OPIN CIG Scoping Meeting
Corrosion: Impacts and Solutions

June 11th 2020

Interreg
EUROPEAN UNION
North-West Europe
OPIN
European Regional Development Fund

Welcome to the CIG scoping meeting

- Attendees microphones will be muted during the presentation. 
- After the presentation there will be time for interaction during the Q&A/Discussion Session.
- Questions can be formulated in the chat at any time and they will be addressed during the Q&A/Discussion session. 
- If you would like to make a comment or ask a question directly during the Q&A/Discussion session, please type “Speak” in the chat. We will then let you know when you can unmute your microphone.
- The meeting will be recorded and the slides will be shared on OPIN website.

Interreg North-West Europe OPIN
EUROPEAN UNION
European Regional Development Fund

Agenda

13:00 – 13:15	**Introduction - OPIN and CIGs** *(Solène Goy – SEAI)*
13:15 – 13:45	**Corrosion: Potential CIG topics** *(Jeroen Tacq & Bart Teerlinck – Sirris)*
13:45 – 14:25	**Q&A / Discussion**
14:25 – 14.30	**Closing remarks** *(Bart Teerlinck – Sirris)*

Interreg North-West Europe OPIN
European Regional Development Fund

OPIN Introduction

Solène Goy - SEAI

Interreg North-West Europe OPIN

EUROPEAN UNION

European Regional Development Fund

What is OPIN ?

Ocean Power Innovation Network (OPIN) is a **European collaborative network**

OPIN Aim:

- Develop both cross-regional and cross-sectoral **collaboration**

OPIN Targets:

- Support over 100 companies
- Develop a self-sustaining network (>200 members)

3 years from 2019 to 2021

2.6M€ total project budget

1.5M€ in financial support from Interreg North West Europe

Join the network (free)

Interreg North-West Europe OPIN

European Regional Development Fund

Who are OPIN ?

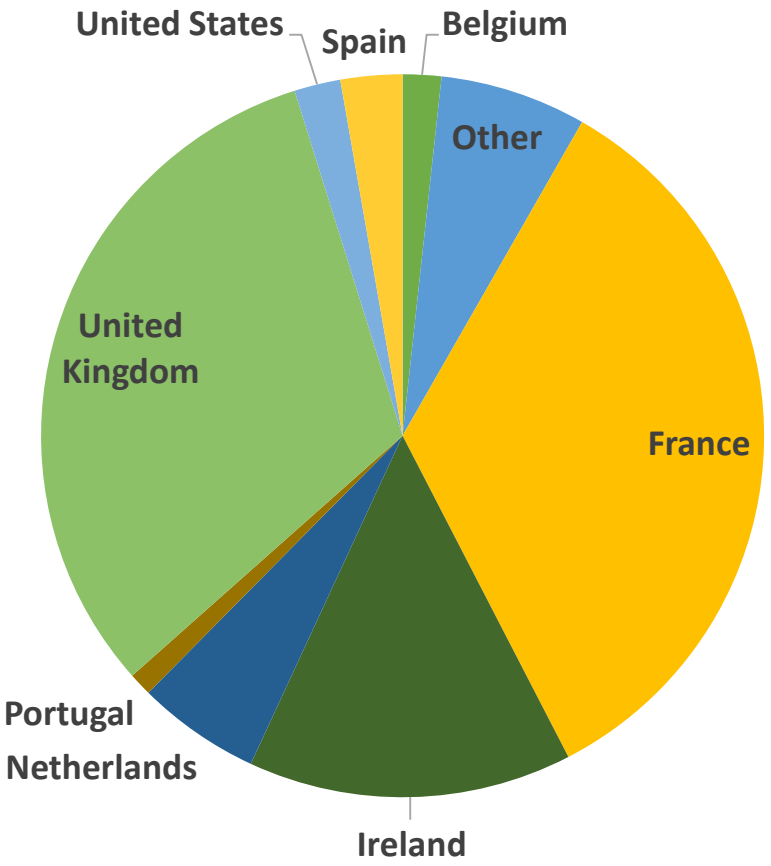
7 partners from Ireland, UK, Belgium, France, the Netherlands and Germany

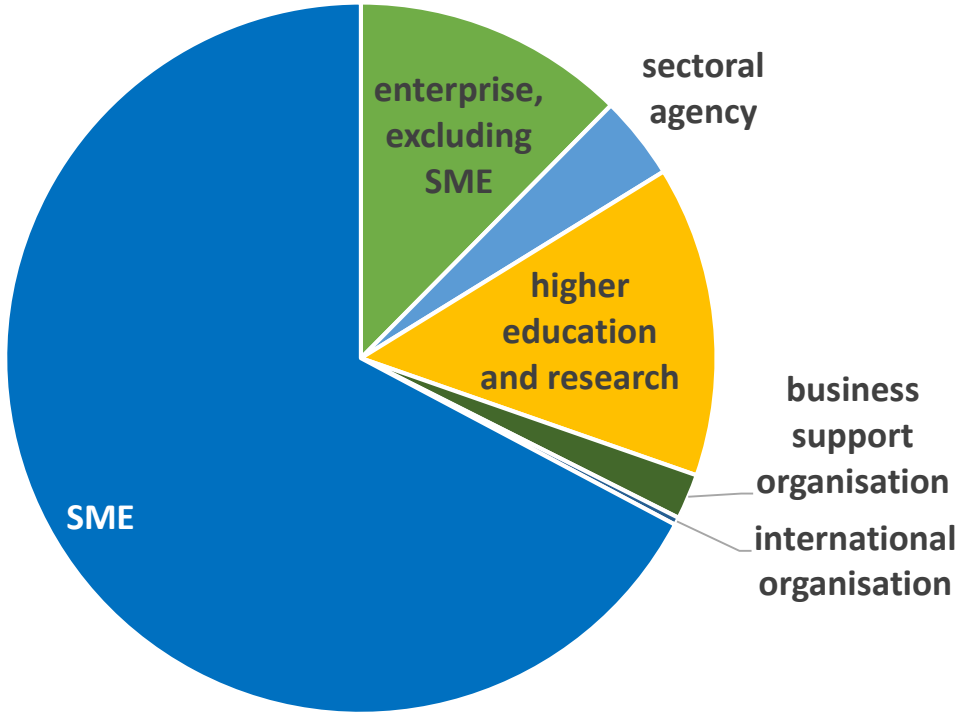
Project Partners	Countries/Regions
Sustainable Energy Authority of Ireland (SEAI)	Ireland
Scottish Enterprise (SE)	Scotland
Offshore Renewable Energy Catapult (OREC)	United Kingdom
Sirris, het collectief centrum van de technologische industrie (SIRRIS)	Belgium
West Atlantic Marine Energy Community, École Centrale de Nantes (WEAMEC)	France Pays de la Loire
Dutch Marine Energy Centre (DMEC)	Netherlands
Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. (Fraunhofer IEE)	Germany

