2nd Environmental Interactions of Marine Renewable Energy Technologies conference
Stornoway, Isle of Lewis, Scotlland, 28 April – 02 May 2014

The implications of tidal resource interactions

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Introduction

- Motivation; Interaction of Tidal Developments
  - Resources are not additive
  - Environmental effects at a distance
- Modelling Approaches
  - 2D and 3D hydrodynamic models
  - Circuit diagrams
- Interactions
  - Systemic
  - Inter-Channel, [Draper et al. x 2)
  - Intra-Channel, [Easton and Woolf]
- Conclusions

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Interaction of Tidal Developments

- Resources are not additive
  - **Cannot calculate extractable energy by separate models of each site**
  - **The optimum is not obvious and requires experimentation**
  - **“Parallel is good, Serial is bad”**
- Environmental Effects
  - Local
    - E.g. displacement and collision
    - Spatial planning with GIS tools, “piled on top of each other”
  - At a distance
    - E.g. migration, **fluid dynamics**
    - **Spatial planning complicated**

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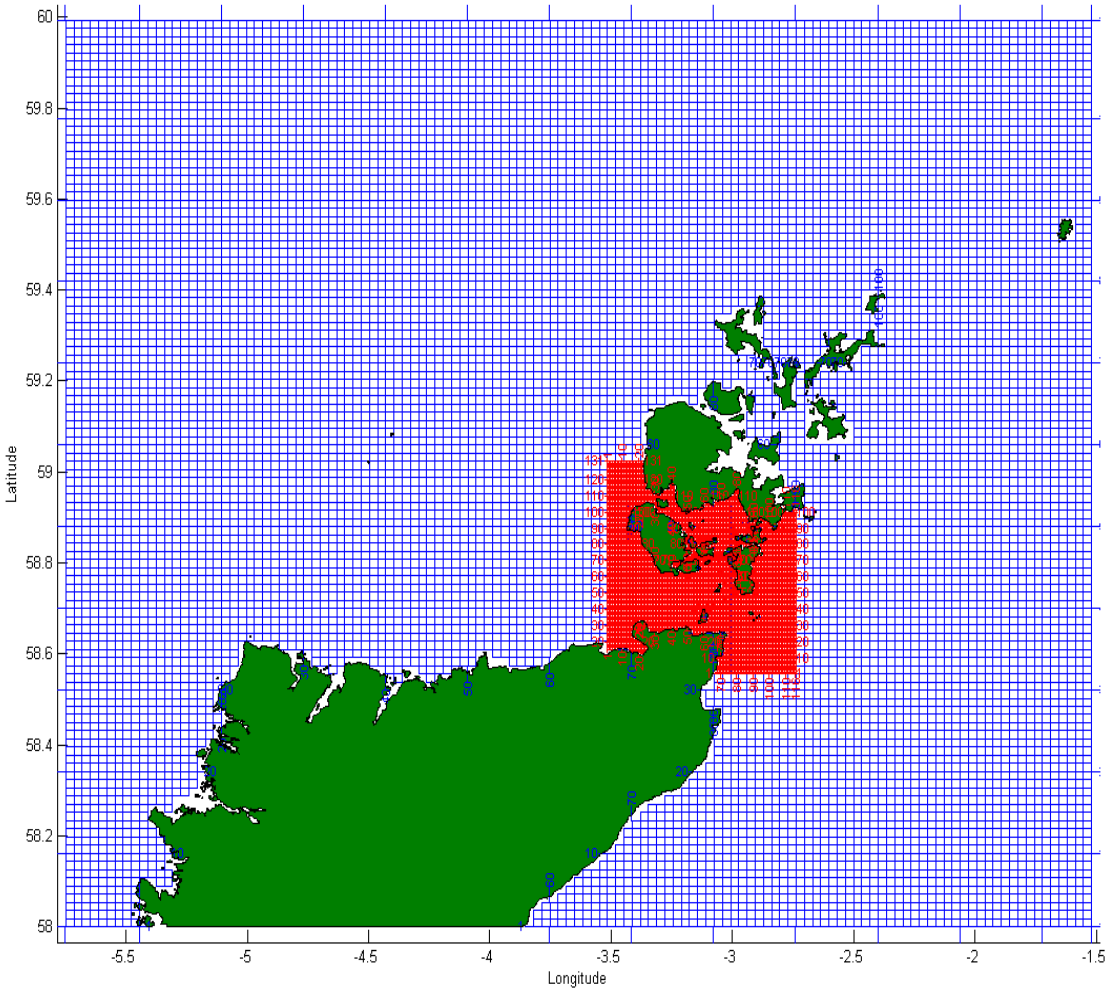
3D or 2D model with nested grid



Courtesy of Susana Baston

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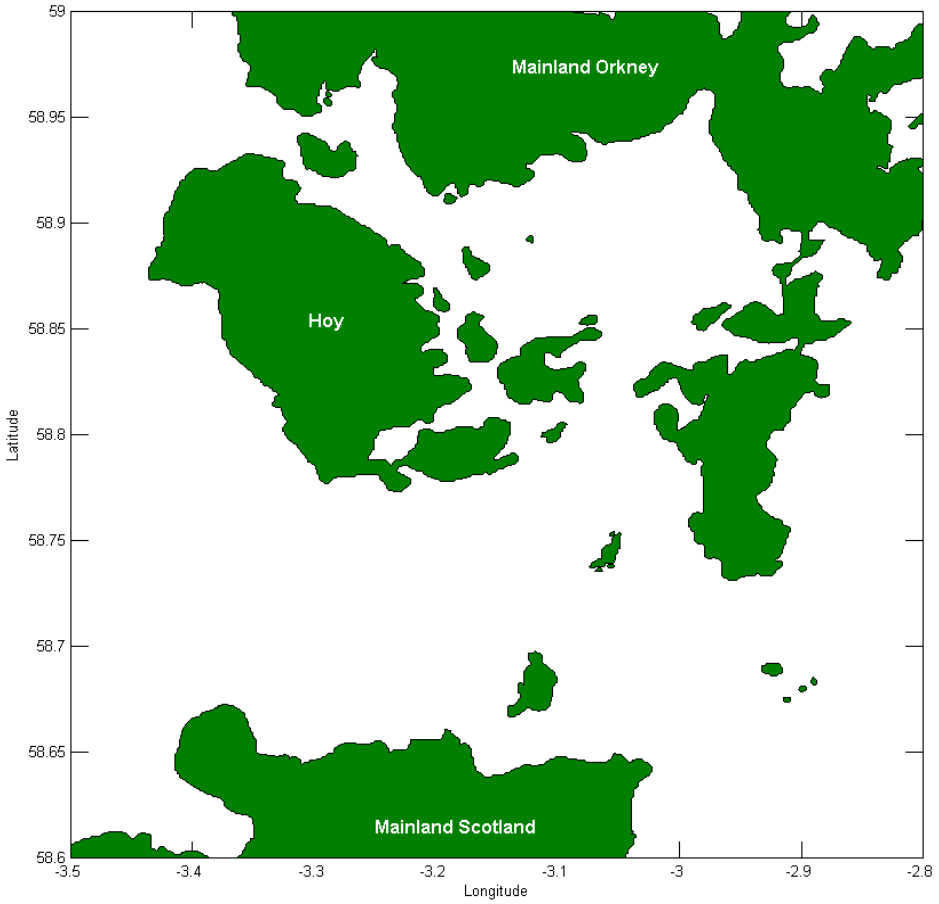
Pentland Firth and Scapa Flow I

