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Bernard, S. and Elsner, Paul and Krug, M. and Marques, M. and Matos, J.C. and Roro, K. and Govender, S. and Landman, S. (2019) International collaboration on integrated geospatial approaches for new offshore wind energy development. In: Summit Southeast: International Commerce & Innovation Summit: Energy, Ocean Economy and Sustainable Development, 10-11 September 2019, Charlotte (NC), USA. (Unpublished)

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AIR CENTRE  
ATLANTIC INTERNATIONAL RESEARCH CENTRE

# International Collaboration on Integrated Geospatial Approaches for New Offshore Wind Energy Development

2019 Summit Southeast - International Commerce & Innovation Summit: Energy,  
Ocean Economy and Sustainable Development, Charlotte, NC, September 2019

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AIR CENTRE

ATLANTIC INTERNATIONAL RESEARCH CENTRE

The Atlantic International Research Centre (AIR Centre) is an international framework for scientific and technology collaboration and development of innovative ideas, common policies, shared research programmes and joint projects, aligning national priorities and global challenges

The AIR Centre integrates Space, Ocean, Climate, Energy and Data Sciences to deliver growth of the blue economy and societal impact in the Atlantic region





# Timeline Scientific Diplomacy





# Ever expanding Network

Flexible, distributed and inclusive approach



USA

NORWAY

UK

SPAIN

PORTUGAL

SENEGAL

CAPE VERDE

MAURITANIA

GHANA

NIGERIA

SAO TOME  
AND PRINCIPE

ANGOLA

BRAZIL

NAMIBIA

URUGUAY

SOUTH AFRICA

ARGENTINA



# Main areas of interest

## Convergence is key

Marine Resources  
& Biodiversity



Clean &  
Healthy Oceans



Earth Observation:  
from Deep Sea  
to Inner Space



Mitigation & Adaptation  
to Climate Change



Renewable  
Offshore Energies



Data Science &  
Deep Learning



Infrastructures, Capacity Building, Knowledge for All

# So... Why Collaborate?

## Several reasons and motivations



- Pool resources to address large, complex problems
- Increase solutions' robustness
- Increase odds of success
- Decrease costs
- Amplify results
- No one left behind
- Benefit from diversity



# Typical collaboration framework

## Bottom-up approach with strong Top-down support

Definition of high priority topics

Countries / affiliated organizations and AIR Centre

Identification of key needs/requirements

AIR Centre and international stakeholders

Elaboration of the initiative

Countries / affiliated organizations and AIR Centre

Implementation of the activities

Industry / research organizations

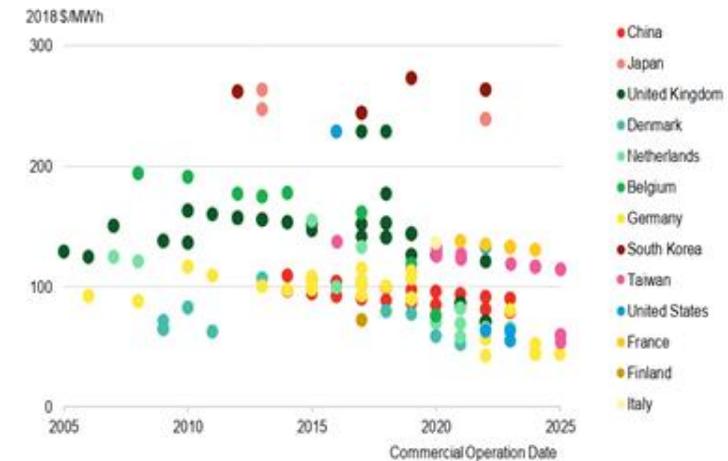
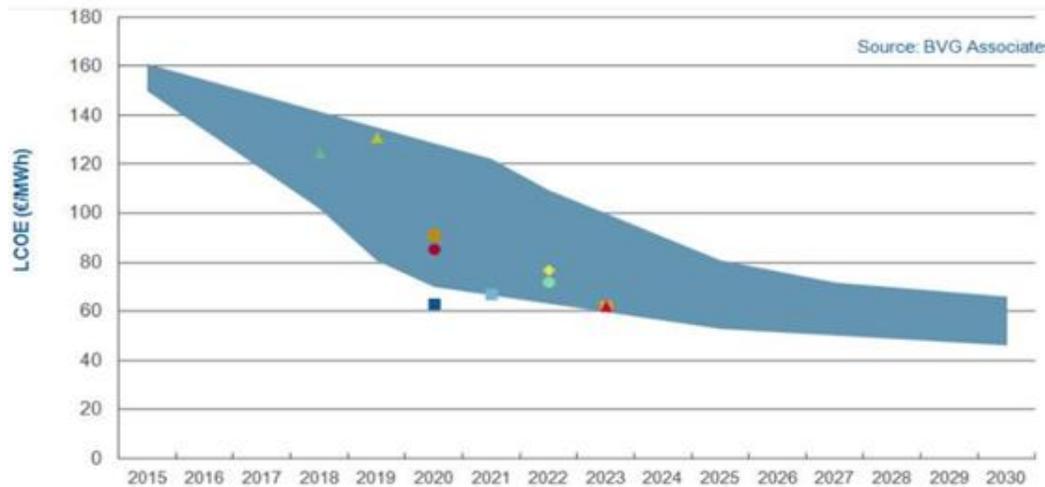
Service Fruition

User communities

Impact evaluation (feedback loop)