Interreg North-West Europe OPIN
European Regional Development Fund

OPIN Members

290 members from
24 countries





Other countries (2 members or less):
Australia, Canada, Denmark, Finland, Germany, Hong Kong, India, Indonesia, Italy, Malaysia, Monaco, Norway, Russia, Sweden, Switzerland, Vietnam

Interreg North-West Europe OPIN
European Regional Development Fund

What can OPIN do for you (1/2)

Access **free events**: learning and networking opportunities

- **OPIN Scoping meeting: Mooring Lines and Anchoring Solutions**
  17/06/20, online
- **OPIN Webinar: Funding Opportunities for the Offshore Renewable Energy Sector**
  24/06/2020, online
- **OPIN/TIGER Webinar: Tidal Supply Chain Opportunities**
  09/07/20, online
- **OPIN Workshop: Challenges and Solutions for Improved Durability of Materials**
  22/10/20, Antwerp, Belgium

Have a look at our Events page and register today !

Interreg North-West Europe OPIN
European Regional Development Fund

What can OPIN do for you (2/2)

Access **expert advice** on your technology (TAPs)

- ✓ Independent expert opinion – e.g. on the route to market, on reducing development risks and costs, etc.
- ✓ Advice on next steps, funding and collaboration opportunities

Support **collaborative projects** (CIGs)

- ✓ Preparatory step to National and EU research calls
- ✓ Find ways to solve technical or financial problems you are facing
- ✓ Expand your network nationally and internationally
- ✓ Benefit from the experience of those in other industries

Receive **travel support**

- ✓ Enabling Irish and Scottish SMEs to travel abroad for OPIN events

Interreg North-West Europe OPIN
EUROPEAN UNION
European Regional Development Fund

OPIN Resources

OPIN Members list

OPIN Library:

- Workshops/masterclasses presentations
- Value chain study - summary report
- Ocean energy challenges and recommendations: Desktop analysis of studies and reports

OPIN Twitter and Linkedin groups. Join us for the latest updates!

Email us at: OPIN@seai.ie

Interreg North-West Europe OPIN
European Regional Development Fund

Collaborative Innovation Groups (CIGs)

Solène Goy - SEAI

Interreg North-West Europe OPIN

EUROPEAN UNION

European Regional Development Fund

What is a CIG?

CIG: Collaborative Innovation Group

CIG Format:

- Clusters of SMEs with research / large companies
- Project objectives and outputs

CIG Aim:

- Solve specific problems which are barriers to deployment of ocean energy
- Work up an idea, product, process, funding application

Benefits of CIGs

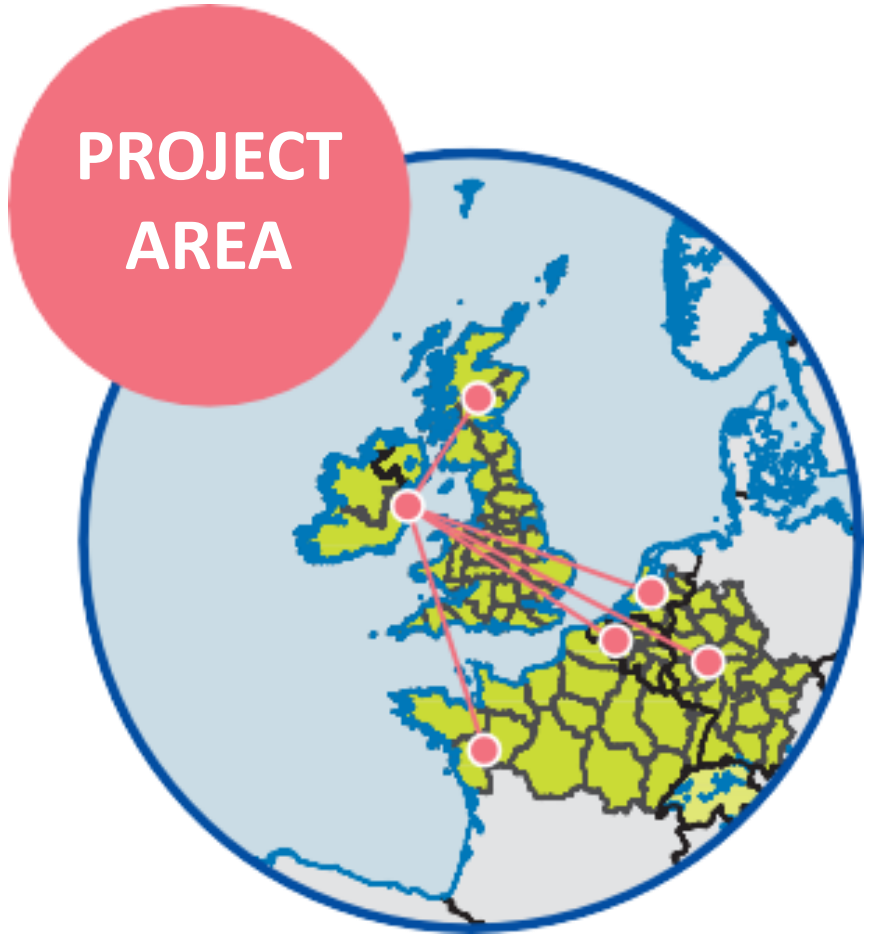
- Solve specific problems/challenges you could not solve alone
- Explore opportunities for new products, services, markets
- Expand your network nationally and internationally
- Gain complementary skills and expertise
- Gateway to other support / Preparatory step to National and EU research calls
- …

