MaREI
Centre for Marine and Renewable Energy

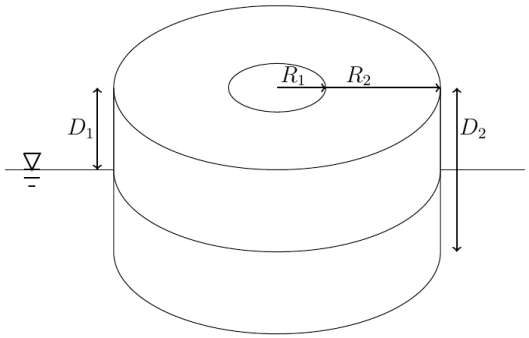
MaREI at MRIA Forum 2016

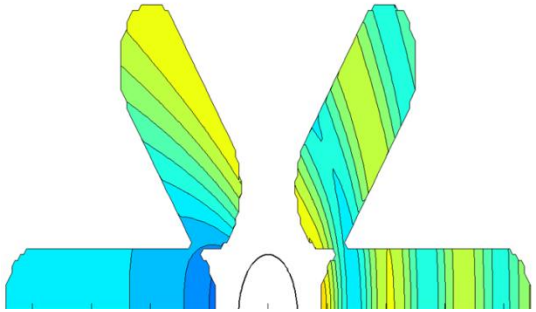
Presentation Title: Design Optimisation of WECS
Presenter Name: Christopher Wright
Platform: P1 – Wave Energy Device Design, Innovation and Optimisation

Science Foundation Ireland sfi For what's next

Design Optimisation of WECS:

- **Multiple heaving point absorbers located on a single platform**
- **Individual WEC Geometry Optimisation:**
  - **Radius**
  - **Draft**
- **Mini-Array Optimisation:**
  - **WEC spacing**





- **Modelling Tools:**
  - Frequency Domain - Hydrodynamic Parameters (ANSYS AQWA) Wavefield (AQWA FLOW)
  - Time Domain - ORCINA OrcaFlex

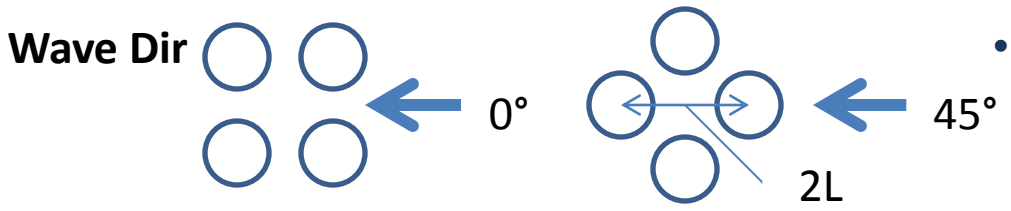
Individual WEC Optimisation

- **Radius:** 6 - 10m, **Draft:** 3 – 6m
- **Shallower Draft**:

  Strongest Performance for **CWR**, Absorbed Energy/Mass, Absorbed Energy/Surface Area, Absorbed Energy/PTO Force

  Weakest performance for **Absorbed Energy/ Pitch Moment**

Mini – Array Optimisation 4 WECS

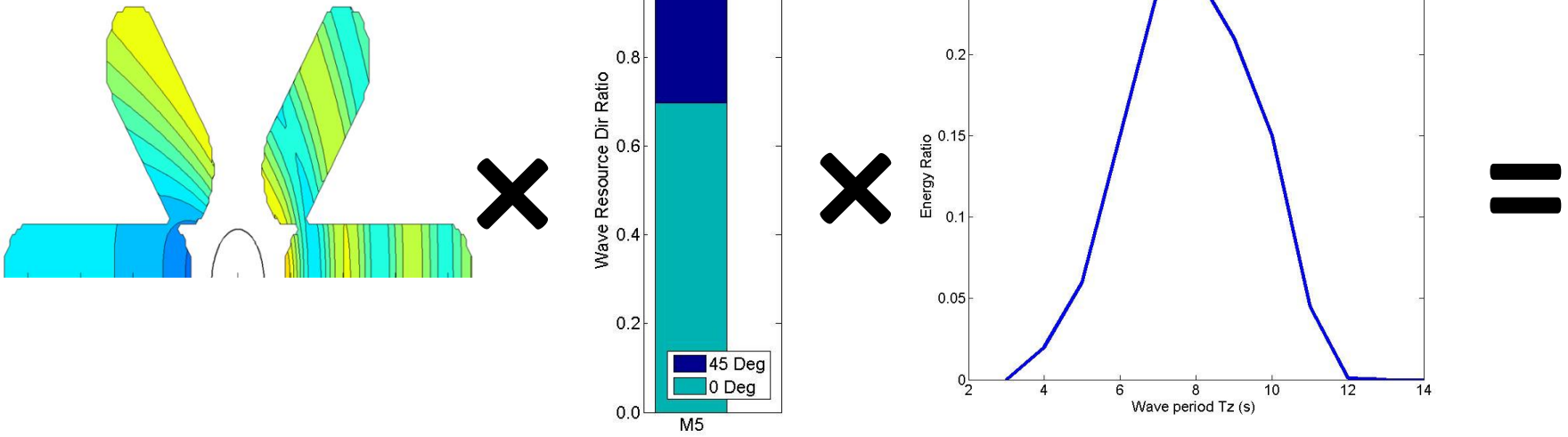


- **WEC Spacing**
  - **L = 20 - 40m**
  - **L/Diameter = L/D**
- **Wave Field**
  - **Incident**
  - **Radiated**
  - **Diffracted**
  - **PTO abs**