AIR Centre and end users

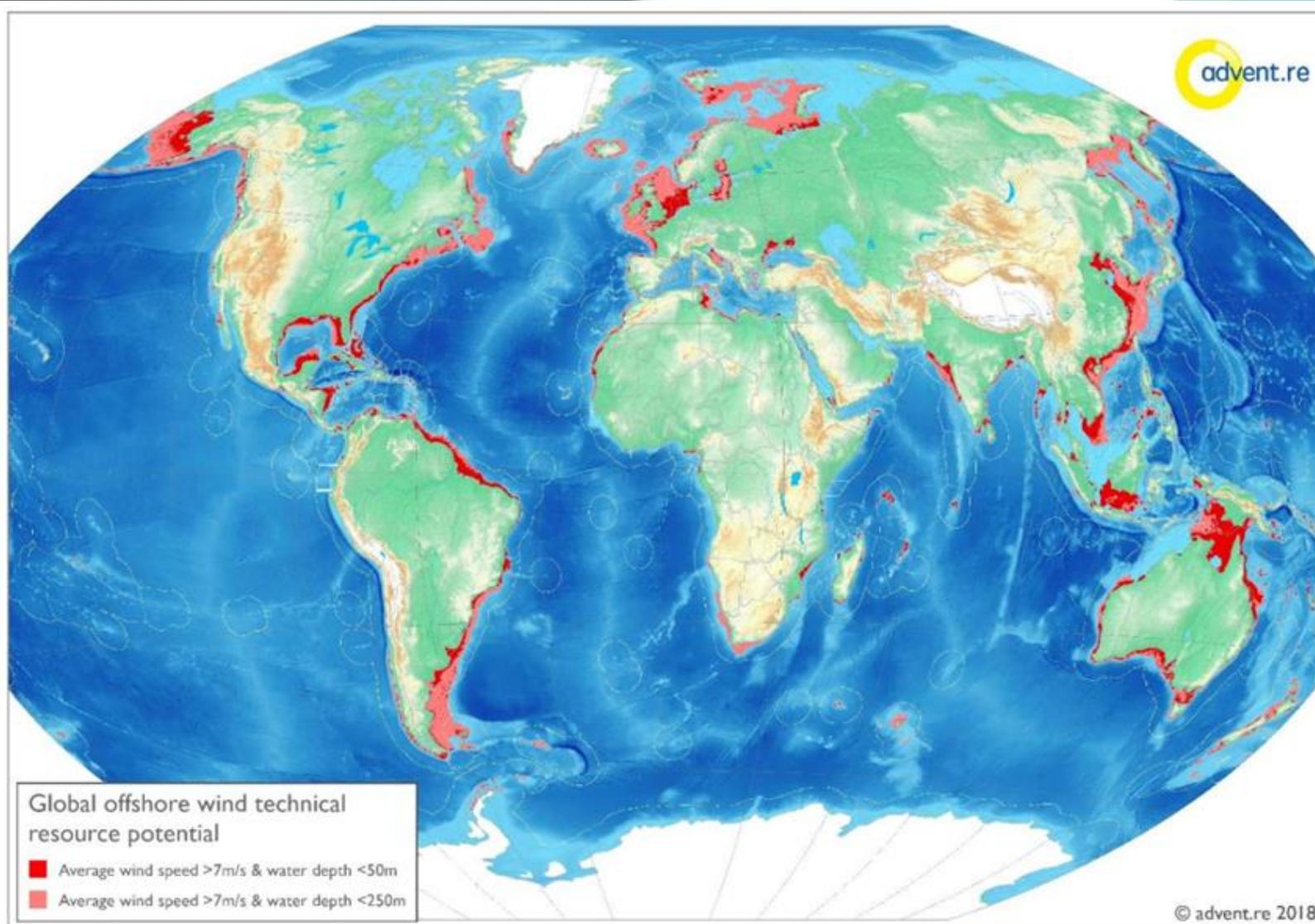
# Mature, cost effective & low carbon offshore wind energy technology seeking markets...



Source: BNEF. 2019. Offshore Wind Roundtable Tokyo: Global trends & local opportunities. Available at: <https://www.bnef.com/core/insights/20553>

- Offshore wind
- Borssele 1&2 (NL)
- Triton Knoll
- ▲ NNG (UK)
- Vesterhav (DK)
- Hornsea 2
- ▲ EA1 (UK)
- Kriegers Flak (DK)
- ▲ Moray Firth
- Horns Rev 3 (DK)
- Borssele 3&4 (NL)

# Offshore wind resource potential: untapped Atlantic coastlines





# Integrated Geospatial Approaches for New Offshore Wind Energy Development

Policy and fiscal landscape for transition to low carbon renewable energy infrastructure

Science-driven high quality wind data infrastructure

Marine Spatial Planning mechanisms to inform development around multi-use zones

Mechanisms for translation into technology- & policy-driven scenario planning

Standardised & comparative geospatial approaches

Market- & technology-driven landscape for investment in offshore wind energy infrastructure

Informed management for cost-effective planning, licensing, construction and operation of Offshore Wind Energy infrastructure

# A South African Example: Integrated Geospatial Approaches for New Offshore Wind Energy Development



Degraded, insufficient, coal dominated & debt-laden generational capacity with Eskom. New Integrated Resource Plan (IRP) expected 2020.

Policy and fiscal landscape for transition to low carbon renewable energy infrastructure

Regional high resolution earth observation & wind models, plus new MSP capabilities in place...