OPIN CIG Support

- OPIN partner facilitation of the CIG
- Technical / Business Support: value up to €20,000 per CIG
- Travel support
- No financial contribution required from companies but ensure company staff / resources are available for tasks

CIG Eligibility

- Minimum of 2 SMEs
- Large companies and research organisations may participate
- Cross border – members from minimum of 2 OPIN regions
- Cross sector - recommended



Interreg
North-West Europe
OPIN
European Regional Development Fund
EUROPEAN UNION

Corrosion: Potential CIG Topics

Jeroen Tacq & Bart Teerlinck (Sirris)

Interreg North-West Europe OPIN

EUROPEAN UNION

European Regional Development Fund

GENERATE IDEAS

CIG Example:
Remote Monitoring

Challenges related to corrosion

YOUR INPUT

Start-up of CIGs

CIG Example - Remote Monitoring

Challenge

Remote monitoring to support **Design Optimisation, Asset Management and O&M** of remote and difficult to access assets.

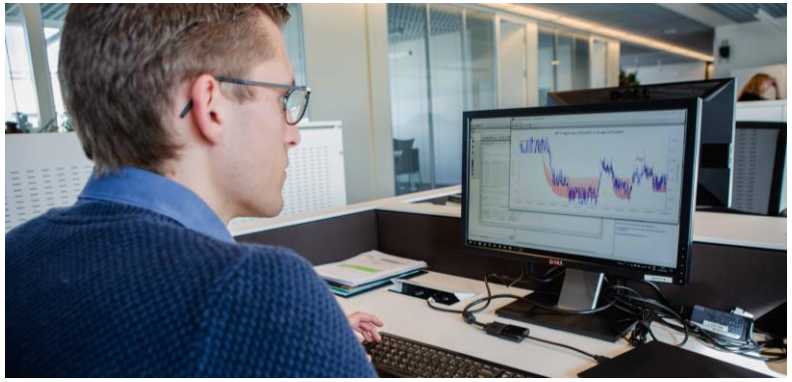
- Loads, environmental parameters and corrosion, Structural Integrity
- Mooring lines and power cables
- Cathodic protection
- Management of a larger array of devices

Scope Definition
➔ Corrosion Monitoring

Learn from Offshore Wind

Identify benefits and requirements

Move forward



Potential activities

OPIN Expert support

- State-of-the-art study
- Market study of available sensors
- Write technical specifications
- Collect and analyse partner input (templates)

Work meetings

- Identify potential economic/technological benefits of corrosion monitoring
- Discussion on technical requirements to be able to implement sensors
- Define challenges related to sensors integration
- Define future steps
- Take the first next step to a follow-up project

Required input

- Presence at meetings (in-person/online)
- Provide technological input
- Share information about challenges faced and previous experiences
- Review of meeting and activity reports
- Active involvement in definition of follow-up project

CIG Outputs

✓State-of-the-art report

✓Requirements for remote monitoring in wave and/or tidal arrays

✓Identification of potential economic/technological benefits of remote monitoring

✓Specifications for a standardized monitoring set-up and strategy

✓Preparation for a case specific demonstration project

Where can corrosion be expected in my device?

How critical is this corrosion?

What are the most critical areas of my device?

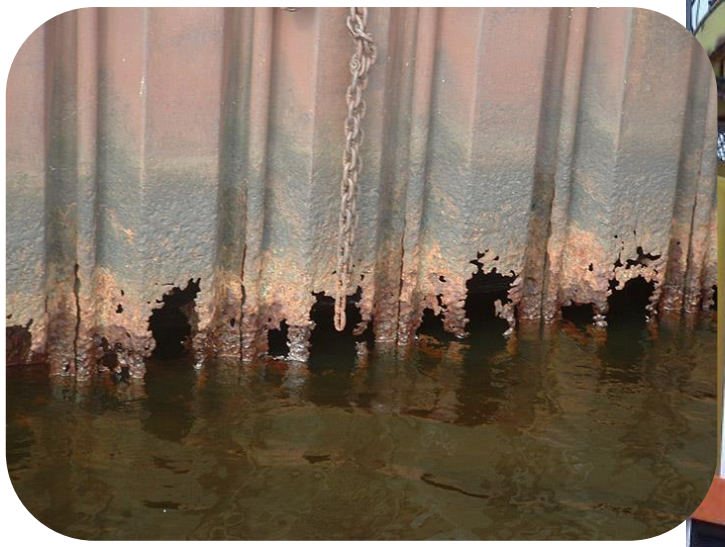
How to manage corrosion effectively?

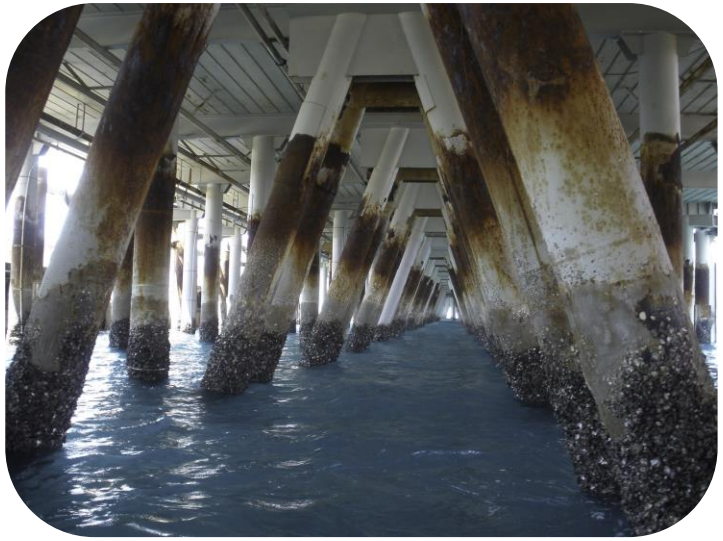
What solutions are available and how much can they cost?

