Social and Economic Effects around Marine Renewable Energy Development

Agenda

Time	Item
13:00 – 13:15	Registration and coffee
13:15 – 13:30	Welcome and introductions Plan for the day
13:30 – 14:40	Case Study presentations - Orkney - Canada (*slides not included in this document, available on request*) - Wales
14:40 – 14:55	Introduction to breakout sessions
14:55 – 15:10	Coffee break
15:10 – 15:50	Breakout session 1
15:50 – 16:30	Breakout session 2
16:30 – 16:45	Report out from breakout sessions
16:45 – 17:00	Closing remarks

ORJIP Ocean Energy

- Sponsers:

THE CROWN ESTATE

marinescotland

Cyfoeth Naturiol Cymru Natural Resources Wales

Scottish Natural Heritage
All of nature for all of Scotland

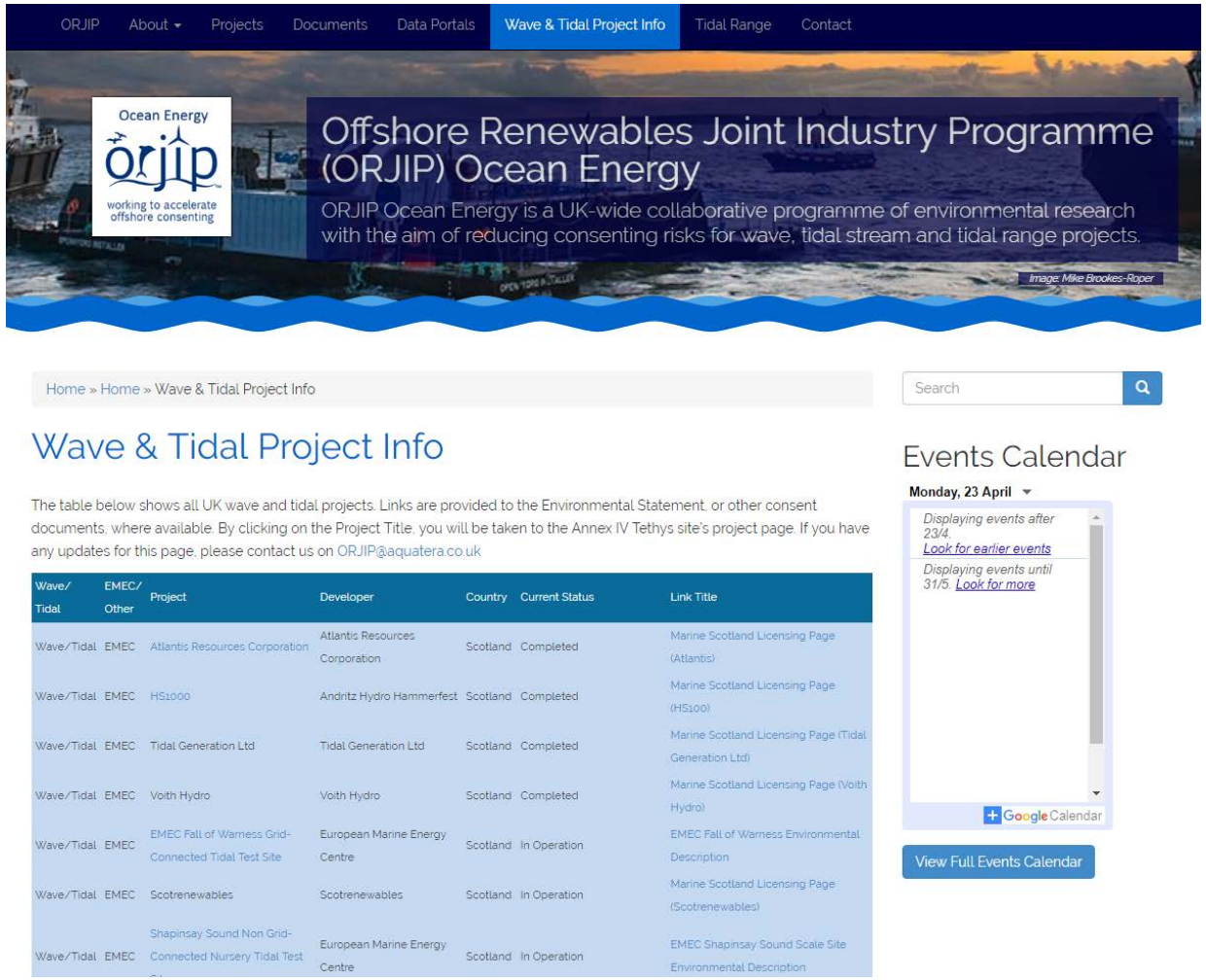
Llywodraeth Cymru
Welsh Government

ORJIP Ocean Energy

- Aims:
  - Reducing consenting risks for wave, tidal stream and tidal range projects.
  - To ensure that the principal EIA and HRA consenting risks for early array deployments in the wave and tidal sectors are addressed by facilitating a strategic, coordinated and prioritised approach to monitoring and research which is endorsed by industry, regulators and SNCBs.
- Objectives:
  - Provide a funded Secretariat to coordinate creating and sharing the information and encourage action.
  - Support project developers by coordinating research and monitoring to ultimately assist with commercialisation.

ORJIP Ocean Energy

- Activities
  - Steering Group
  - Network
  - Dissemination & outreach
  - Forward Look
  - Workshops & conferences
  - Website
  - http://www.orjip.org.uk/oceanenergy/about



Annex IV

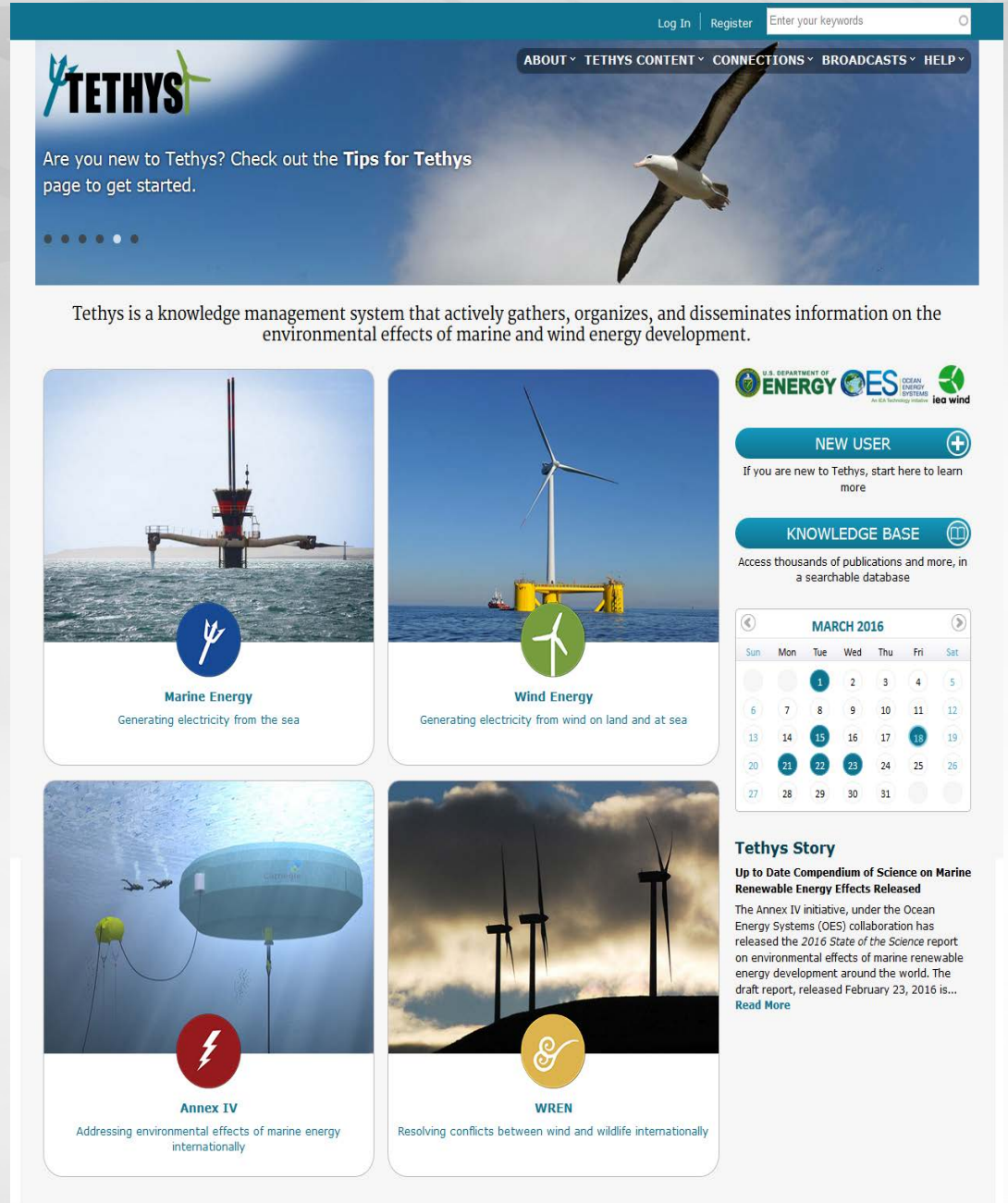
- Annex IV - a task under the Ocean Energy Systems collaborative
- Started in 2010, Annex IV is in its third phase (2010-2013, 2013 – 2016, 2016-2020)
- US leads Annex IV with the US Department of Energy as Operating Agent, in partnership with other US federal agencies (BOEM and NOAA).
- Pacific Northwest National Laboratory implements Annex IV.

Phase 3 Annex IV
Member Nations and Representatives

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

Annex Member Nations	Analysts
Canada	Anna Redden, Acadia University
China	Wei Xu, National Ocean Technology Center
Denmark	Hans Chr Sorensen, Wave Dragon
Ireland	Anne Marie O'Hagan, Univ College Cork
Japan	Daisuke Kitazawa, University of Tokyo
Norway	Lars Golmen, NIVA
Portugal	Teresa Simas, WavEC
South Africa	Wikus van Niekerk, Stellenbosch University
Spain	Juan Bald, AZTI-Technali
Sweden	Jan Sundberg, Uppsala University, Olivia Langhamer, Chalmers University
United Kingdom	Annie Linley, NERC
United States	Andrea Copping, PNNL

https://tethys.pnnl.gov



- *Tethys* knowledge management system on environmental effects of MRE
- Publically available, constantly curated and updated
- Contains 3000+ documents (papers, reports, etc.)
- Supports outreach activities (webinar archives, expert forums, events calendar, *Tethys* Stories, contact list, organizations, etc.)
- *Tethys Blast* biweekly, mailing lists of 1200+, webinar notices, etc.
- Join our mailing list!