- A normal view



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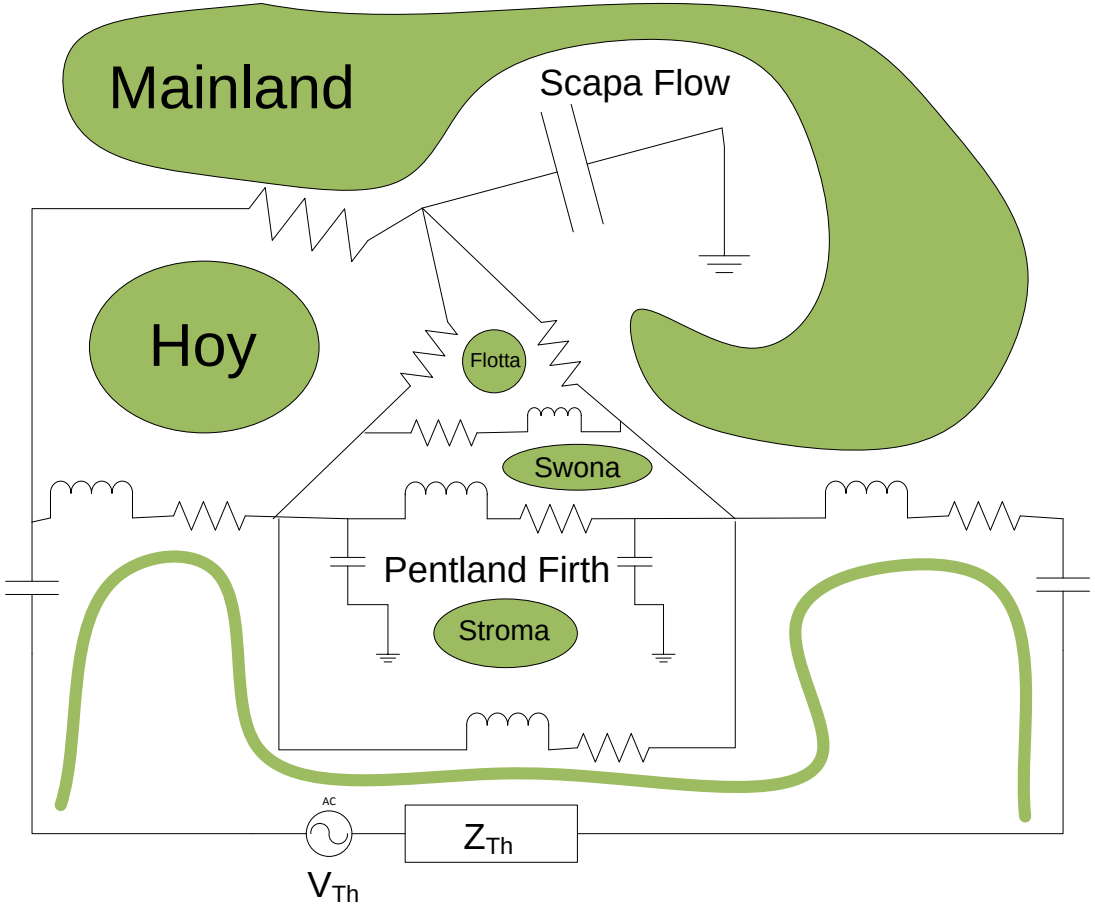
Pentland Firth and Scapa Flow II

- An electrical analogue



For more details see:

Woolf, D. K. (2013) “The strength and phase of the tidal stream”, International Journal of Marine Energy, 3, 3-13.

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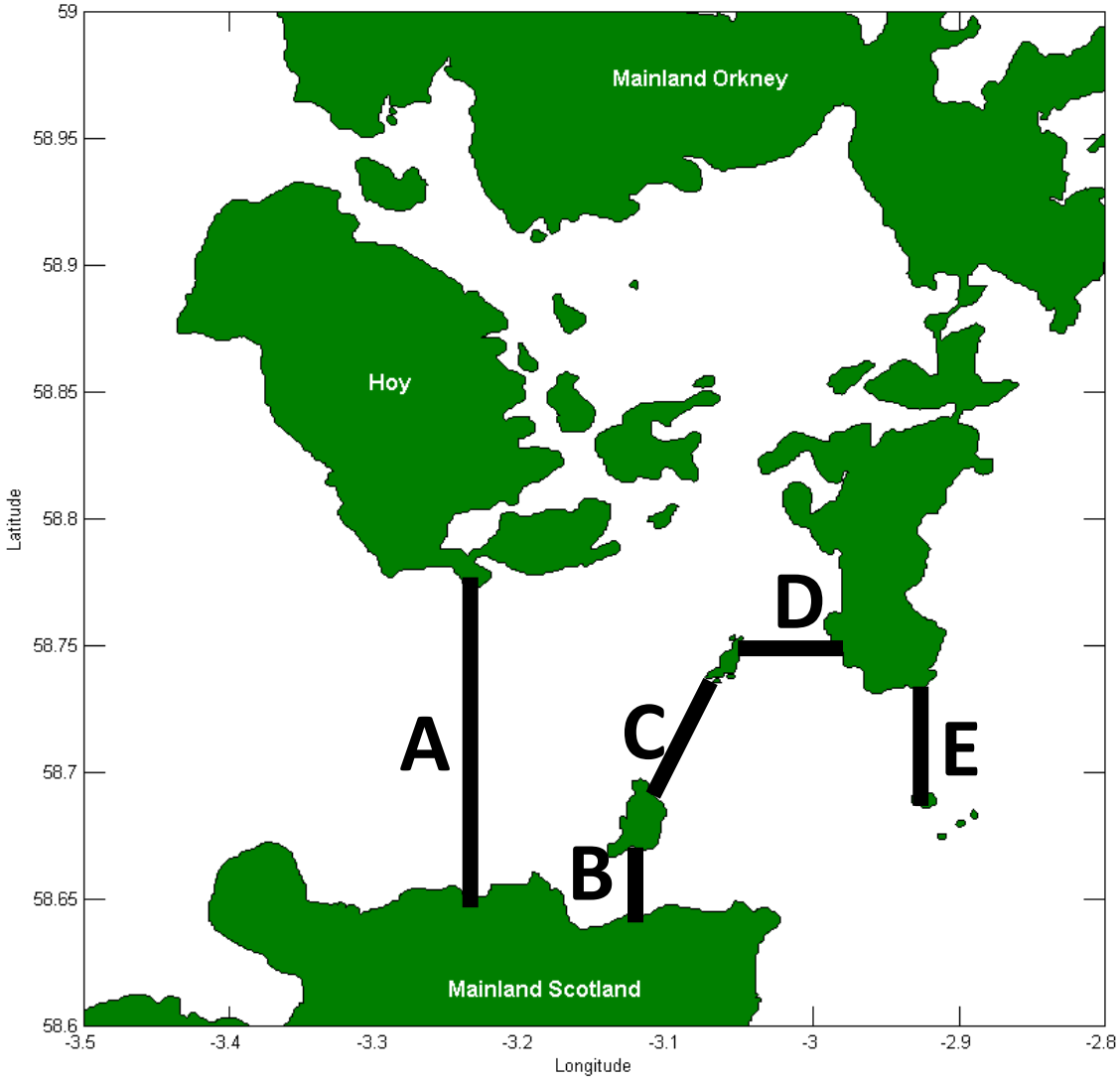
Inter-Channel effects in the Pentland Firth {after Draper et al. 2014a, b}