I can't be the first one facing this challenge?

Potential CIG topics – Corrosion Management

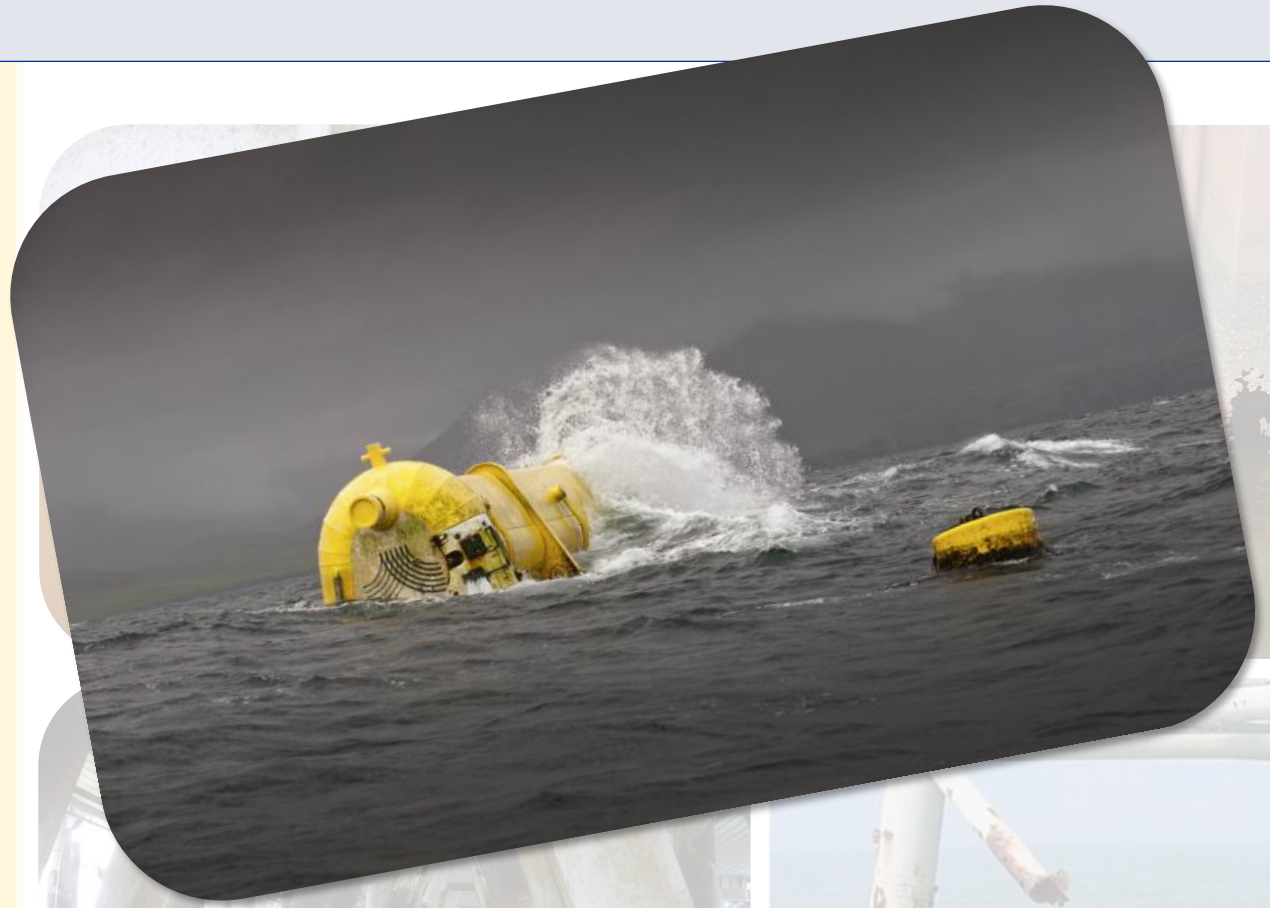
IMPACT ON LCoE





Potential CIG topics – Corrosion Management

IMPACT ON LCoE



Most aggressive: Splash zone and tidal zone.

corrosion rates up to 1-3mm/year

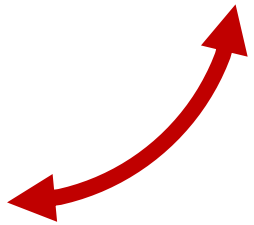
Potential CIG topics – Corrosion Management

IMPACT ON LCoE

Decisions at the design stage will influence both CAPEX and OPEX costs. Issues you must consider are:

- CAPEX
  - Materials
  - Fabrication (welding, bolts, bonding)
  - Load & safety margins
  - Deployment environment
    - Salinity, temperature, dissolved oxygen, erosion, water flow velocity
    - Other structures – circulating currents
    - Biocorrosion (MIC)
  - Corrosion protection
    - Nothing – Corrosion allowance
    - Paint – apply by hand, spray, or coating
    - Passive – anodes
    - Active – sensors and monitoring system, alarms, tolerance

- OPEX
  - Regular maintenance routine - monthly, 6 monthly, yearly?
  - Activity on inspection:
    - Accessibility - inside/outside, above splash zone/subsurface, strong currents
    - Visual inspection, clean, recoat/repair/ anode replacement
  - Options for monitoring