Standardised & comparative geospatial a

Market- & technology-driven landscape for investment in offshore wind energy infrastructure

Climate change mitigation financing mechanisms for Eskom debt relief and new IRP will push towards renewables

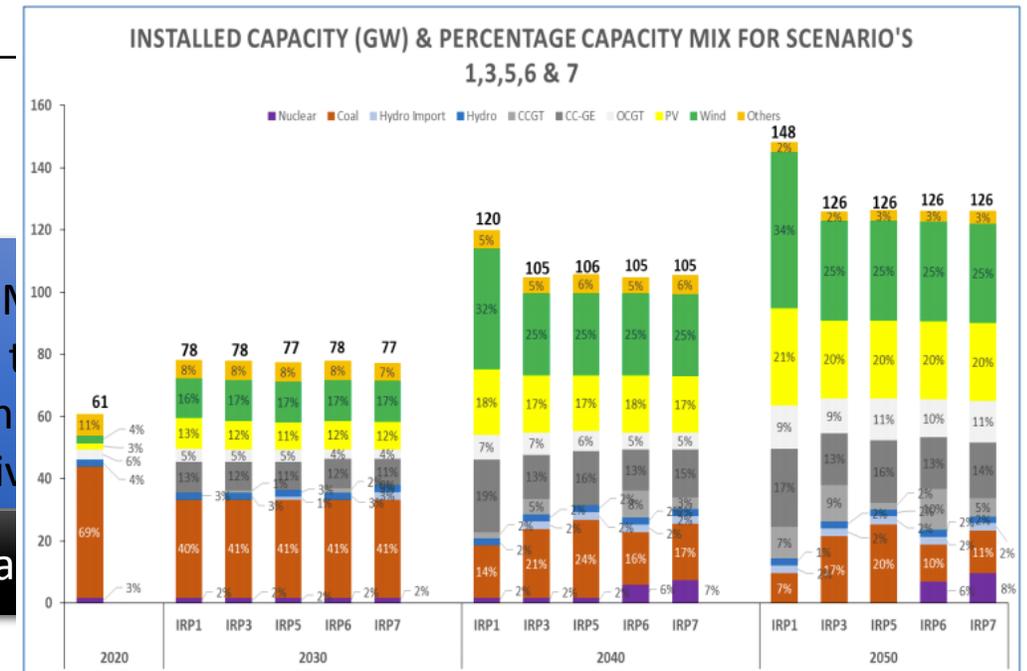
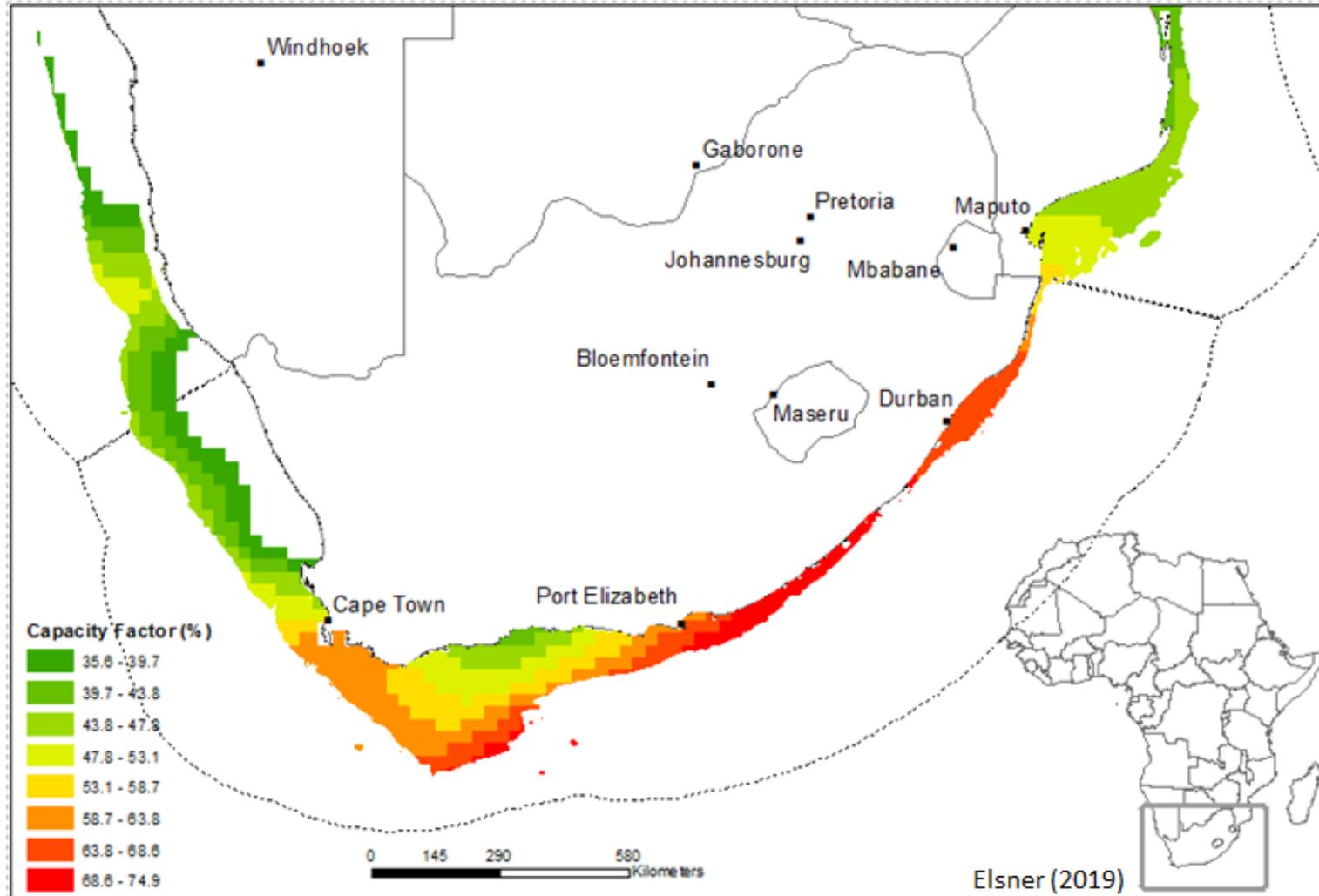