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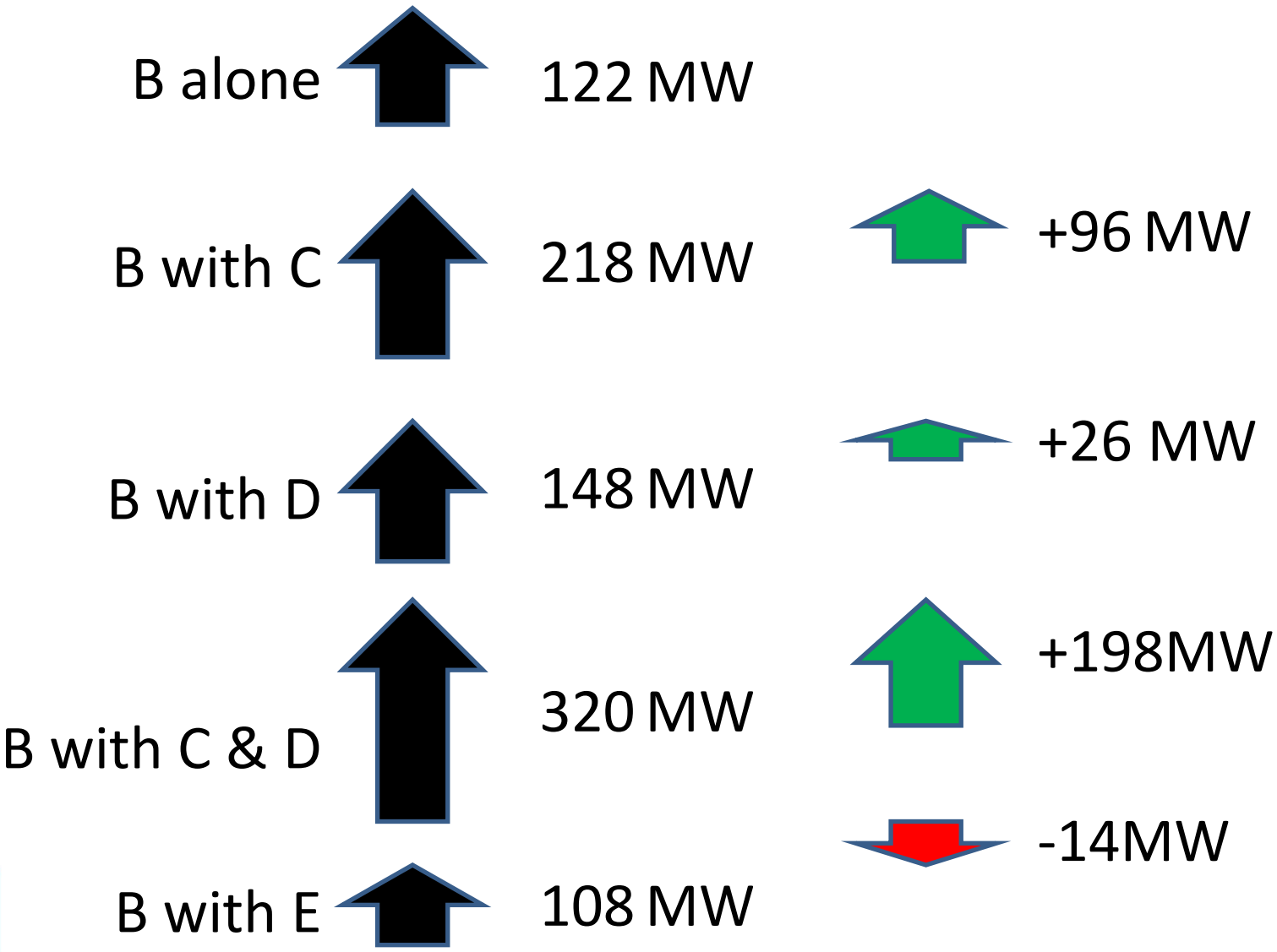

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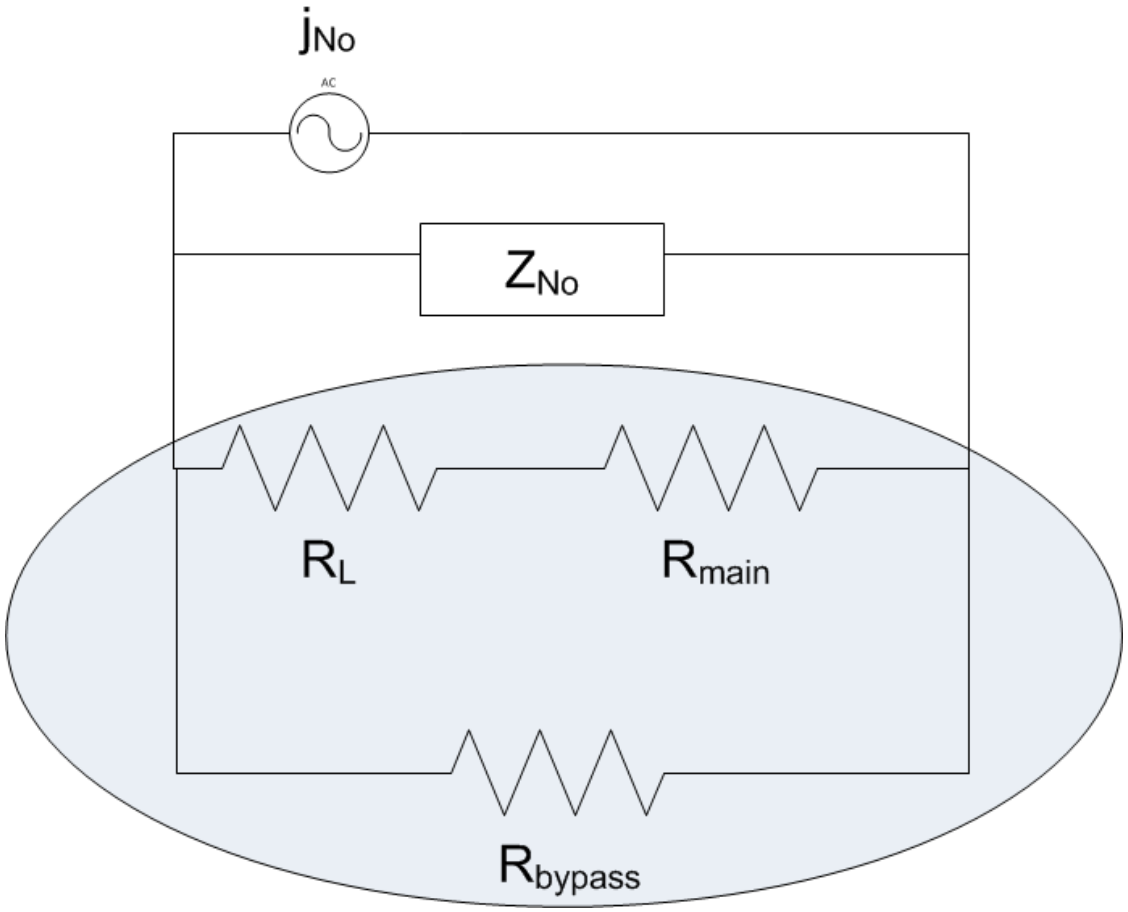
Simple Representation of Systemic and Inter-Channel Effect



Systemic Effect

Inter-Channel Effect

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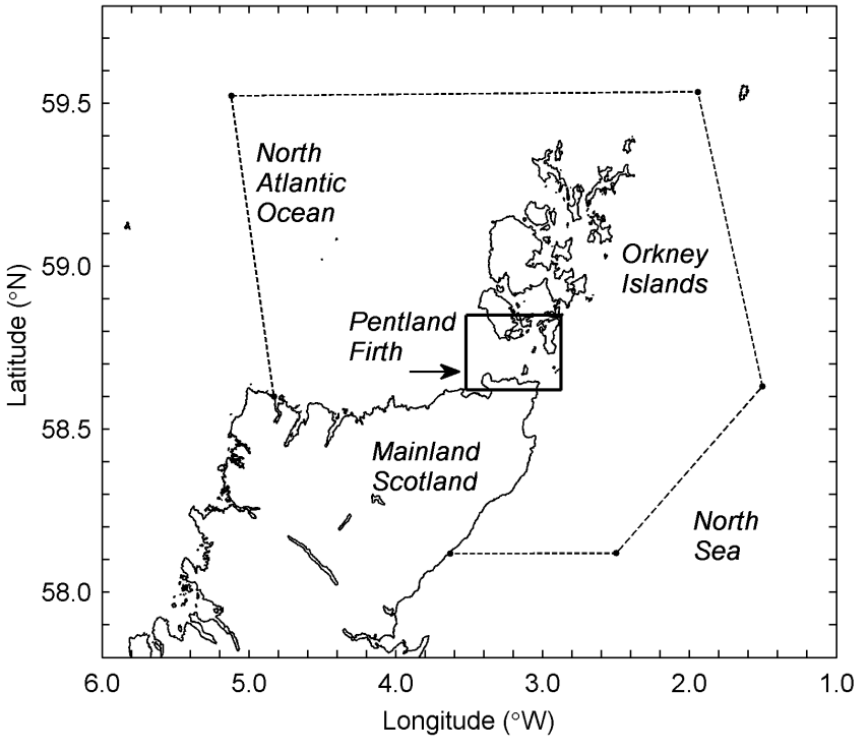
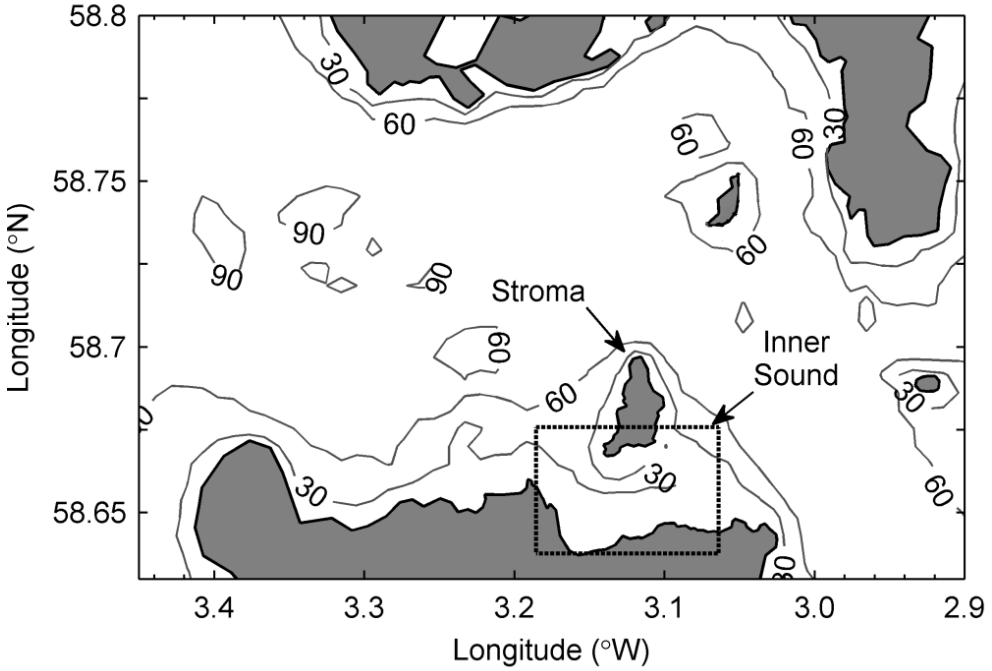
Geographic setting