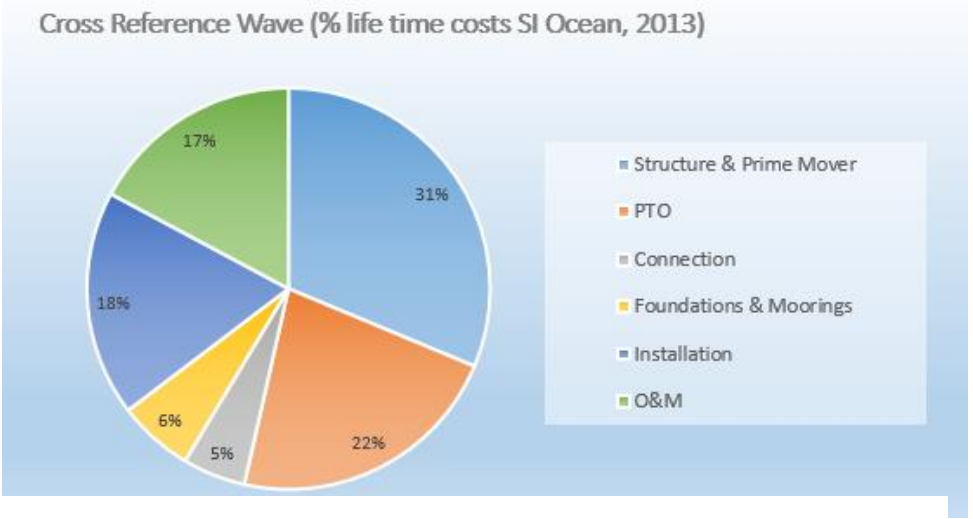


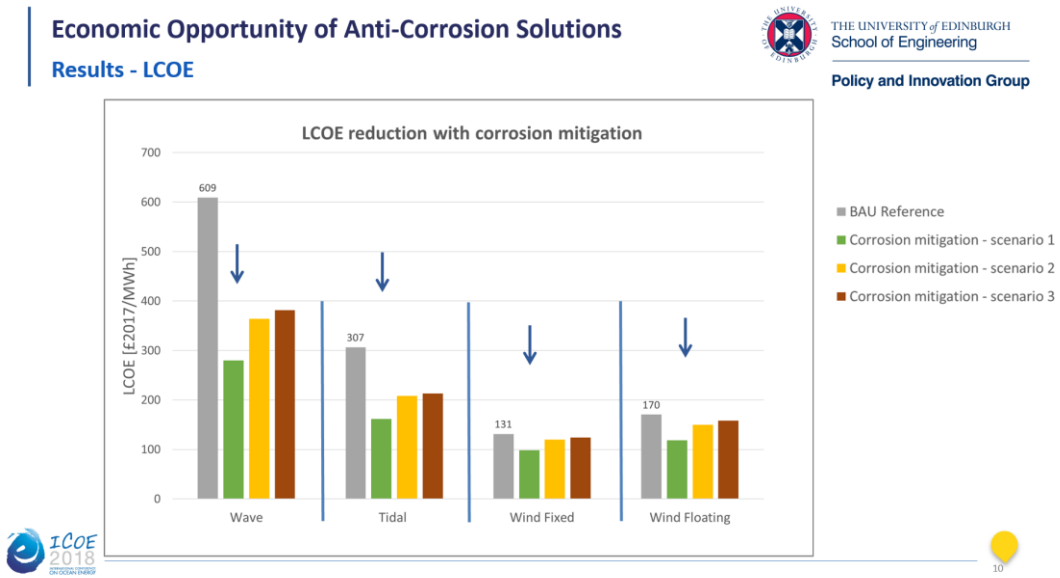
Decisions relating to one column will influence the other column.

Potential CIG topics – Corrosion Management

IMPACT ON LCoE

- ✓ What is the most cost-effective way to implement corrosion protection measures?
- ✓ Insights from existing devices?
- ✓ Standard methodology to determine the LCoE of corrosion?
- ✓ Up-front estimation for new devices?
- ✓ Assess viability of new solutions.

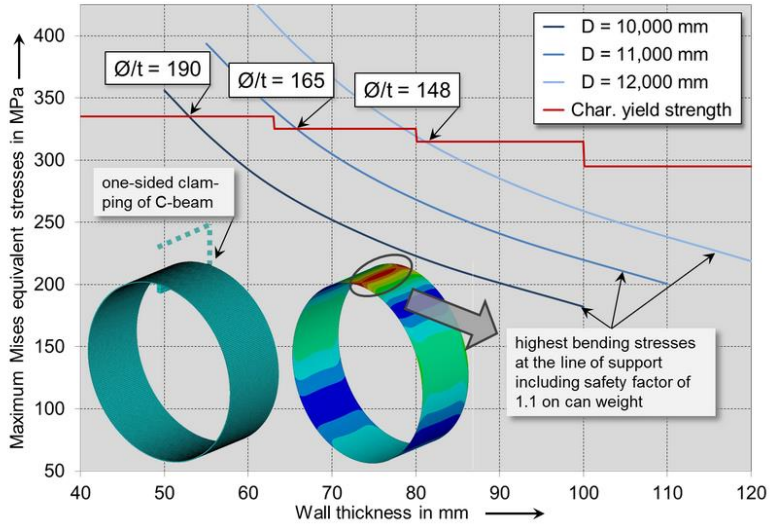




Potential CIG topics – Corrosion Management

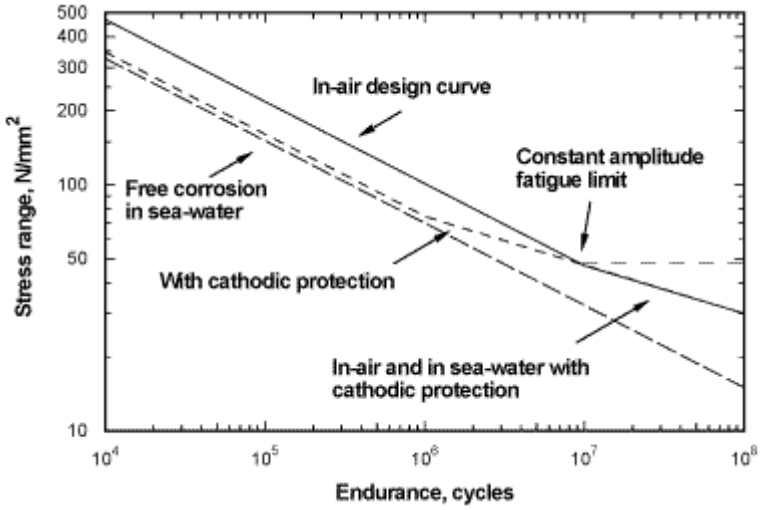
DESIGN

- ✓ Understand the relevant corrosion mechanisms and affected components during the design phase
- ✓ Ensure required service life time of the complete system
- ✓ Avoid a too conservative (expensive) design of structural components
- ✓ Minimize design risks, e.g. due to influence of corrosion on fatigue degradation