Vision for Annex IV

The vision for Annex IV is to:

1. Be the premier international marine energy program that provides reliable information and insights into research and monitoring of environmental effects; and

2. Facilitate collaboration within the global marine energy community to increase understanding of environmental effects and the role they play in project development.

2016 State of the Science Report

- Marine Renewable Energy (MRE):
  - Industry in early stages of development, deployment, and commercialization
  - Need to streamline siting and permitting/consenting
- State of Science (SoS) report summarizes interactions and effects of MRE devices on the marine environment, the animals that live there, and the habitats that support them.
- SoS helps:
  - Inform regulators and researchers about potential risks from tidal and wave installations;
  - Assists MRE developers in developing engineering, siting, operational strategies, and monitoring options for projects that minimize encounters with marine animals and/or diminish the effects if such encounters occur.
- SoS information can simplify and shorten the time to permit/consent deployment of single and multiple device arrays, but site-specific knowledge will still be needed
- SoS 2016 serves an update and complement to 2013 Annex IV report:

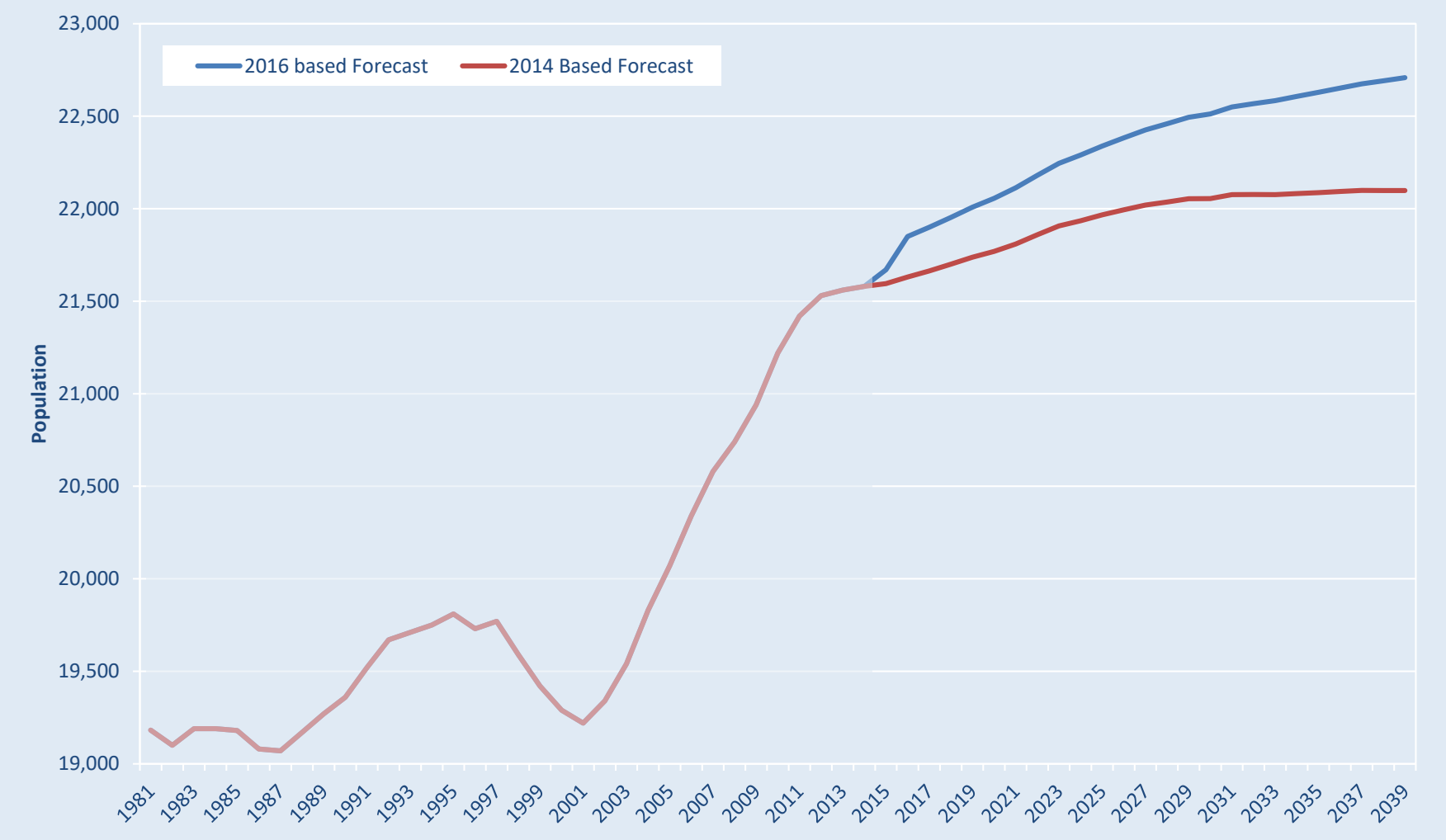
Orkney

Case Study on Social and Economic Effects and Benefits of MRE

Orkney

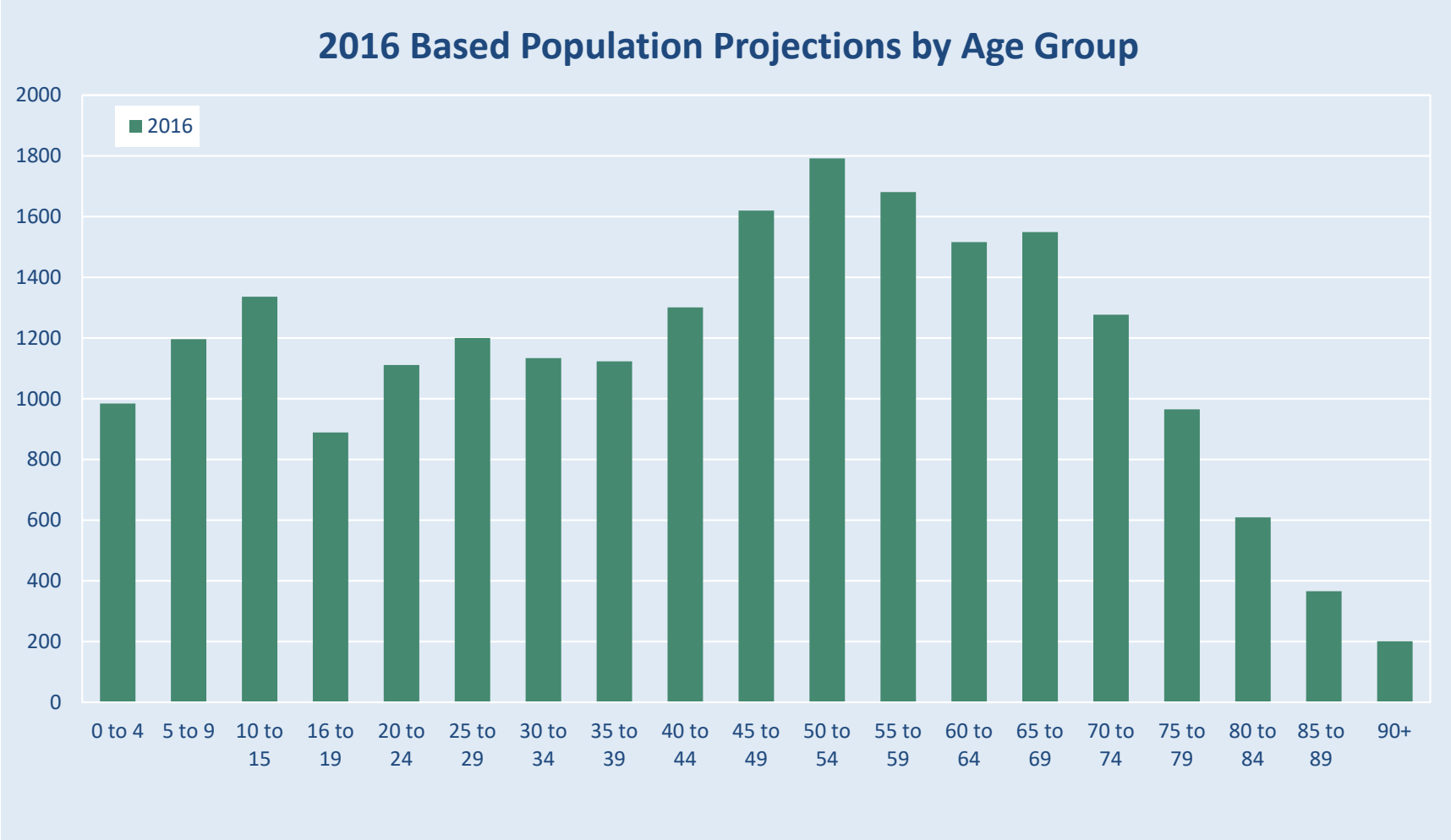
- Position 59 degrees North
- Mean maximum temperature 11°C
- Mean minimum temperature 5.5°C
- Average rain fall 100mm per month
- Average wind speed 4.8 - 7 m/secs
- Sunshine - 89 hours per month