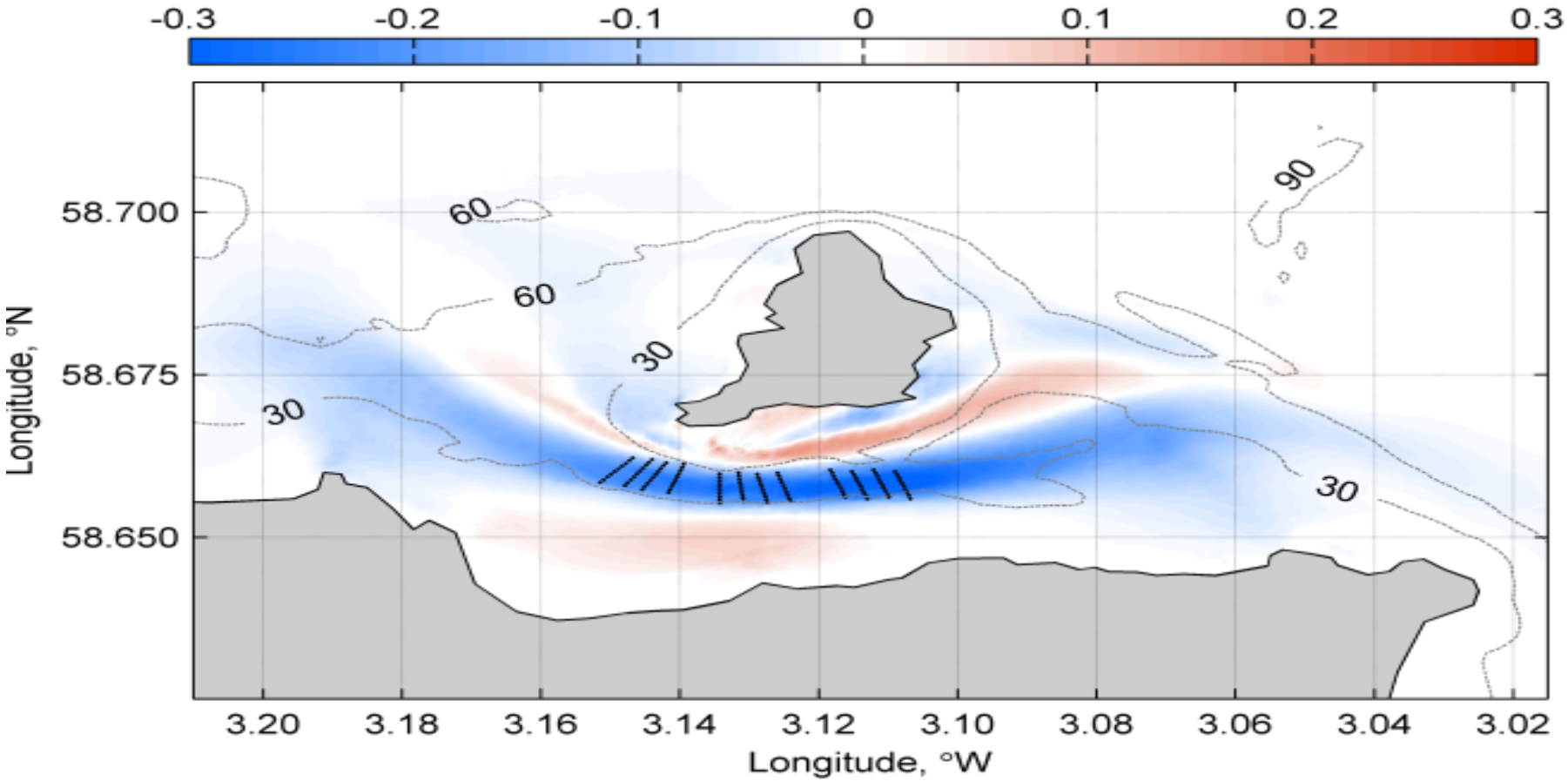
North Scotland and Orkney



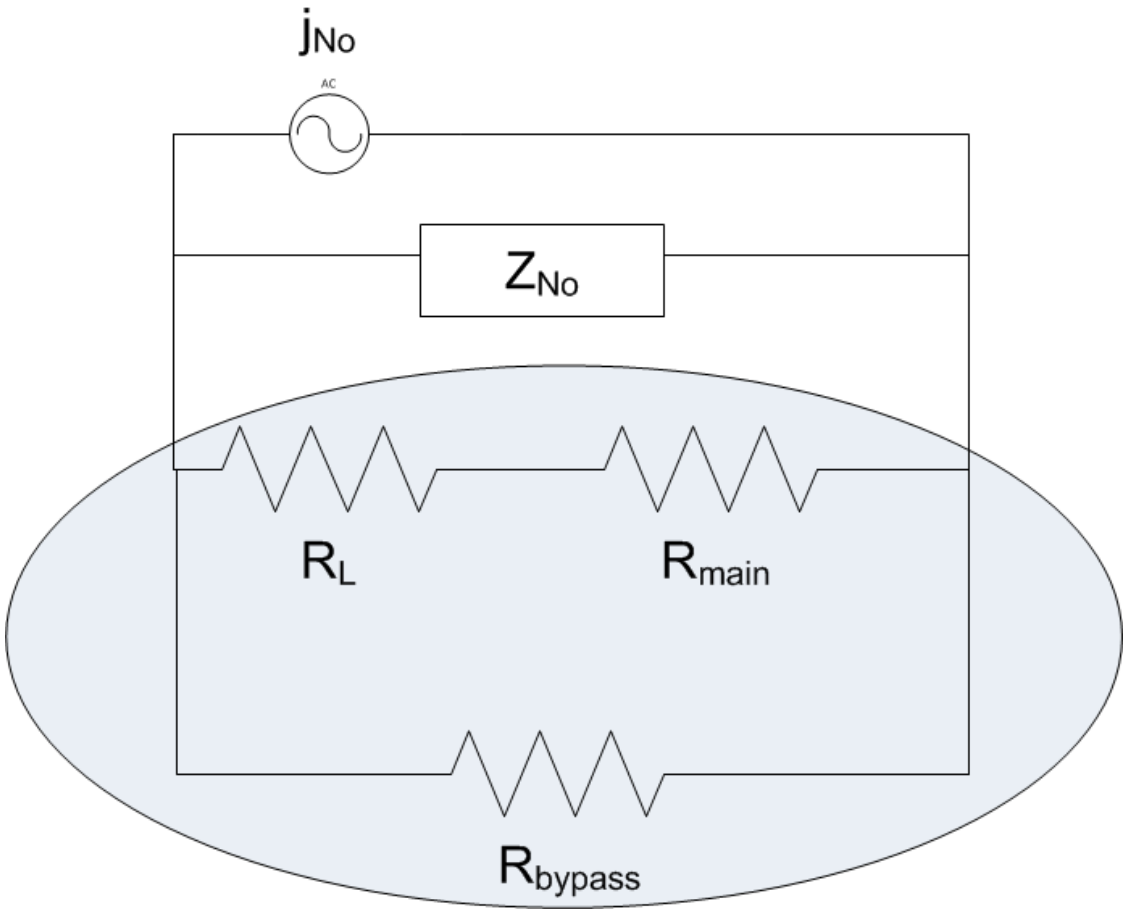
The Pentland Firth



Intra-Channel Effect



Simple Representation of Intra-Channel Effect



Exterior

Intra-Channel Effect

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Effect on Current Speeds

	FULL WIDTH	PARTIAL
ON WHOLE		
ON MAIN		
ON BYPASS	N/A	

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- Conclusions (**Governance and Policy**)