Example design chart for monopile structures

/Source: Steelwind Nordenham, https://www.offshorewind.biz/2020/05/11/beyond-xxl-slim-monopiles-for-deep-water-wind-farms



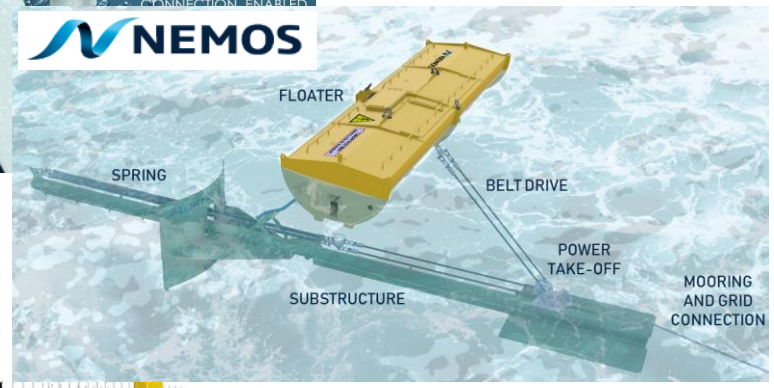
Examples of design S-N curves for steel welded joints operating in seawater

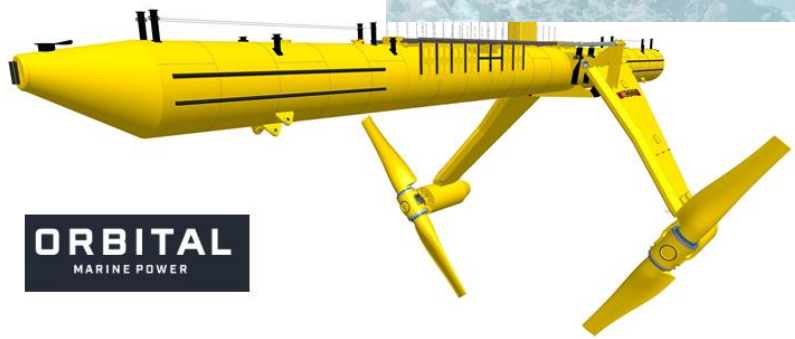
Source: S J Maddox et al.: Corrosion Fatigue of Welded C-Mn Steel Risers for Deepwater Applications: A State of the Art Review, Proceedings of OMAE 2005

Potential CIG topics – Corrosion Management

CORROSION PREVENTION

- ✓ Damage tolerant coatings
- ✓ Environmentally friendly coatings
- ✓ Protection of critical joints and bolted connections
- ✓ Use of Thermal Sprayed Aluminium
- ✓ On-site repair solutions
- ✓ Material selection
- ✓ Material combinations, including polymer composites
- ✓ Cathodic protection
- ✓ Corrosion modelling

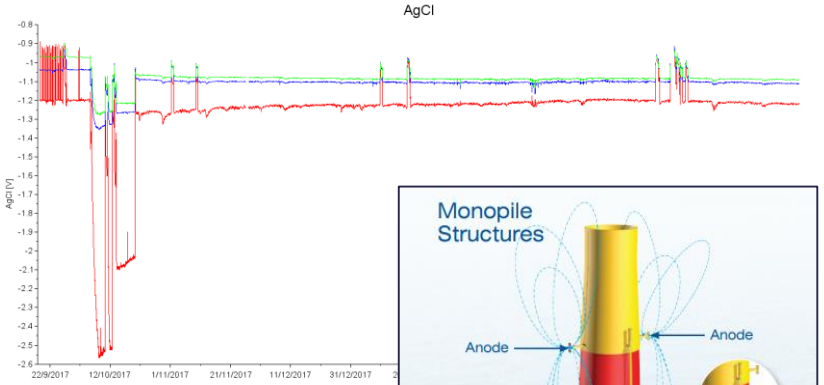




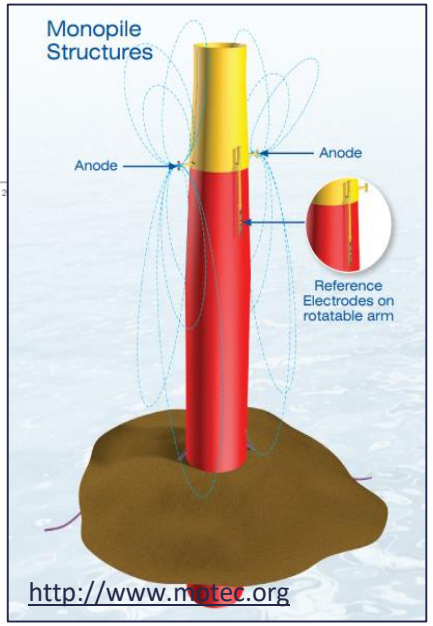
Potential CIG topics – Corrosion Management