Population 1981 - 2039

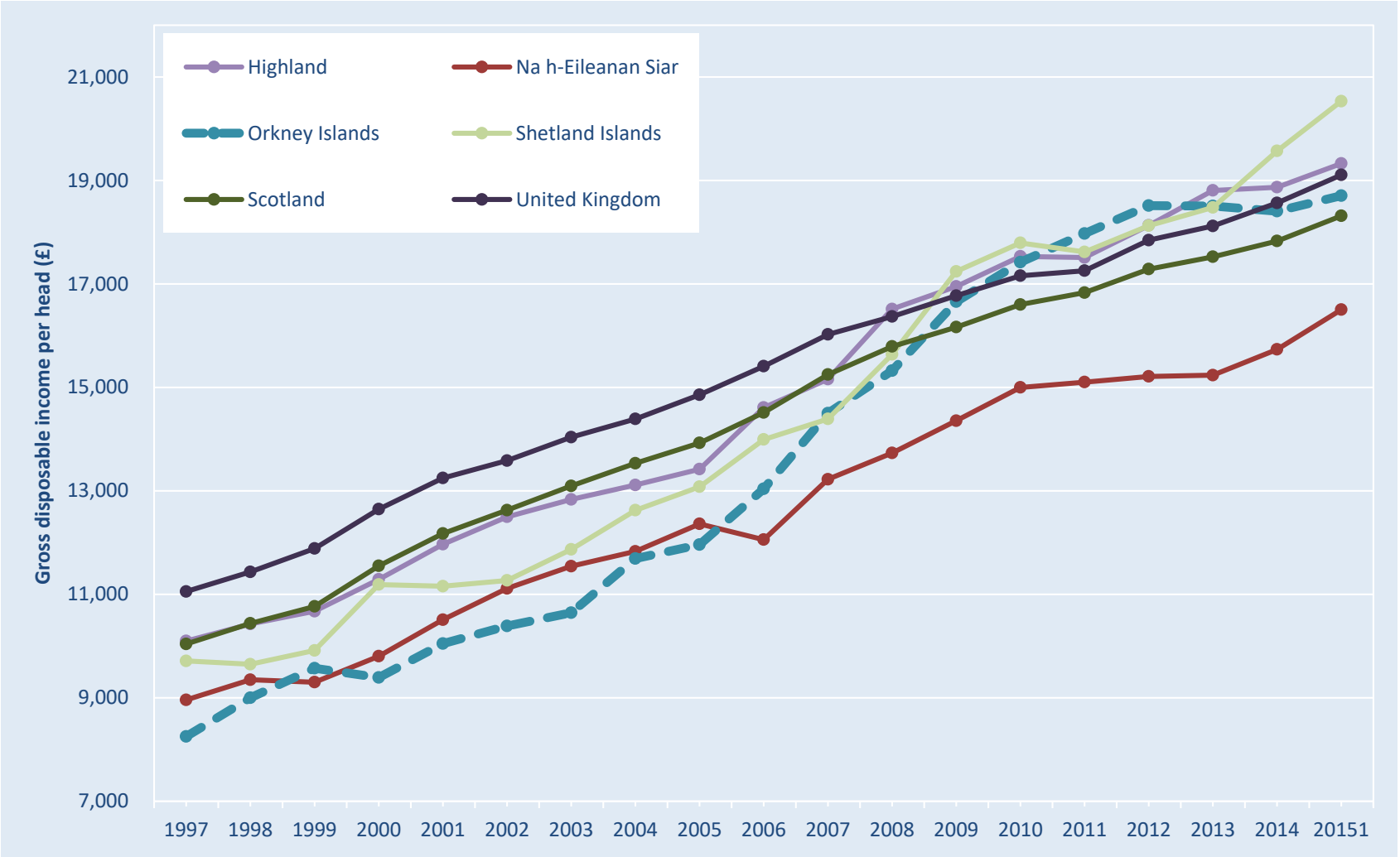


Source: NRS

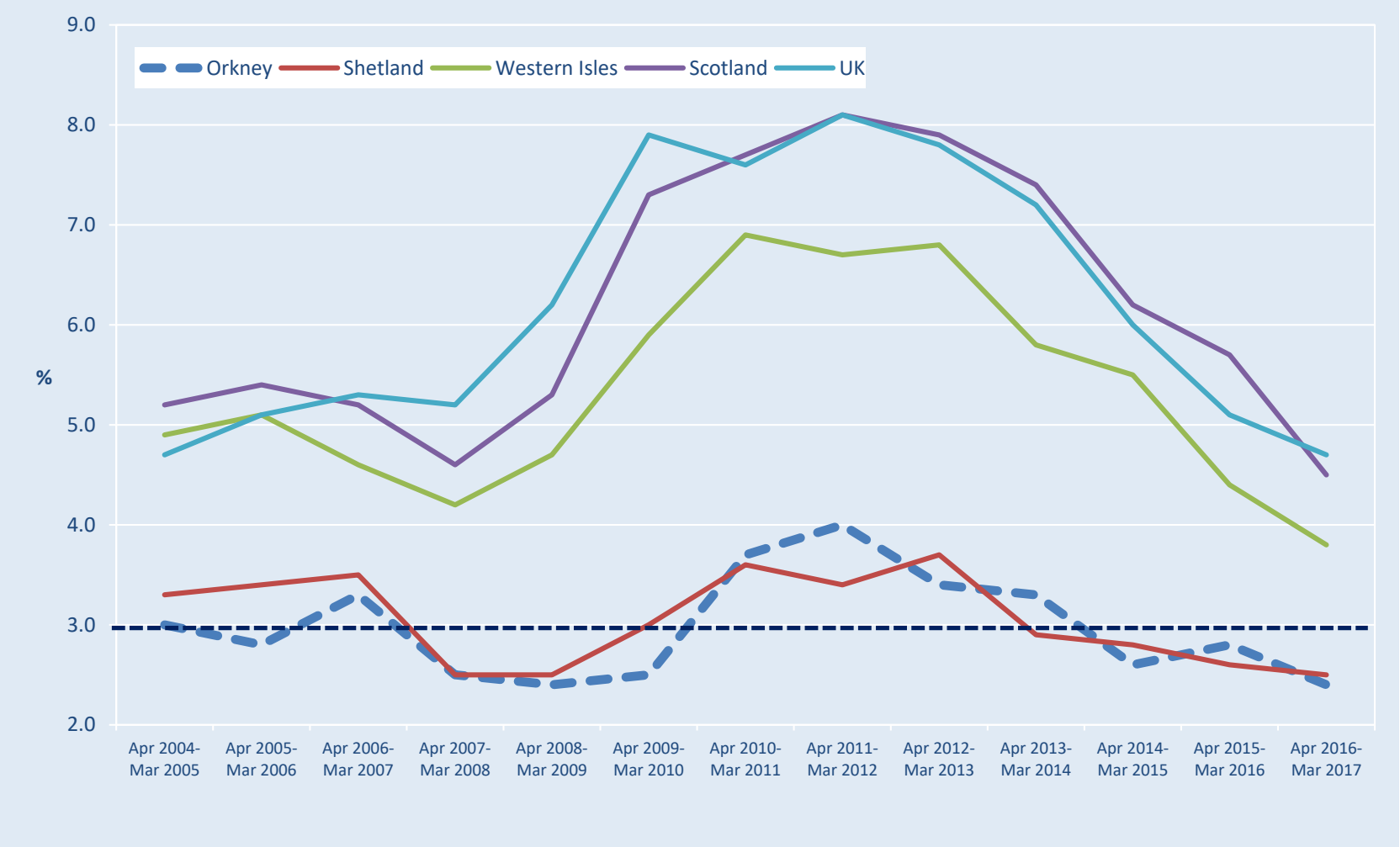
Population spread



Disposable income

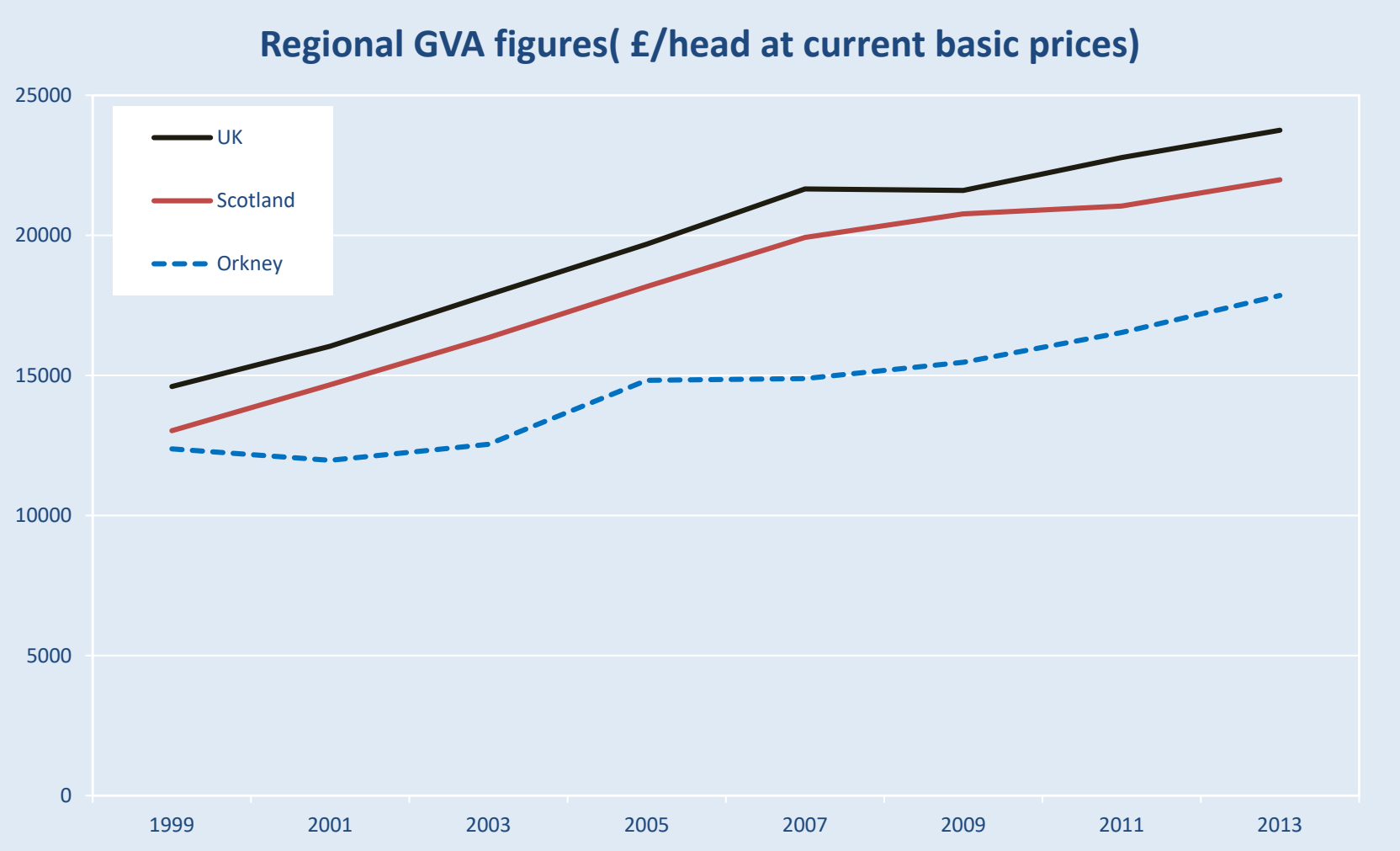


Unemployment 2004 - 2017

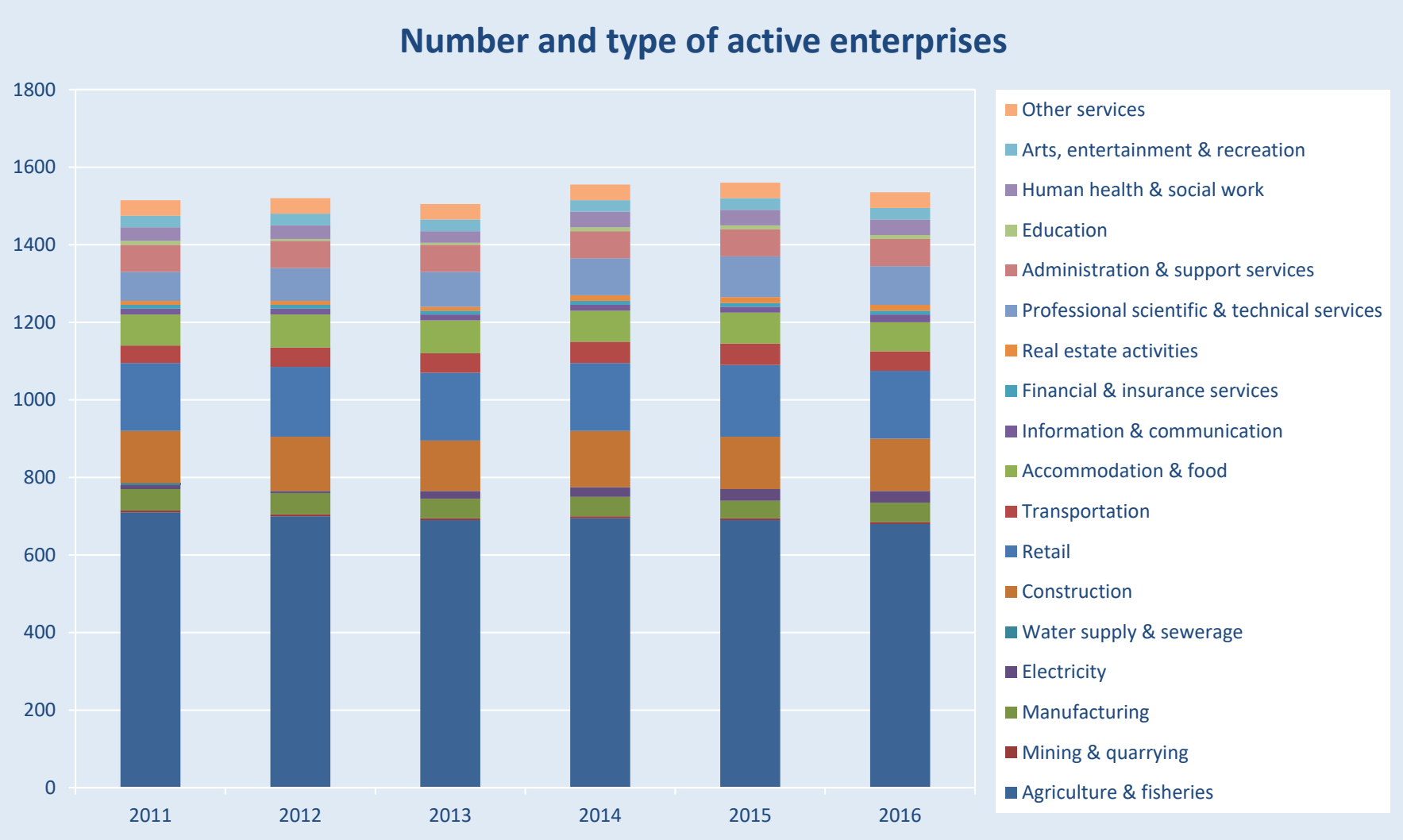


Source: NOMIS

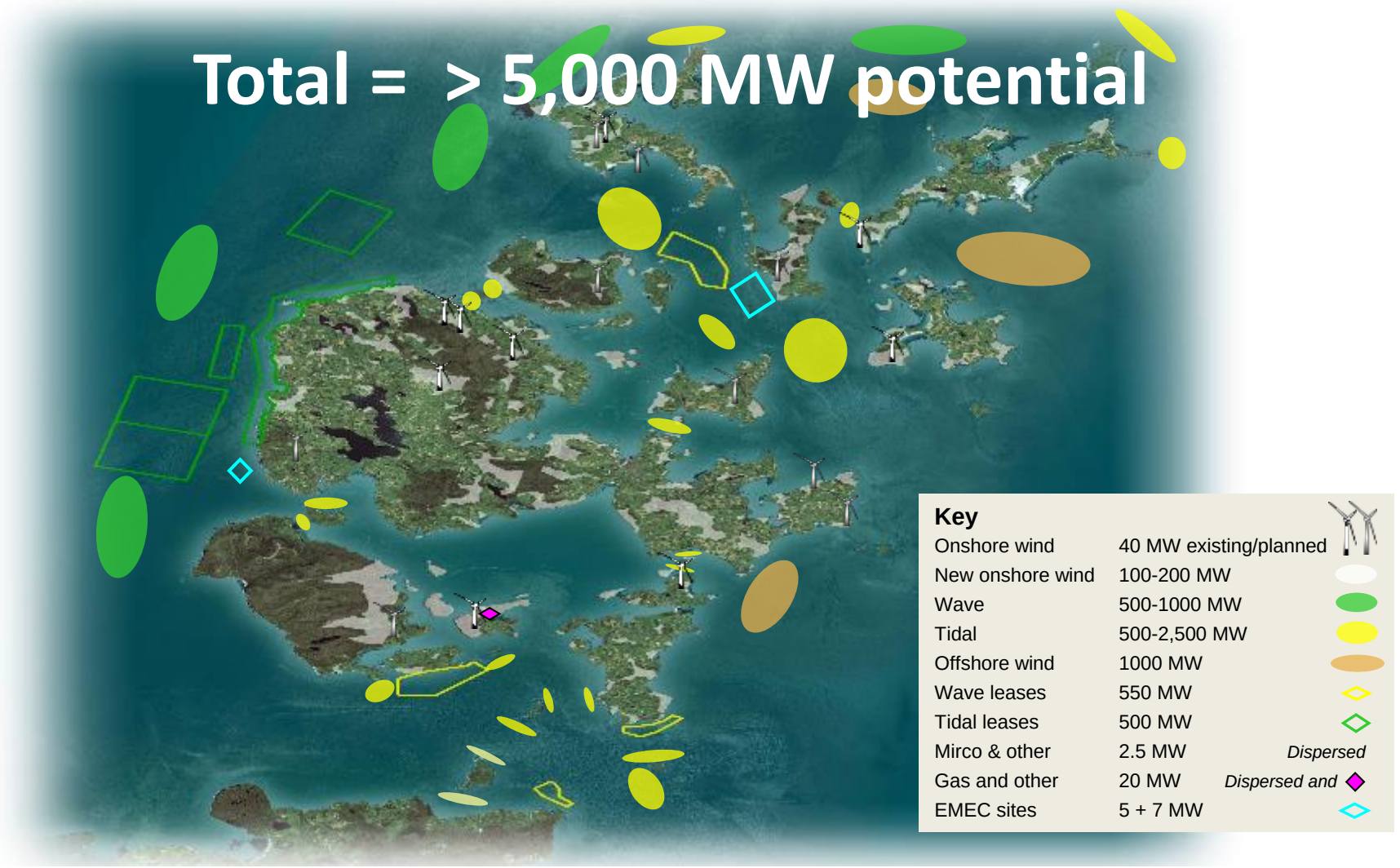