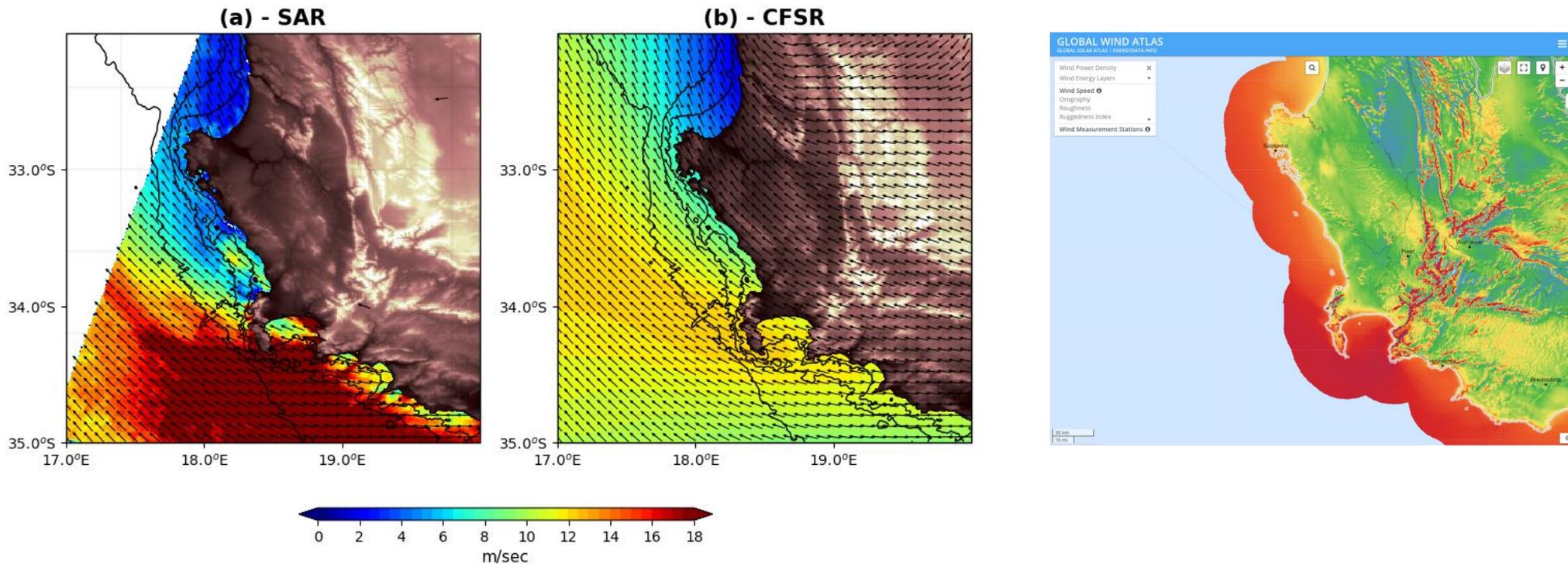
Figure 17: Installed Capacity (GW) for the No RE Annual Build Rate (IRP1), Median-growth (IRP3), Market-linked Gas Price (IRP5), Carbon Budget (IRP6) and Carbon Budget plus Market-linked Gas Price (IRP7) Scenarios

# Offshore wind potential South Africa: marine spatial planning (MSP) and higher resolution wind products needed for more detailed analysis



# Offshore wind potential South Africa: marine spatial planning (MSP) and higher resolution wind products needed for more detailed analysis