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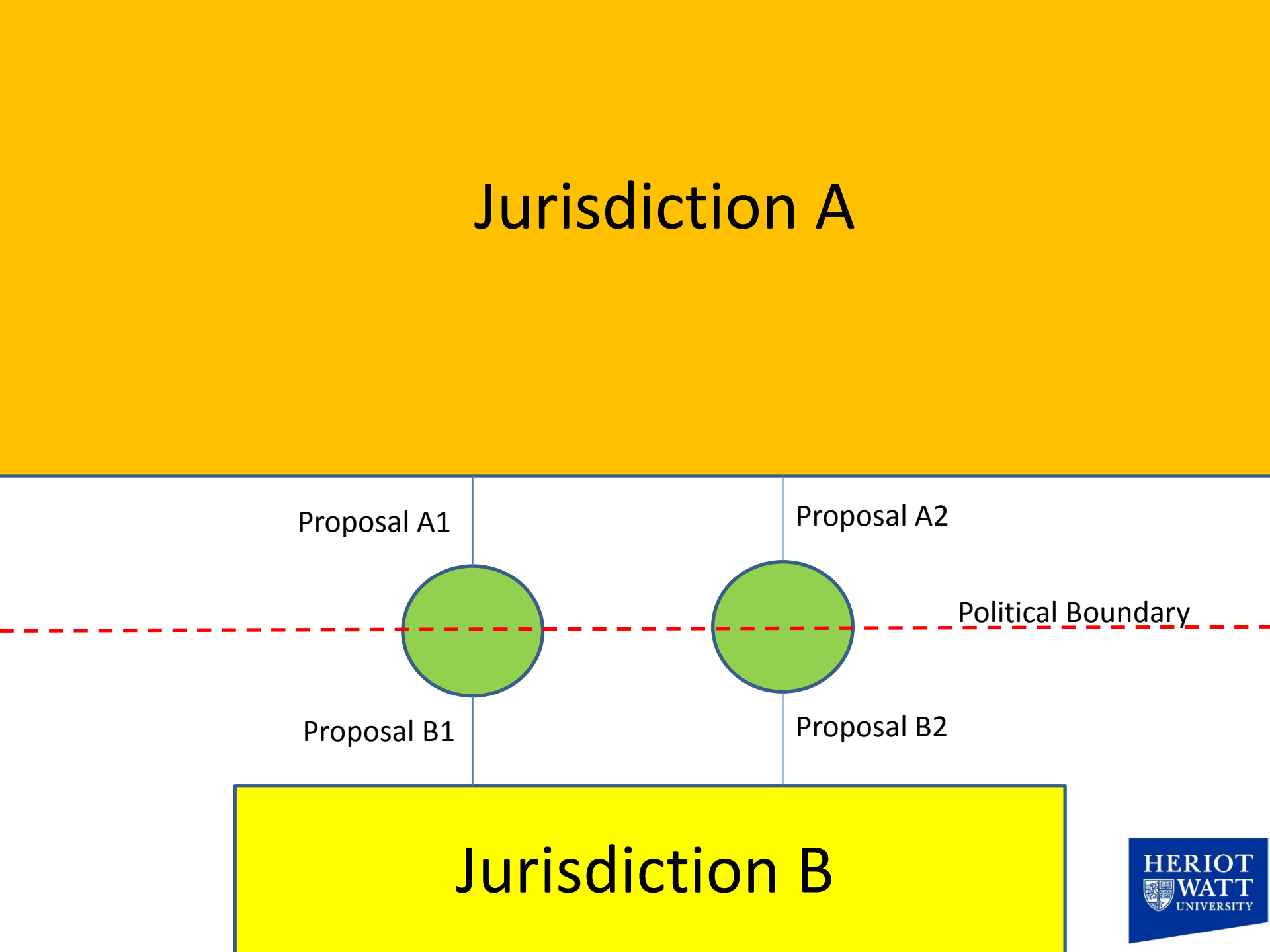
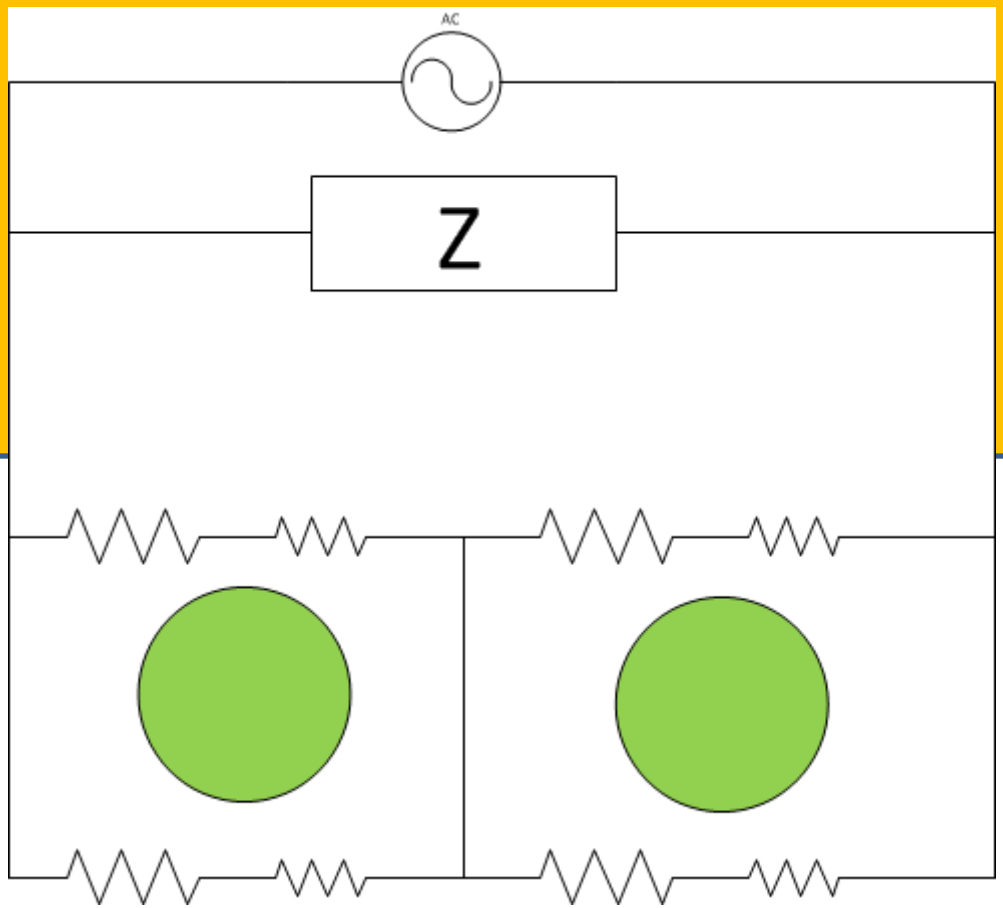

Jurisdiction A
Proposal A1
Proposal A2
Political Boundary
Proposal B1
Proposal B2
Jurisdiction B