Business in Orkney



Business in Orkney



Orkney's energy resources



Our ‘achievements’ - how Orkney works

Generated >100% of electricity from renewables since 2013

Highest levels of ‘fuel poverty’ in Scotland

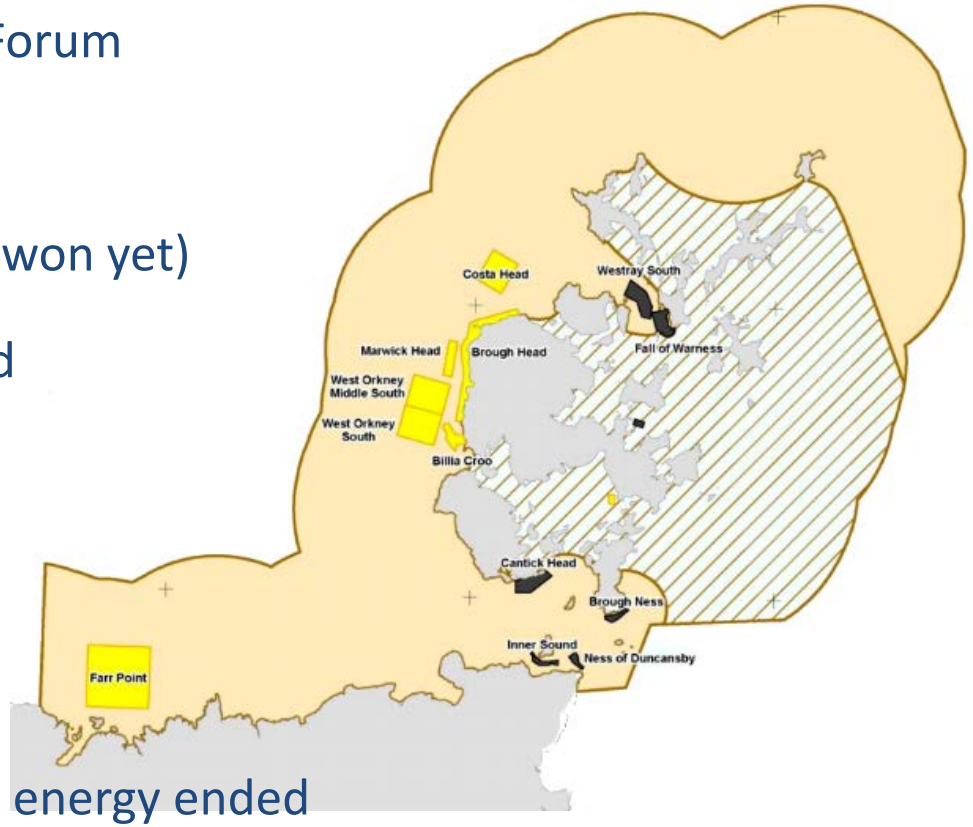
More wave and tidal energy devices than anywhere in the world