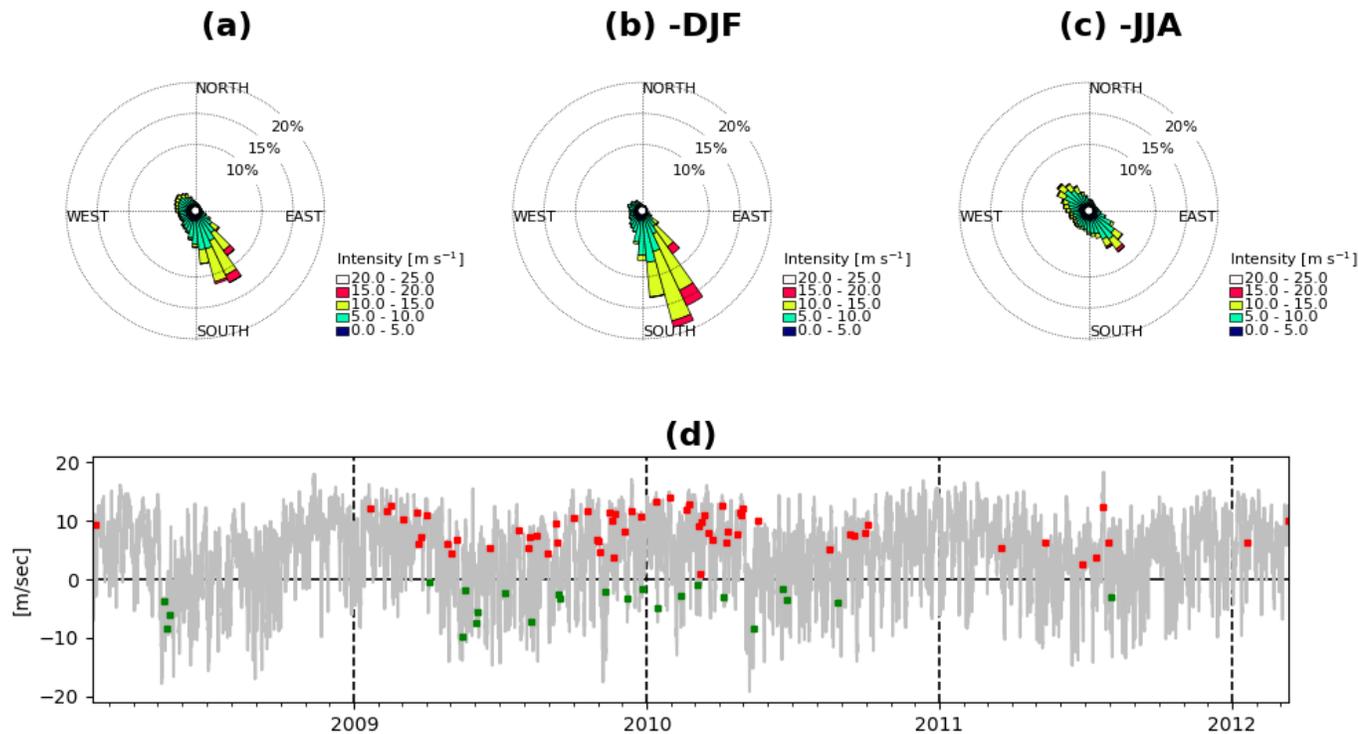
Wind speed estimates from global reanalyses products and observations can show significant discrepancies leading to inaccurate assessment of the wind potential, and extreme events...



Wind speed from (a) observations from the Advanced Synthetic Aperture Radar (ASAR) on 29 April 2010 and (b) from the CFSR reanalysis on the same day. Observations from Synthetic Aperture Radars are able to highlight the high spatial variability which characterises coastal regions.

# Offshore wind potential South Africa: marine spatial planning (MSP) and higher resolution wind products needed for more detailed analysis

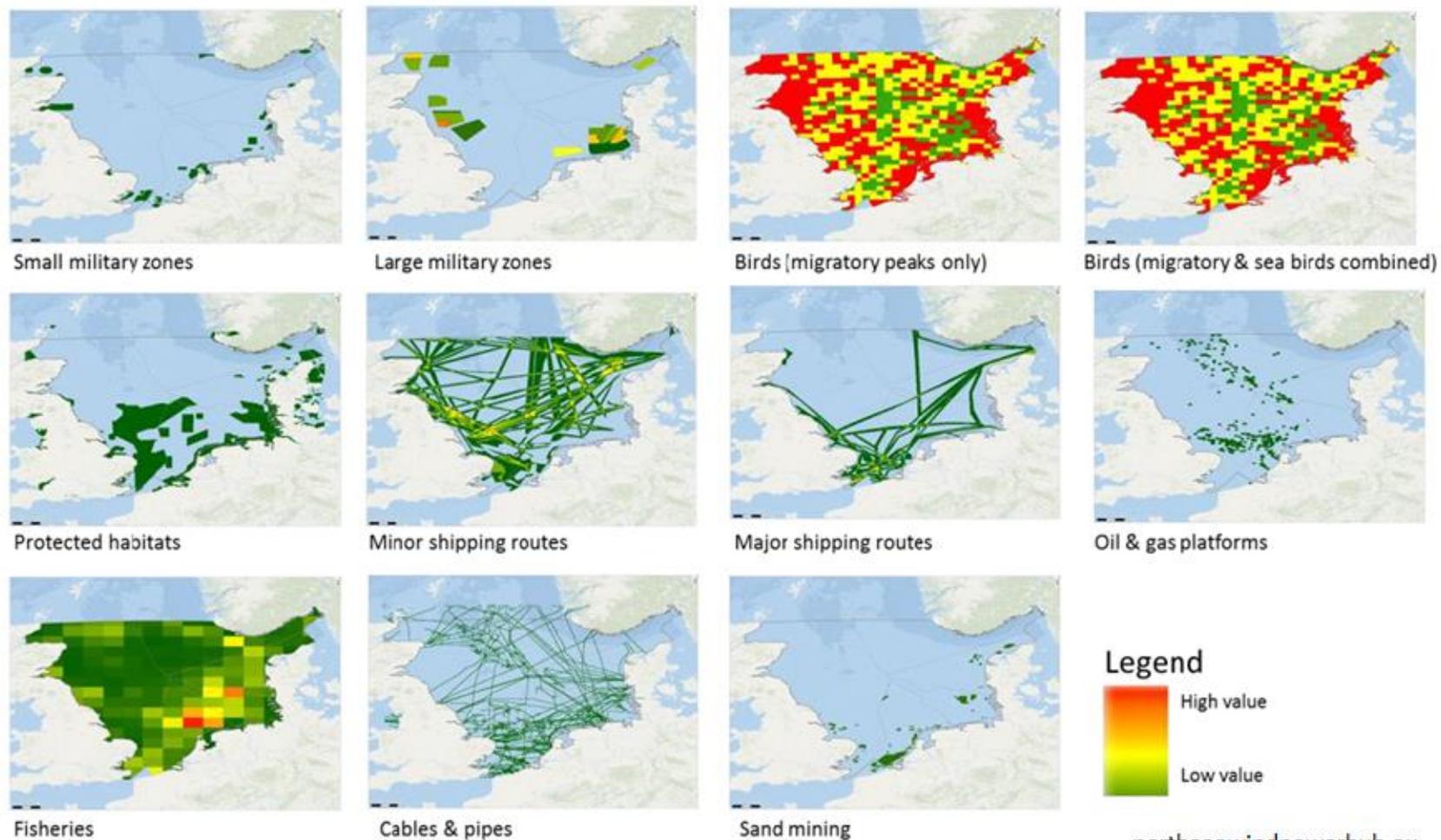
Estimates of wind variability are necessary for an adequate estimation of the wind energy potential. Statistics on wind variability can be derived from model outputs, global reanalyses products and long-term satellite records. **Most valuable products will come from new SAWS high resolution wind models validated with both EO and in situ data...**