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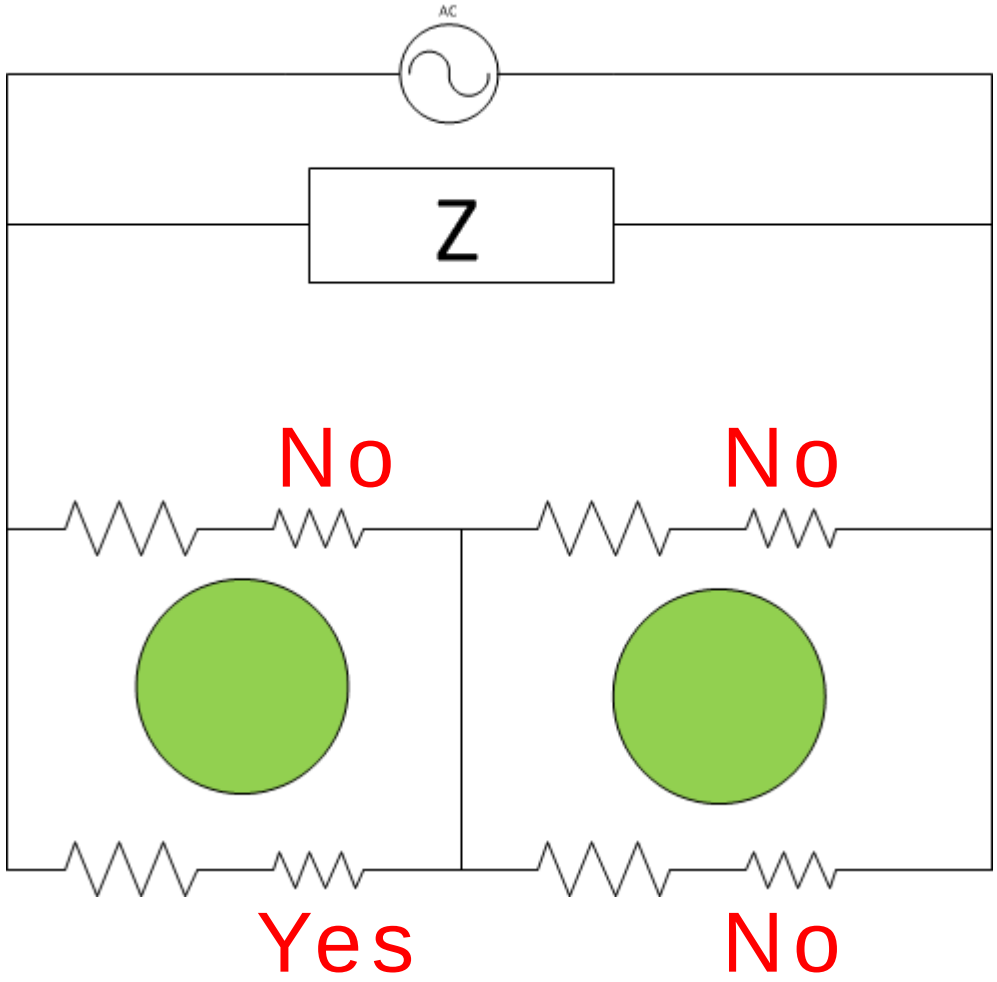
X Bad Strategy

? Questionable Strategy

√ Good Strategy



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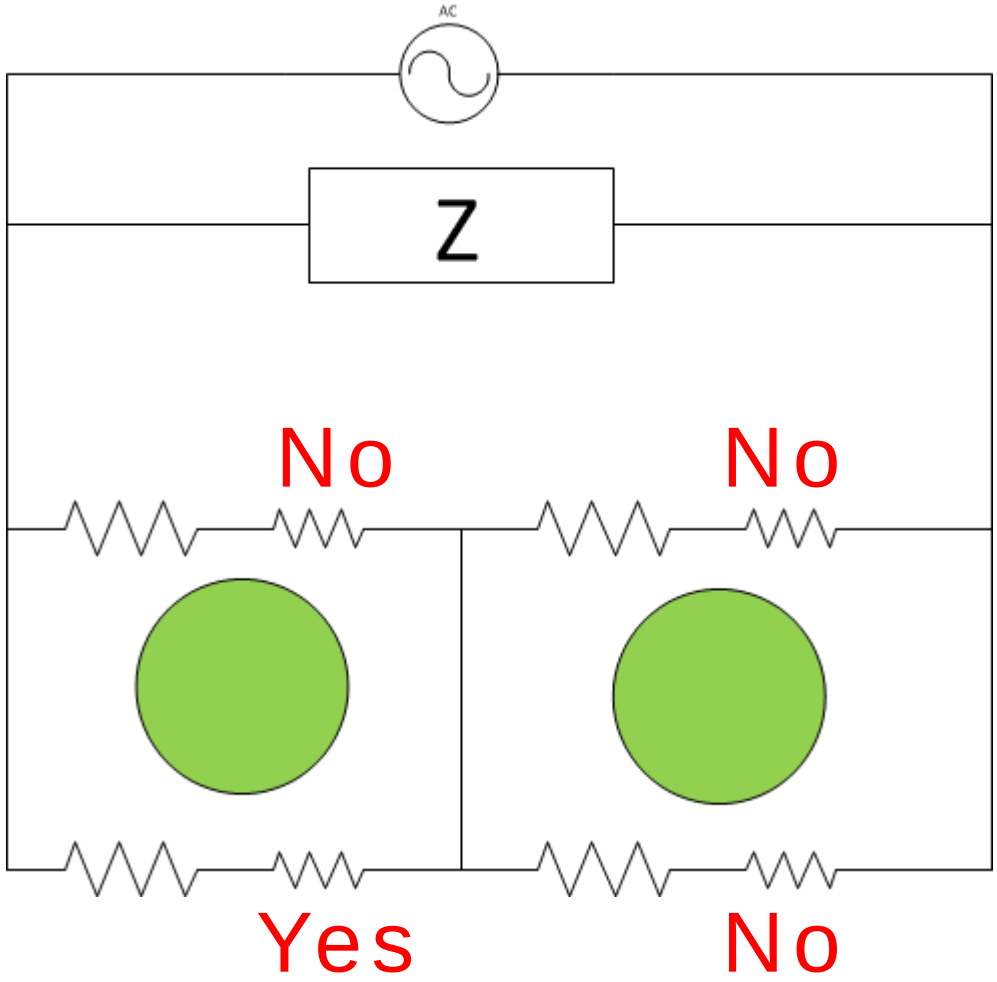

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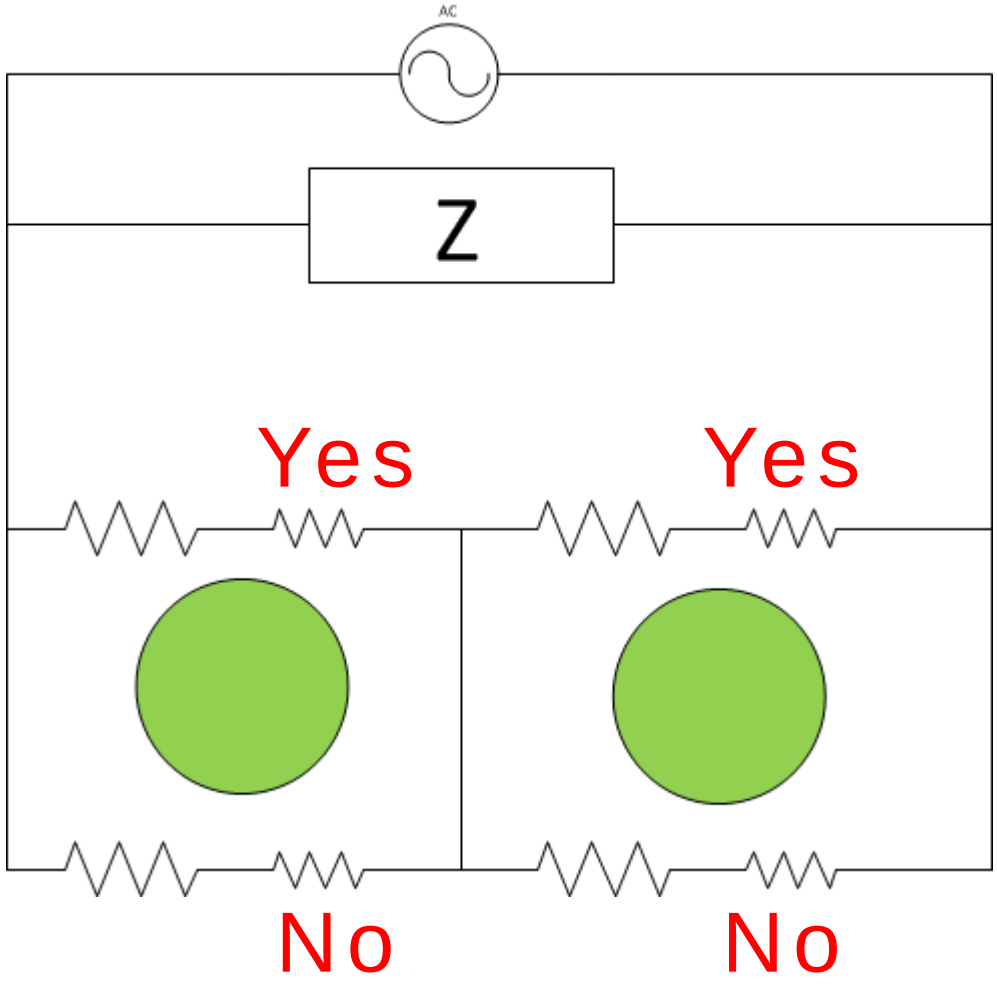