1 in 10 of households make their own power

Piloting powering ferries with green hydrogen made from tidal and wind energy

Orkney's marine energy pedigree and milestones

- Historically wind, hydro and biomass used for energy
- 1995 ICIT established to develop marine energy research
- 1998 Orkney Renewable Energy Forum
- 2003 EMEC set up
- 2008 Saltire prize launched (Not won yet)
- 2010 crown estates leases around Orkney awarded
- 2011 Marine ROC established at £305/MWhr
- 2012 CfD announced
- 2017 revenue support for marine energy ended



Energy achievements of Orkney

- **World's largest** marine energy test centre **EMEC**
- **World's first** grid connected offshore wave generation
- **UK's first** grid connected tidal generation
- **22 marine energy technologies** tested (20 at EMEC)
- Home to **Scotrenewables** - leading tidal technology developer
- **2500 maritime support** operations
- **1600MW** of marine energy capacity was awarded lease options
- Some of the **world's largest** marine energy projects being permitted

Area	Estimated gross investment to date in Orkney	Orkney's investment to date	Orkney contribution (%)
Marine (wave)	£100M	£5M	5%
Marine (tidal)	£140M	£10M	7%
Ports	£22M	£10M	50%
Vessels	£30M	£30M	100%
Total	**£292M**	**£55M**	**20%**

Tidal and wave progress at EMEC

EMEC has hosted

30 devices • **19** developers • **10** countries

£284m GVA

aquatera
environmental services and products

Supply Chain

Aquatera - environmental consultancy working in impact assessments for oil related projects. Saw marine renewable potential develop world leading role

Roving eye – tourist company offering views of Scapa flow seabed. Developed into successful small scale ROV enterprise

Leask marine – Local diving company expanded into marine renewables now has ?? Employees and offices in Wales as well as Orkney

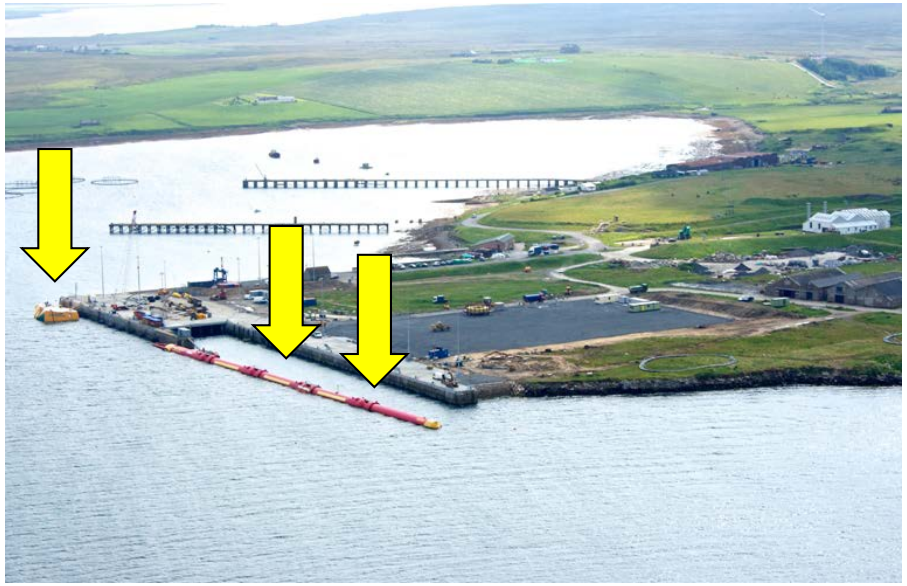
Green Marine started as a successful fishing business saw an opportunity and now employees ?? Involved in marine. Many local

Job trends over time- marine energy

Date	Overall total jobs (number)	Annual income from jobs (£000s)	Monthly salary bill (£000s)	Cumulative jobs (job years)	Cumulative income from jobs (£000s)
2000	26	650	54	26	650
2001	27	675	56	53	1,325
2002	32	800	67	85	2,125
2003	40	1,000	83	125	3,125
2004	48	1,200	100	173	4,325
2005	57	1,425	119	230	5,750
2006	69	1,725	144	299	7,475
2007	77	1,925	160	376	9,400
2008	93	2,325	194	469	11,725
2009	124	3,100	258	593	14,825
2010	163	4,075	340	756	18,900
2011	189	4,725	394	945	23,625
2012	229	5,725	477	1,174	29,350
2013	286	7,150	596	1,460	36,500
2014	300	7,500	625	1760	44,000
2015	250	6,250	520	2010	50,250
2016	220	5,750	460	2240	56,000

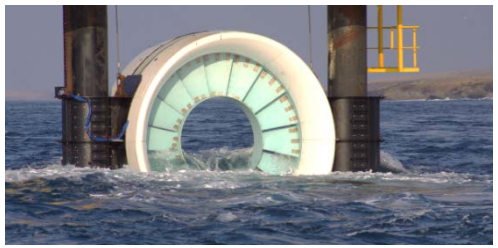
Harbour developments

- 3 ports strategy - £22 Million Investment (OIC, EU and Scottish government) to support marine renewables
- Supports all industries as well as marine renewables



Orkney data capture

- Orkney energy Audit
  - *Energy input and utilisation for whole of Orkney*
- HIE economic review of EMEC activity
  - *Economic review of all the activity EMEC has generated detailing community benefit*
- OREF datasets
  - *Range of datasets created and maintained by OREF*
- OIC economic statistics
  - *Statistics gather and interpreted by Orkney Islands Council*
- Orkney cloud
  - *Initiative to support local development of data within an Orkney cloud format*



Wales

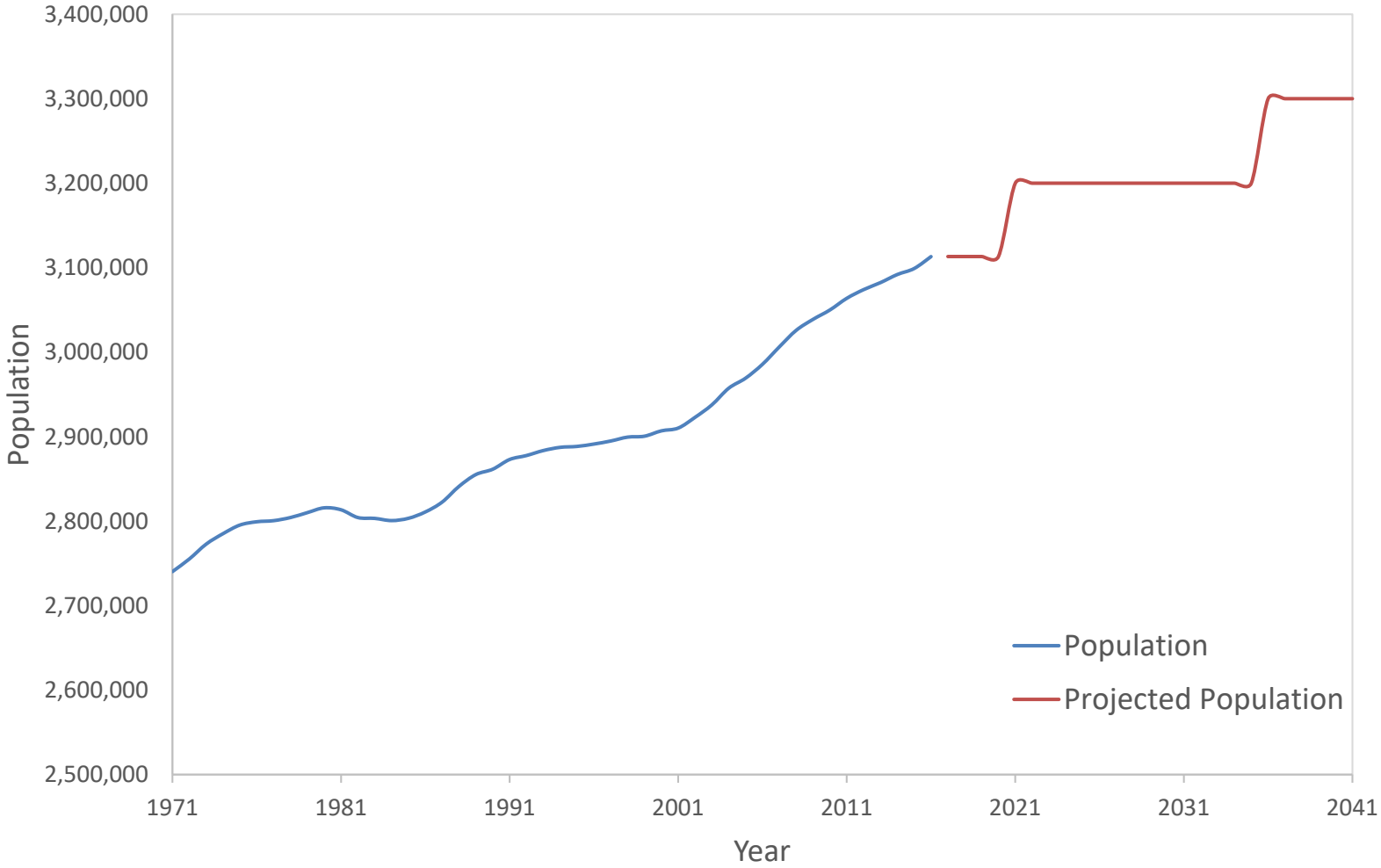
Case Study on Social and Economic Effects and Benefits of MRE