Example of wind roses and time-series derived using outputs from the global Climate Forecast System Reanalysis (CFSR) off the Cape Peninsula (South Africa).

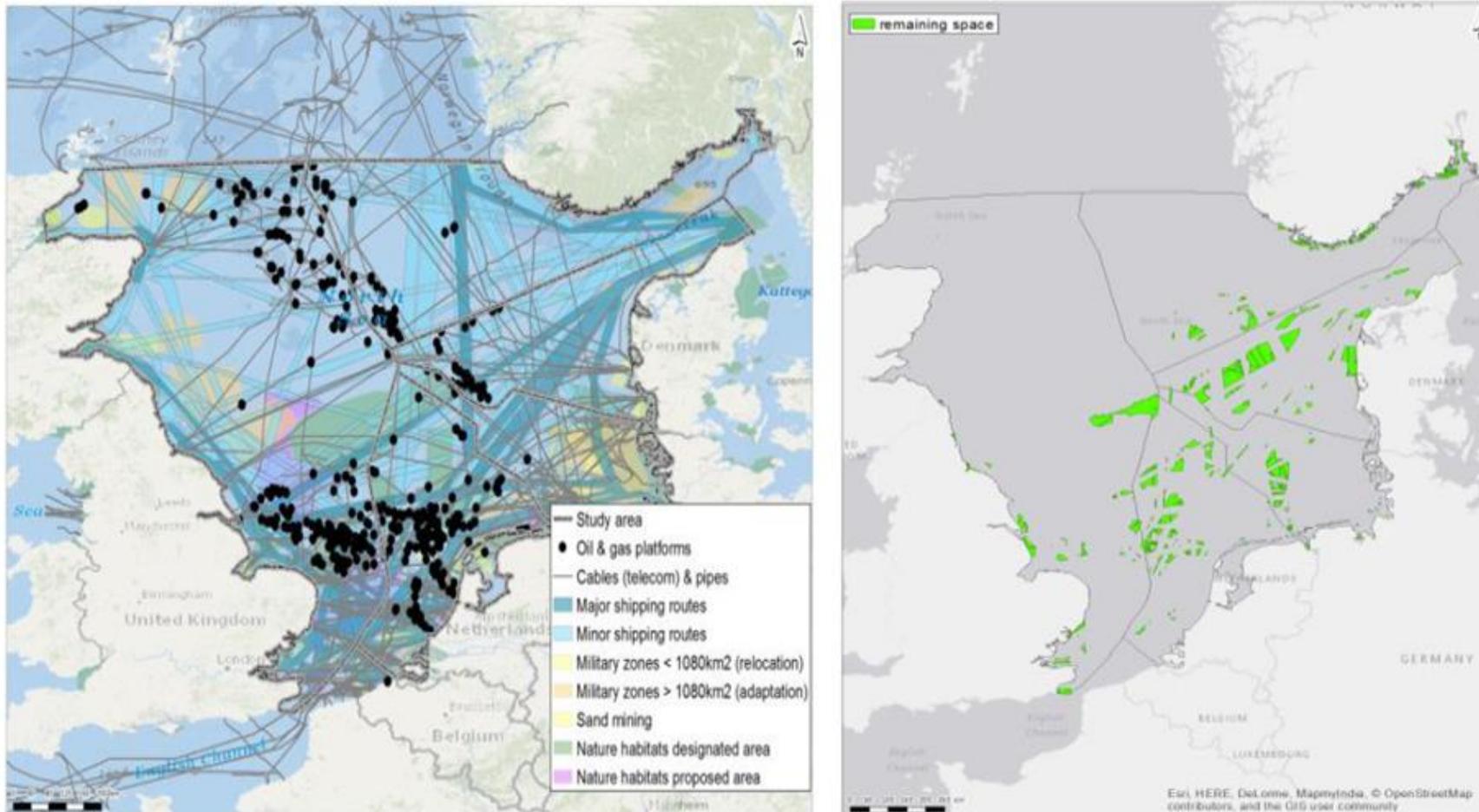
# Marine Spatial Planning for identifying potential stakeholder conflicts