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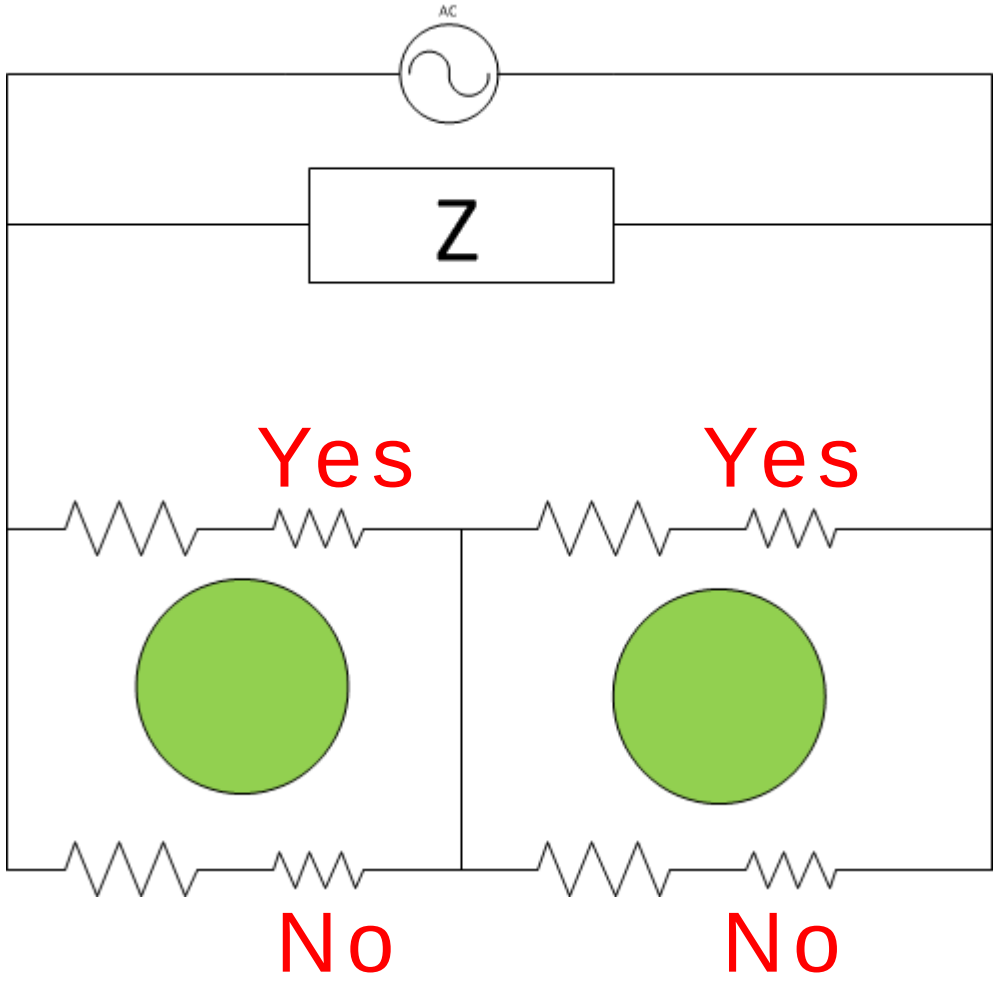

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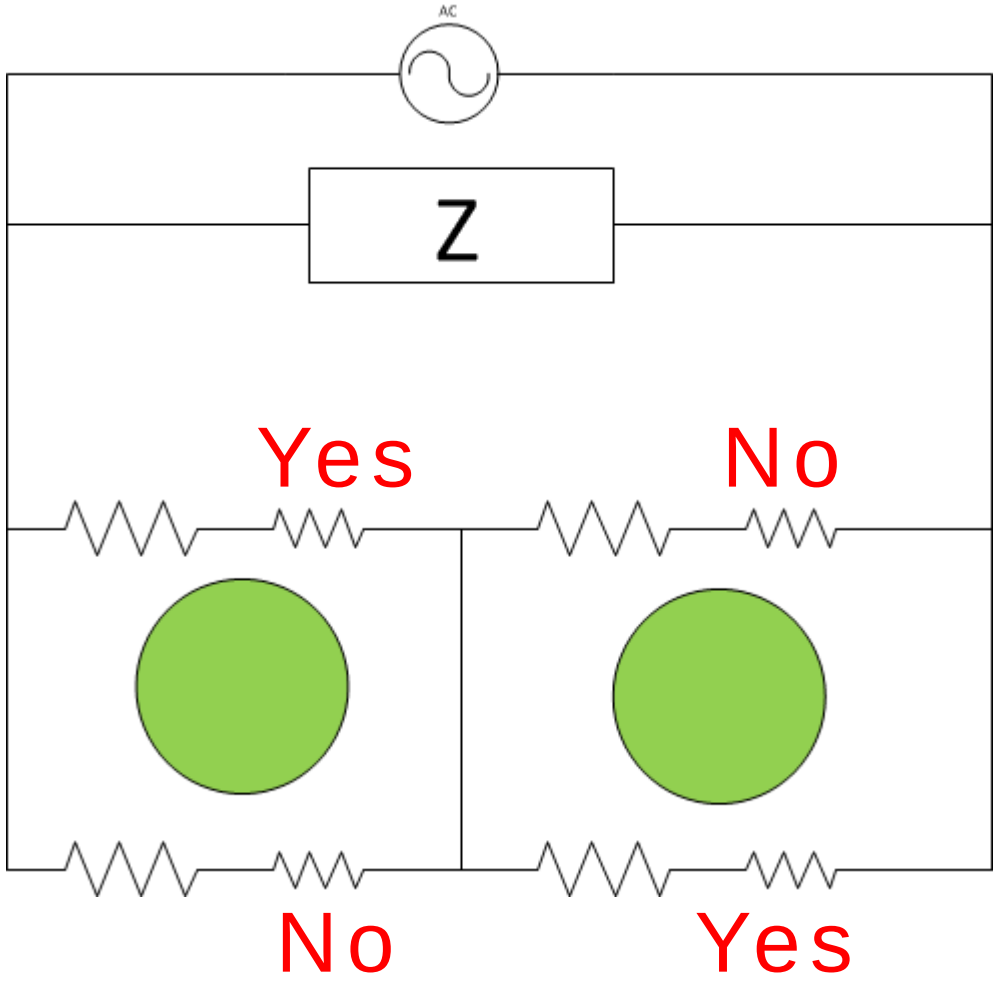

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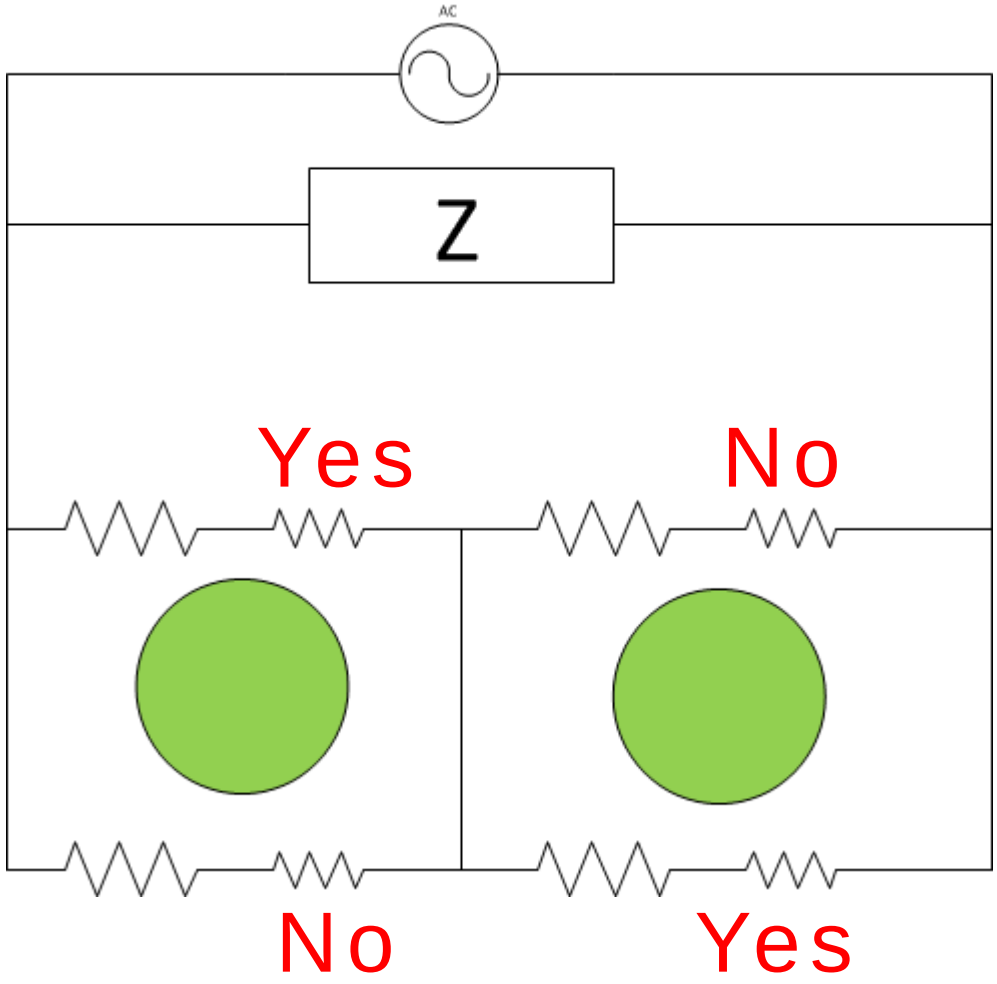