Marine Energy in Wales

Wales statistics

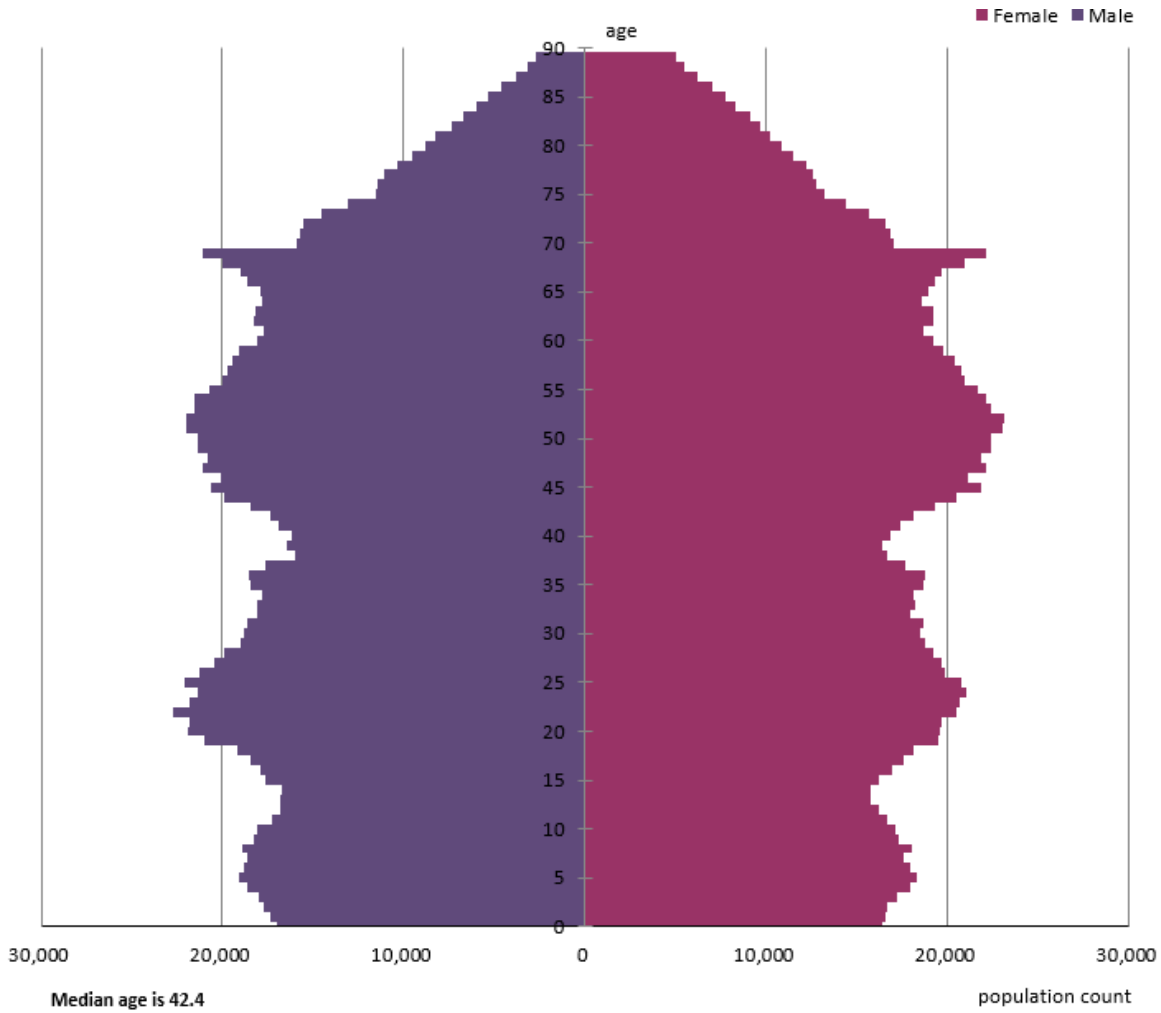
- Position 52 degrees North
- Mean maximum temperature 11°C
- Mean minimum temperature 9°C
- Average rain fall 100mm per month
- Average wind speed 15 knots (Valley)
- Sunshine – 142 hours per month