Figure 4.10 Individual spatial cost maps

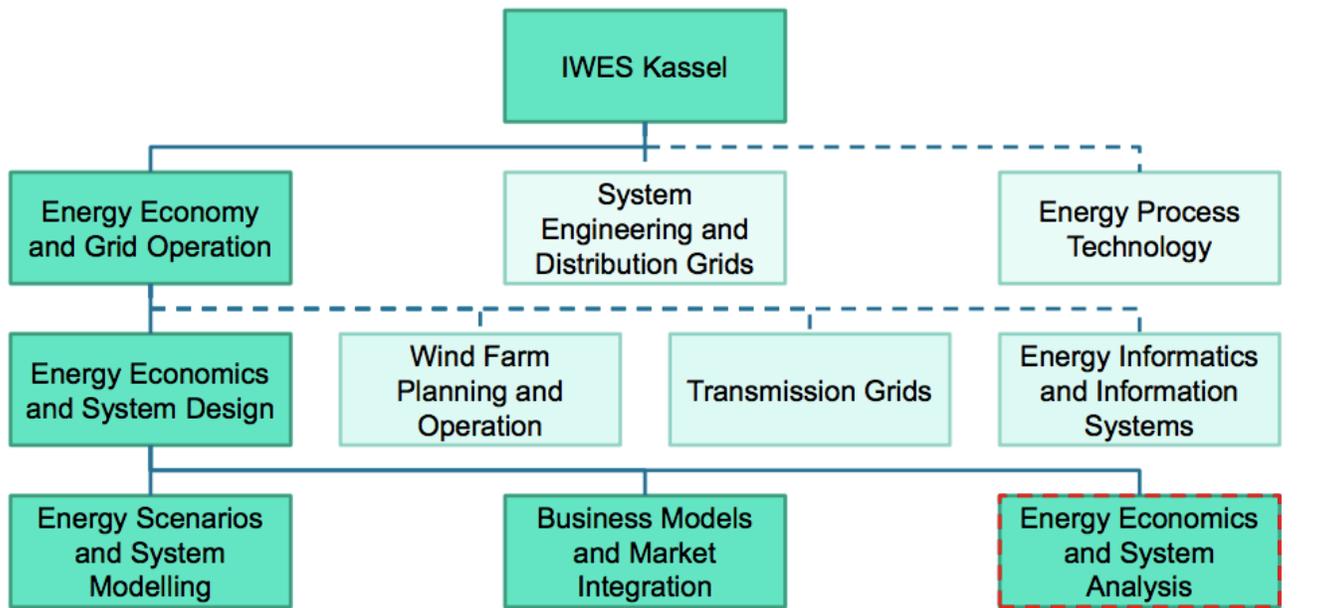


# Marine Spatial Planning for site identification

Figure 2.1 Overview of the present space used in the North Sea [left], remaining space (depth < 55 m) [right]