CORROSION MONITORING

Difficult to access, remote location



Cathodic protection



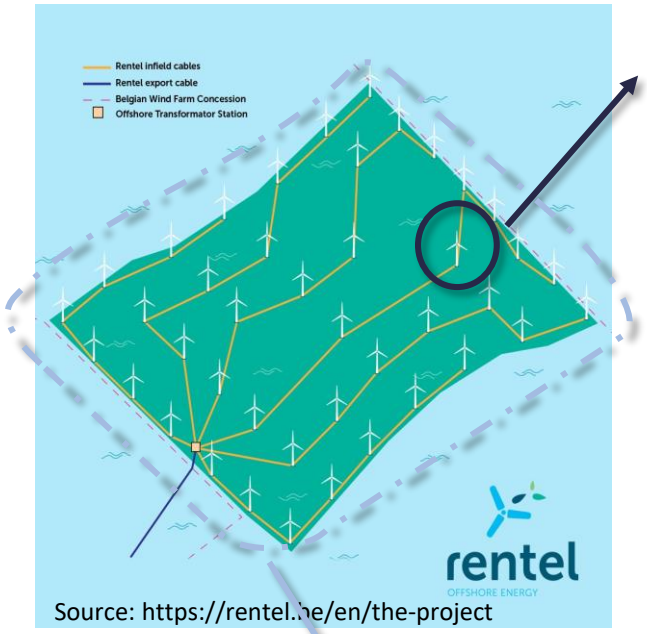
Corrosion rate

Environment

Potential CIG topics – Corrosion Management

CORROSION MONITORING

- ✓ Monitoring techniques
  - ➢ Pitting corrosion
  - ➢ Coatings
  - ➢ Acoustic Emmission based monitoring
- ✓ Data Analysis
  - ➢ Risk based Inspection
  - ➢ Remaining useful life
- ✓ Corrosion and CP models
  - ➢ Effect of high waterflow velocities
- ✓ Combination with fatigue loading
- ✓ Fleet Leader & Digital Twin Concept