Population 1971 - 2041



Source: Office of National Statistics

Population Spread

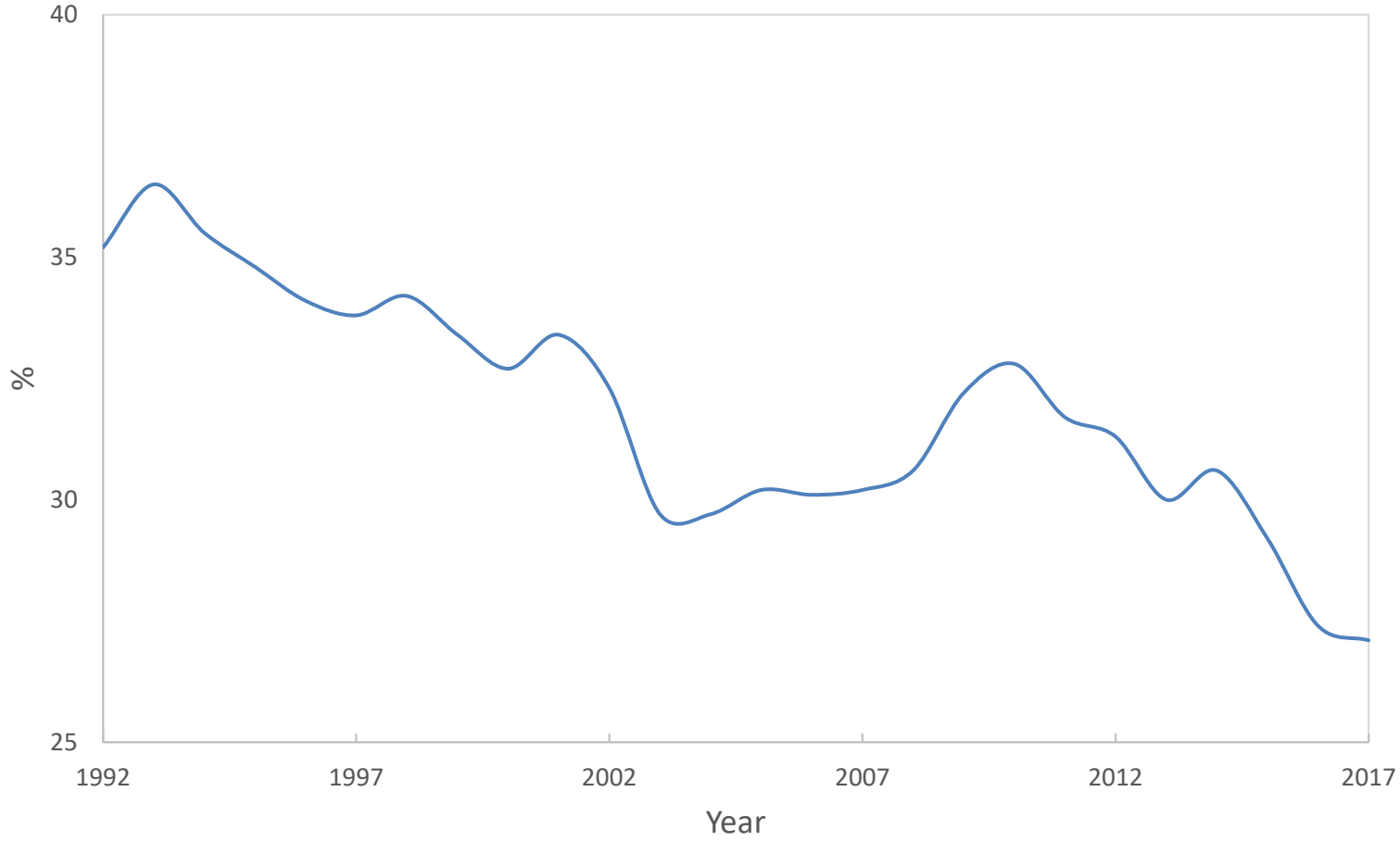


Source: Office of National Statistics

Disposable Income 2005 - 2014

Source: Office of National Statistics

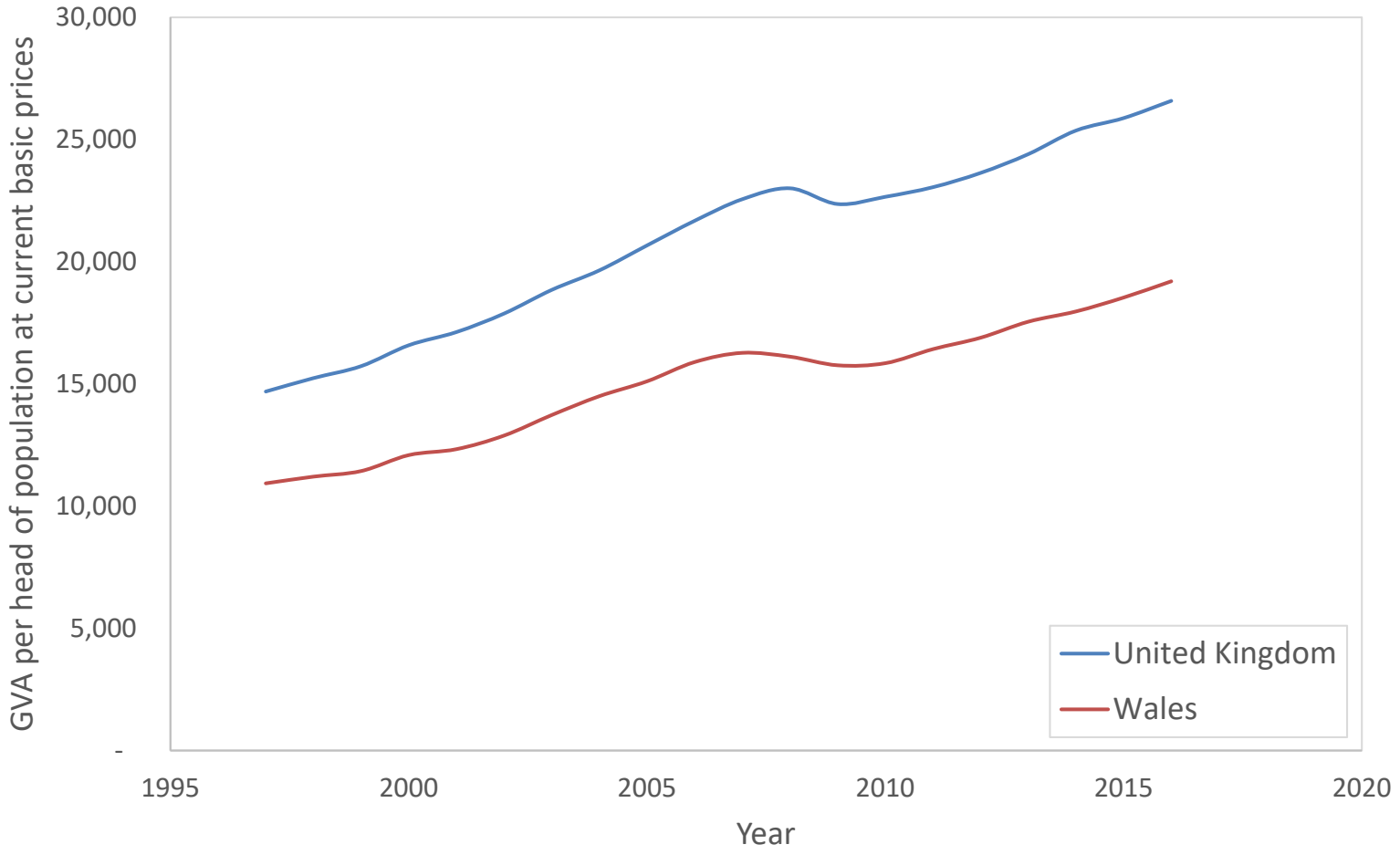
Unemployment 1992 - 2017



Source: ONS

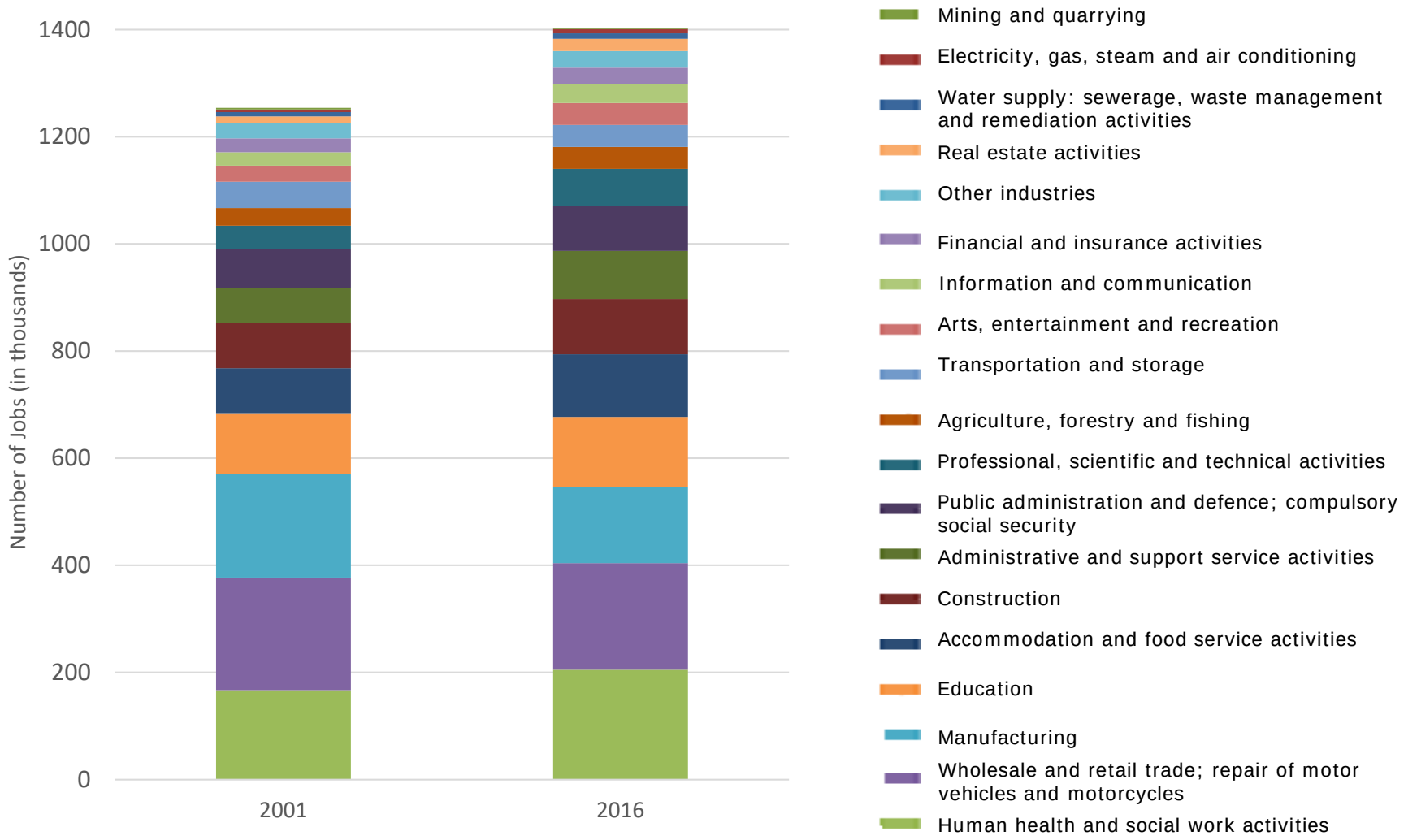
Business in Wales

Gross value added per head of population at current basic prices



Source: ONS

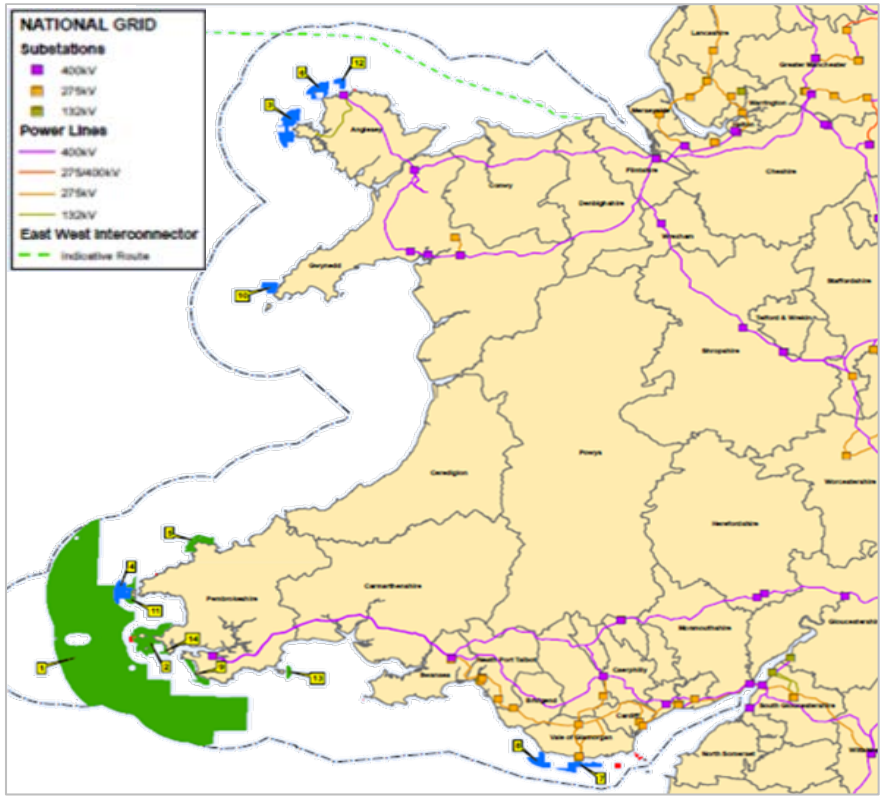
Business in Wales



Source: Welsh Assembly Government

Wales' Energy Resources

- Significant resource -
  - Tidal Stream & Wave 6.4 GW
  - Tidal Range 10+ GW
- World class ports, skills and energy sector supply chains
- Grid access
- 2 Array Scale Demonstration Zones (Anglesey & Pembroke)



Source: Marine Energy Wales

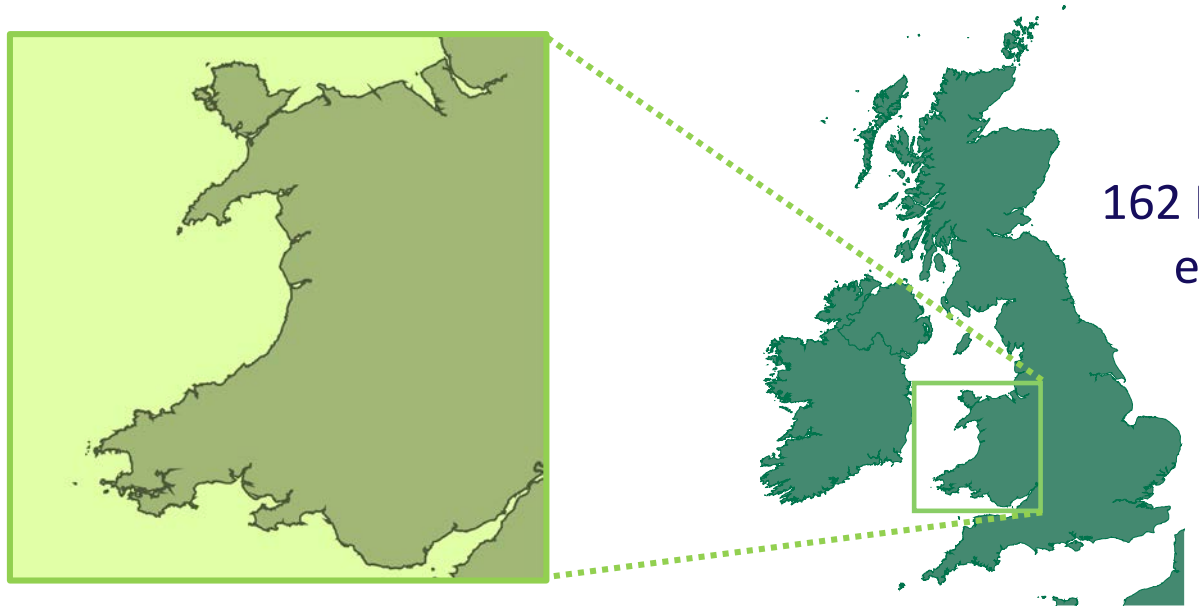
Policy and Welsh Government Support

- Since 1999 Wales legal duty relating to sustainability
- Welsh National Marine Planning Process 30 year plan
- Ministerial Industry led Task and Finish Group (Concluded Nov 2016)
  - Final report: Marine Energy Plan for Wales - Unlocking the Energy in Our Seas
  - Formation of Marine Energy Wales
- Well-being of Future Generations (Wales) Act 2015
- The Environment (Wales) Act 2016
- Welsh Government Target
  - 70% of electricity from renewables by 2030