# Mechanisms for translation into technology & infrastructure assessment & national planning & policy mechanisms



REV 1

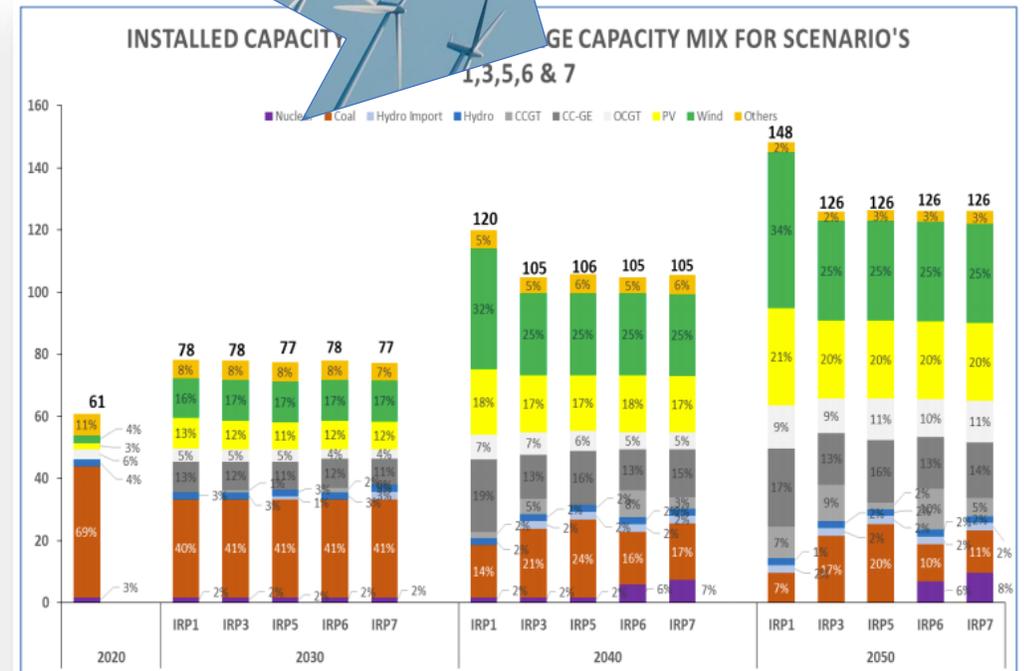
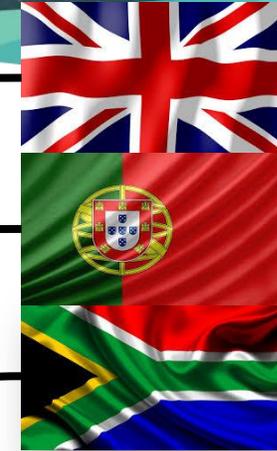
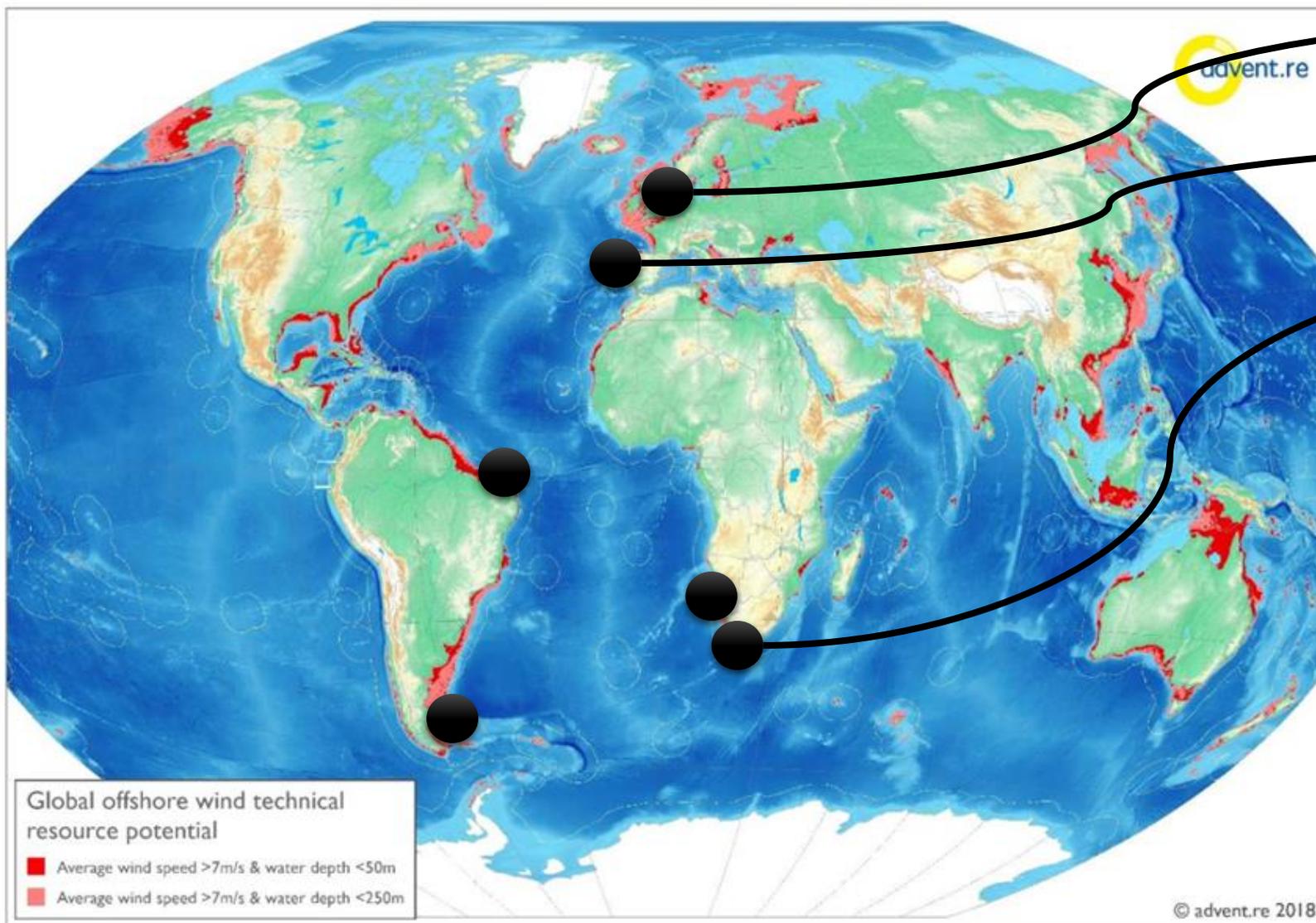


Figure 17: Installed Capacity (GW) for the No RE Annual Build Rate (IRP1), Median-growth (IRP3), Market-linked Gas Price (IRP5), Carbon Budget (IRP6) and Carbon Budget plus Market-linked Gas Price (IRP7) Scenarios

# A collaborative international approach - leveraging expertise, market, and funding opportunities in the developing world



Preliminary South African project with multiple SA partners, UoL in UK, and INEGI in Portugal for science-, MSP- and technology-focused scoping, to be broadened with additional resources....

Scope for African and South American expansion through GMES-Africa II, AIR, Belem Statement, etc...



**GMES**  
AND AFRICA



# Integrated Geospatial Approaches for New Offshore Wind Energy Development

Example potential socio-economic impact points from an AIR Offshore Wind Energy collaboration network:

- Aid small islands or isolated communities to speed up the replacement of foreign diesel with endogenous renewable energies...
- Assess the impact of climate change on renewable sources of energy and hydro storage, estimating the impact at a regional scale...
- Contribute to “first approach”/generic environmental impact assessment methodologies of renewable projects...
- “Crunch the numbers” from weather and earth observation (EOS) systems to obtain regional/national solar and wind resource assessment products, helping to bridge the gap from science/EOS data to standard reports shareable to developers, national officials, funding, OEMs...



# Integrated Geospatial Approaches for New Offshore Wind Energy Development

- South African preliminary assessment project excellent starting point as collaboration showcase:
  - Offshore wind energy little explored resource in South Africa, and emerging political/market/technology/science landscape offers very good potential for OWE development...
  - Established bottom up/top down South African network for science/MSP/resource planning institutes (Council for Scientific & Industrial Research, South African Weather Service) and government (Department of Energy, Department of Environment, Forestry & Fisheries)
  - Establishing expertise collaboration with UK (University of London) and Portugal (INEGI)
  - Need to establish collaboration with technology & market-oriented partners e.g. World Bank
- Modular science & planning structure offers ability to use comparative approaches across Atlantic regions and leverage off established knowledge & capability
- AIR Centre has important role to play in both exchange of expertise & vertically integrated structure offers ability to use science networks & top down collaboration in tandem