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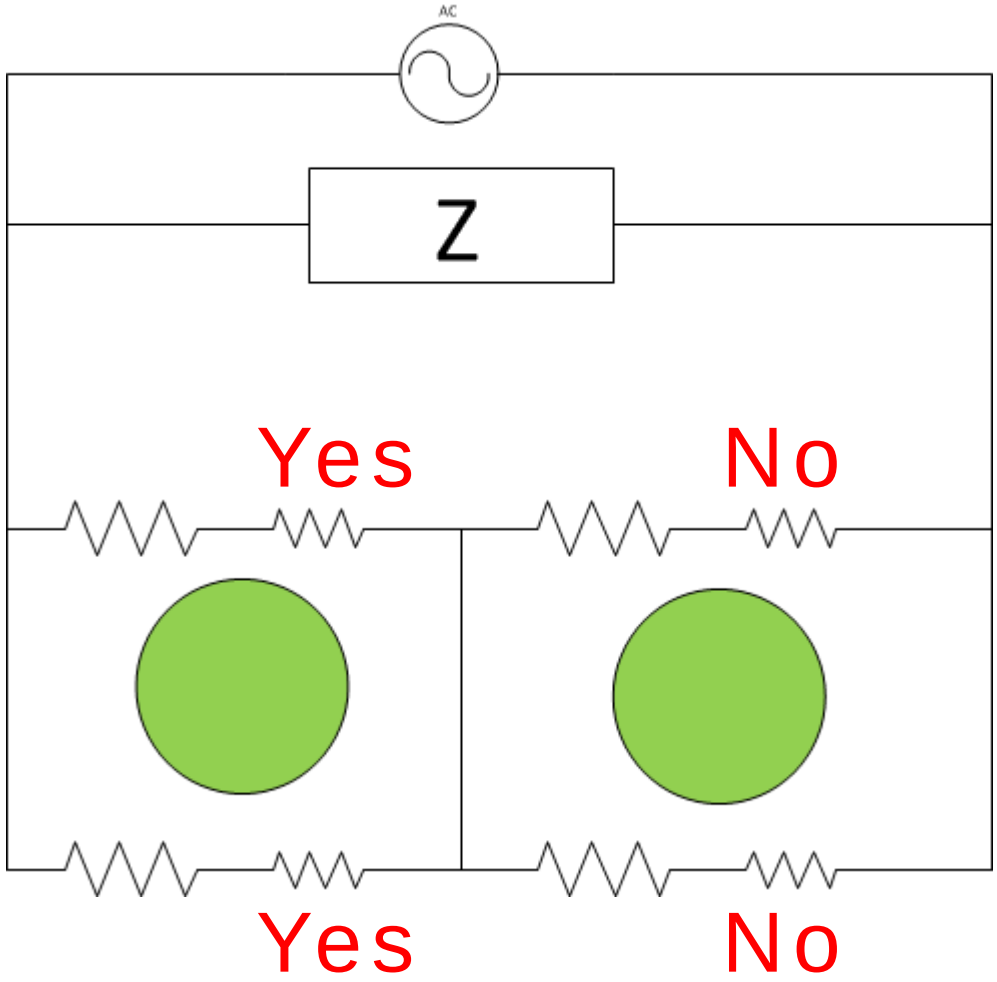

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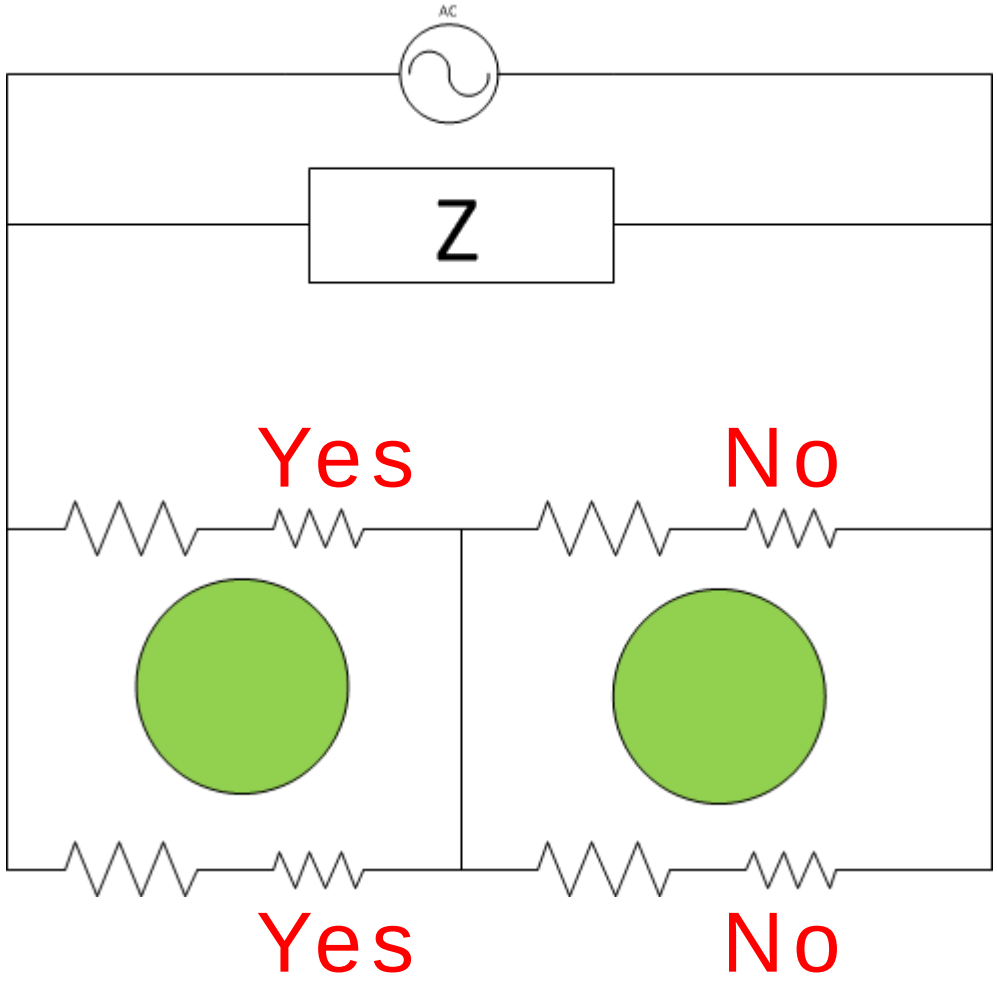

√

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Implications of Tidal Interactions

- Modelling
  - “Essentially, all models are wrong, but some are useful” George Box [b. 1919, d. 2013]
  - Electrical circuit analogies are useful
  - Diversity but not duplication
- Do not confuse
  - Undeveloped with Unaltered
  - Inactivity with Conservation
- Think strategically
  - Design systems and policies that enable strategic decisions

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