Achievements to Date

350 person years of employment to date

£68.3 million direct investment in Wales



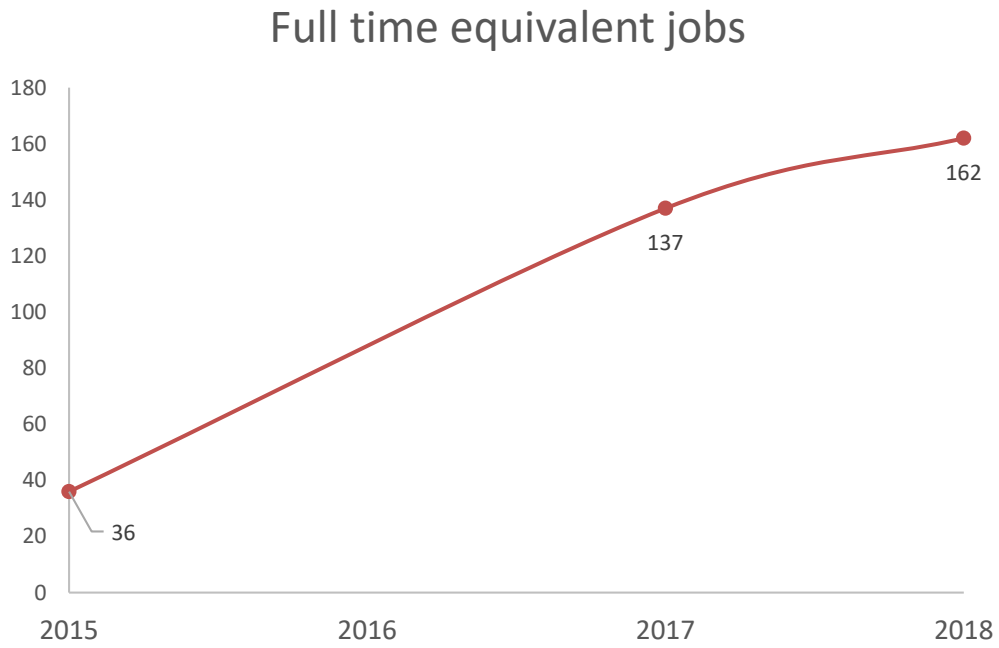
162 FTE jobs in marine energy in Wales

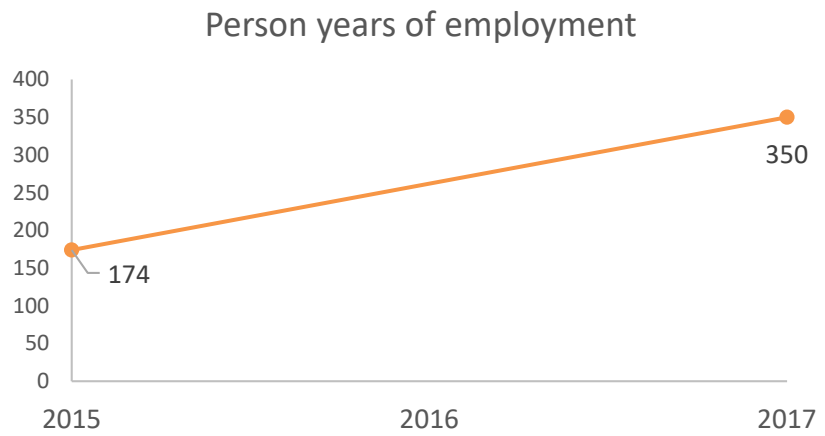
Predictions for over 50% Welsh supply chain content

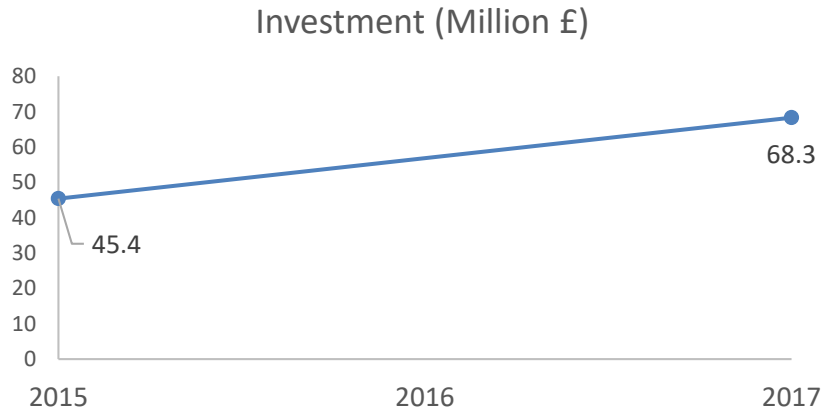
5 year investment plans of over £1.4 billion

Source: Marine Energy Wales, 2017

Marine Energy Socio Economics

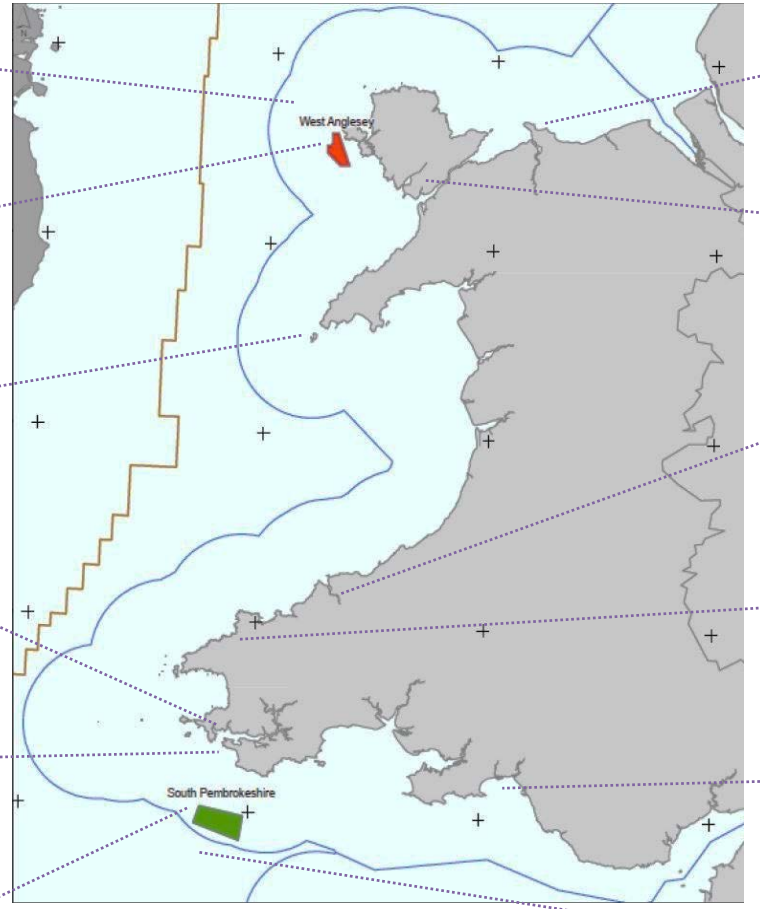






Source: Marine Energy Wales, 2017

Marine Energy in Wales



Source: David Jones, MEW

Investment

- €299.3M for Research and Innovation
- EU Structural Funding - €100,428,444 prioritising Marine Energy in Wales 2014 -2020
- £57.5M Public funding to date
- £10 million of investment in resources in marine energy = total gross value added effects of £2.5 million.
- £10 million of marine energy investment = 75 person years of employment
- Every £1 of public money invested in major marine energy businesses has leveraged in £7 of private investment
- 77% of this investment has been spent in the UK supply chain

Source: Fanning et al., 2014 & Highland and Island Enterprise, Regen SW & Marine Energy Pembrokeshire, 2016

Supply Chain

- 27 marine energy organisations active in Wales
  - 40% of their supply chain comes from within Wales
- Supply Chain examples
  - Mainstay Marine Solutions contracted to build first stage of £5.8 million WEC for Wave-tricity
  - Ledwood Mechanical Engineering constructing Marine Power Systems' WaveSub quarter scale WEC
  - Tata's Port Talbot steel plant provided steel for Scotrenewables SR2000

Future Projections(1)

Welsh Government commissioned study looking at the potential under different scenarios

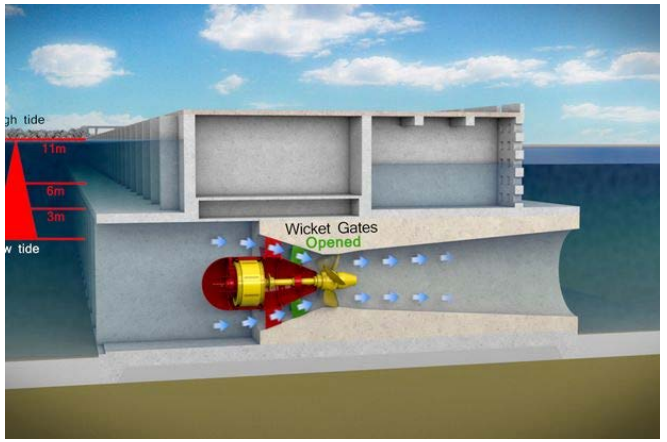
- 30MW wave installation and a 30MW tidal stream installation
  - 2,000 person-years of employment associated with development and installation
  - 50 FTE per annum during generation
  - £70M of GVA across Wales based on a total investment of £150M

- 300MW
  - 8,500 person-years of employment during development and installation
  - £300M for Wales with an investment of £500M
  - £840M of GVA based on an investment of £1.5bn

Future Projections(2)

- 1GW
  - 24,000 person- years
  - 440 FTE per annum during generation

- Tidal range
  - An investment of £1,046M with half of this investment retained within the Welsh economy.
  - 1,900 jobs will be created at the height of the construction programme
  - Annual operation of the lagoon amounting to approximately 181 FTE jobs



Contact details

Jennifer Fox

Jennifer.fox@aquatera.co.uk

Dr Andrea Copping

Andrea.copping@pnnl.gov

www.orjip.org.uk

https://tethys.pnnl.gov/