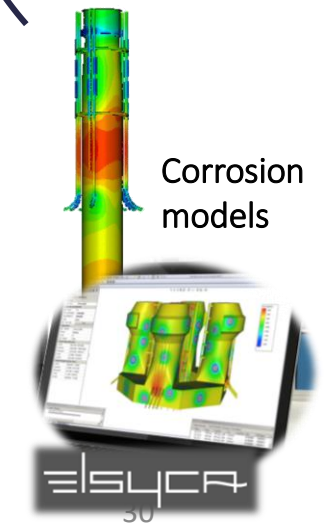


Source: https://rentel.be/en/the-project

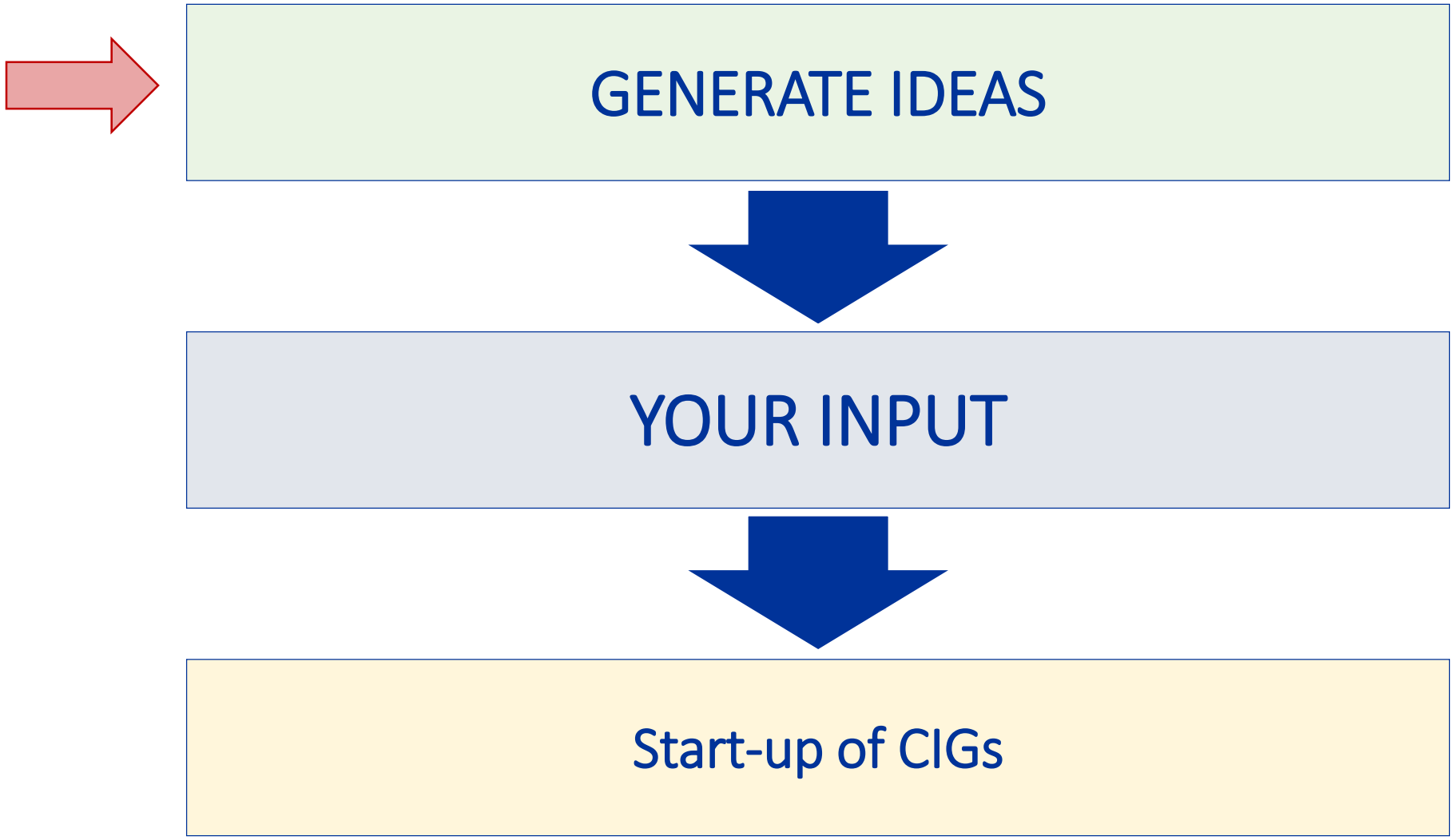
Extensive monitoring

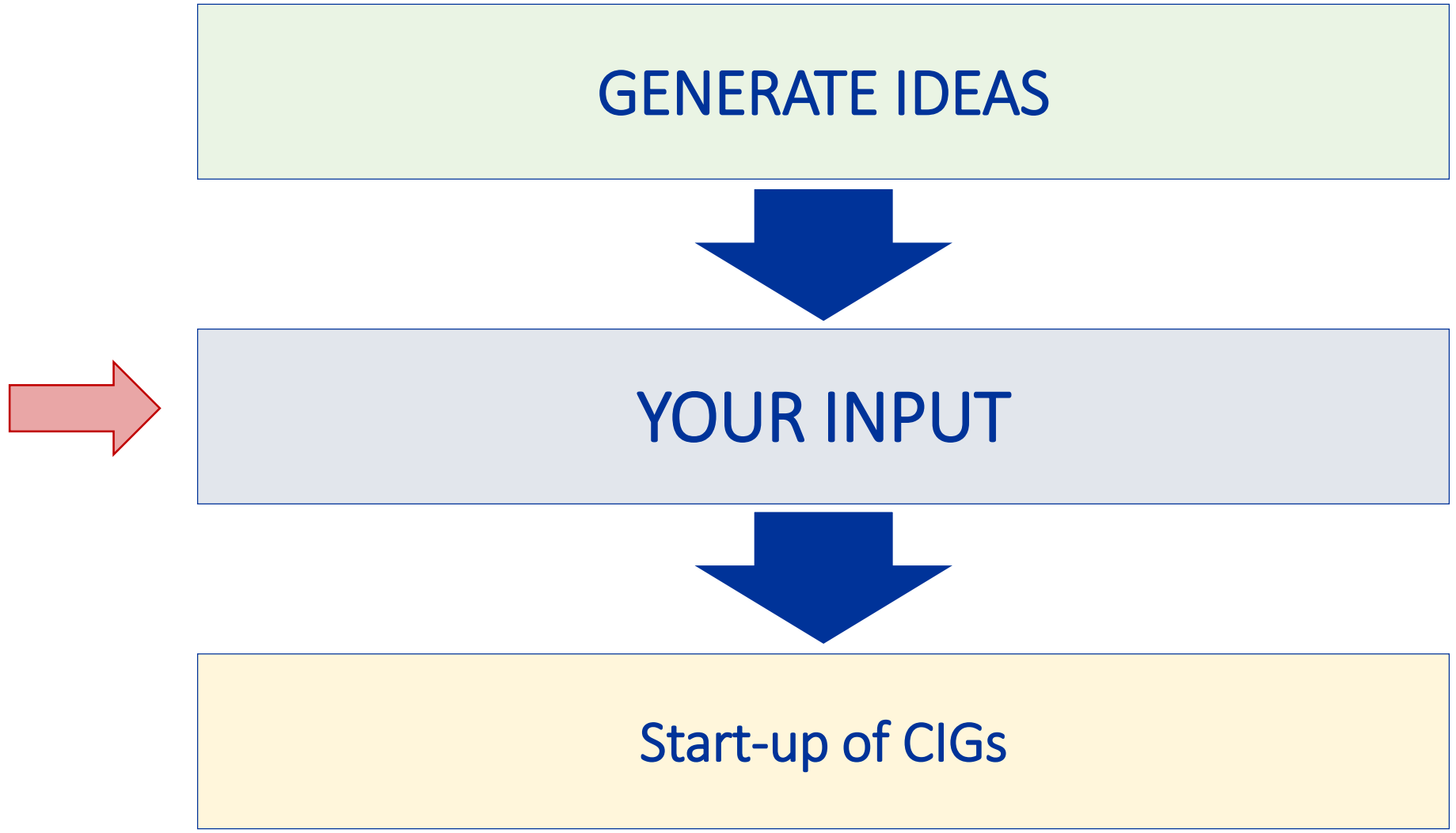
II ?

Minimal monitoring set-up

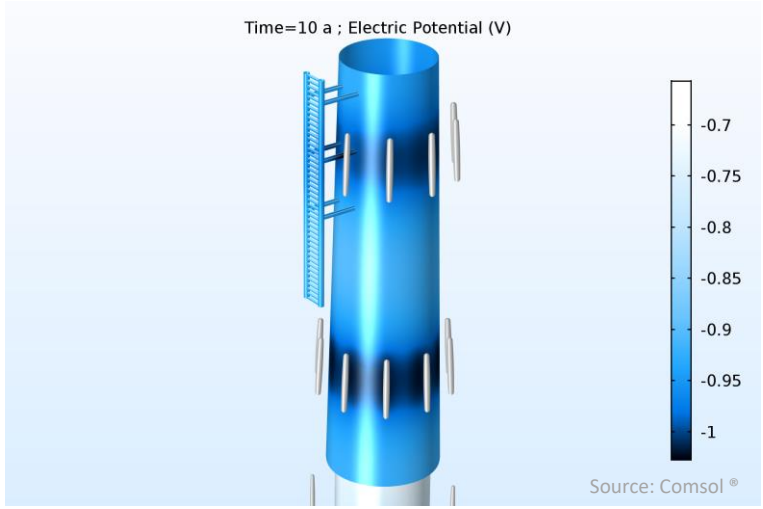


Corrosion models


GENERATE IDEAS
YOUR INPUT
Start-up of CIGs


GENERATE IDEAS
YOUR INPUT
Start-up of CIGs

Simulation and testing to establish industry benchmark.



Raise awareness,
Learn from O&G
Learn from Offshore wind.
Start at the drawing table!

Use early testing to identify corrosion hotspots and test solutions to avoid costly learning in a later stage.

Need to develop and integrate sensor technology.
Develop standardized solutions.

Avoid being over-protective of data.
Collaboration pays off.

Interreg
North-West Europe
OPIN
European Regional Development Fund

EUROPEAN UNION

OPIN@seai.ie

Thank you!