Mini – Array Optimisation 4 WECS

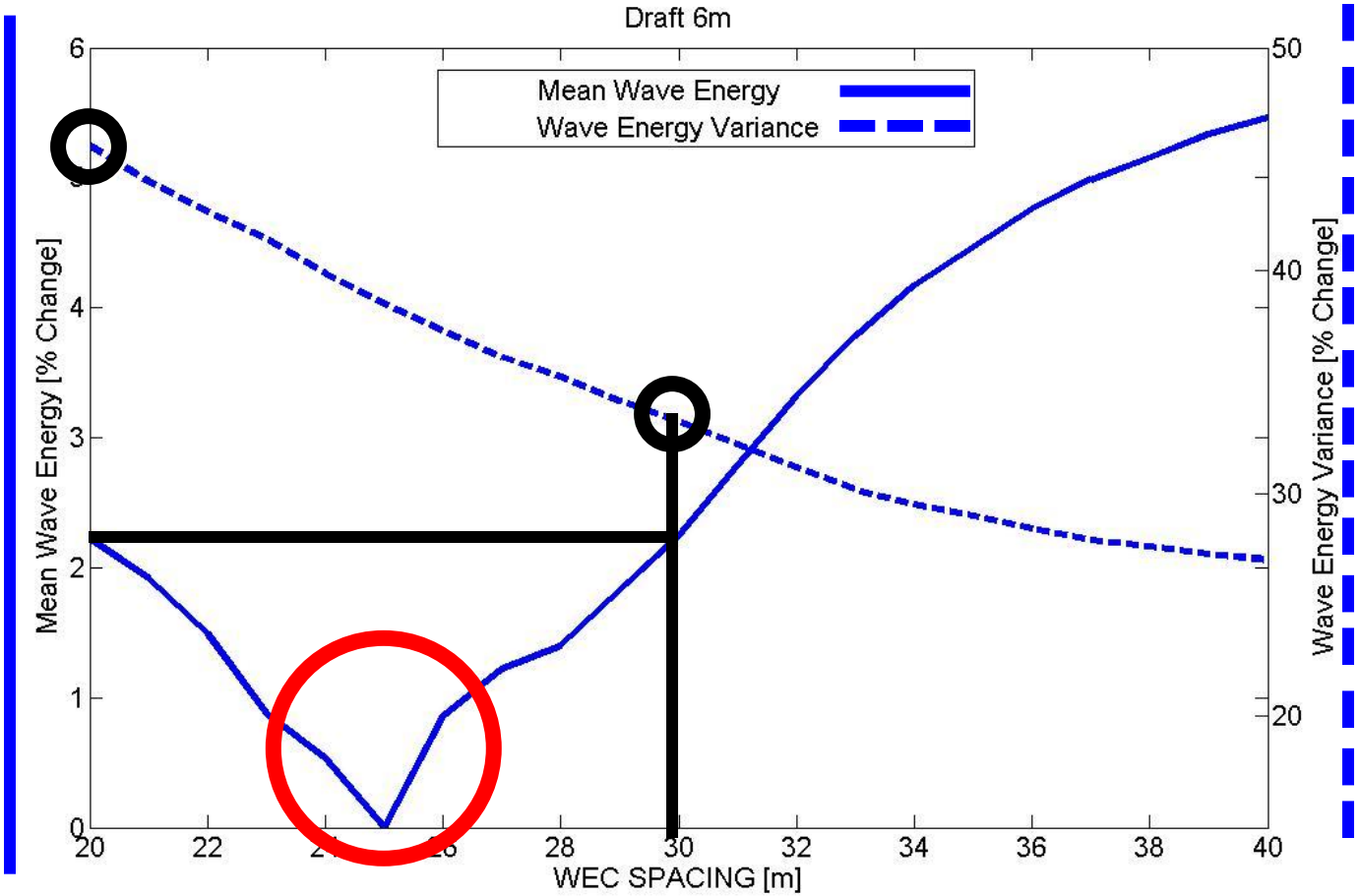
- **Wave Field Weighted by Site Factors**

Wave Field × Direction Ratio × Period Ratio =



Mini – Array Optimisation 4 WECS

- WEC Seperation Distance, Example for Diameter 20m, Draft 6m, located at M5 :
- At L = 20m & 30m Equal Mean Wave Height, Variance 47% to 33%
- **Where to AVOID!**



Design Optimisation of WECS:

- **Conclusions:**
  - **Individual WEC**
    - **Shallower Draft performs better but watch out for PITCH FORCE on platform (Only a Problem for pitch restrained devices i.e. WaveBob column reactance type, Not a problem for Ceto tether reactance type)**
  - **Mini-WEC ARRAY**
    - **Need to look at both mean wave height and WAVE HEIGHT VARIANCE**
    - **Variance will affect fatigue loading of WEC and PTO**
    - **Where to AVOID!!!**