

Small Hydro Power: The Opportunities



Eur Ing George A Aggidis

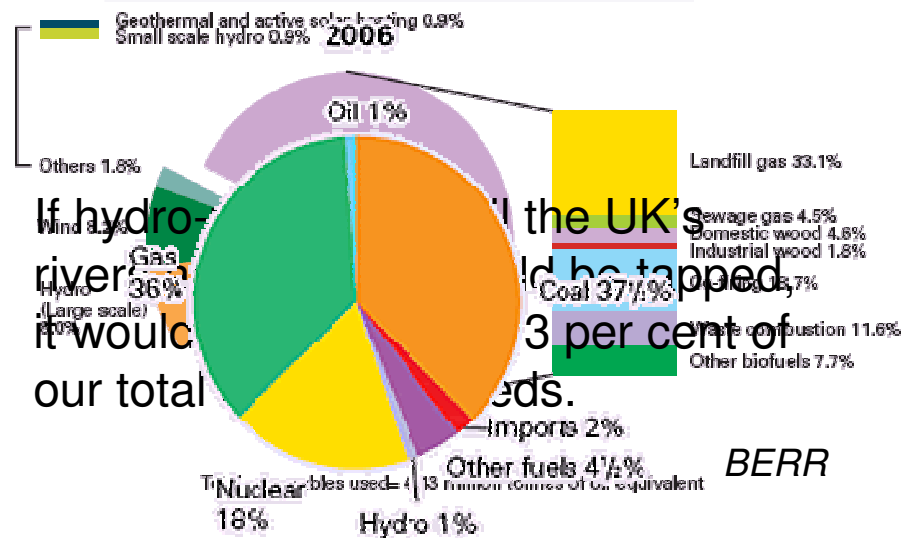
Director Lancaster University Renewable Energy Group &
Fluid Machinery Group

Joule Centre Annual Conference 2008

**Small Hydro Power Schemes in the North West of England:
Overcoming the Barriers.**

Hydropower in UK

Energy supplied by sources, 2006



Small Hydro ~ 1%
Large hydro (> 5MW) ~ 8%

Renewables accounted for 2.8% of total energy generated in the UK in 2006.

(DUKES 2007)

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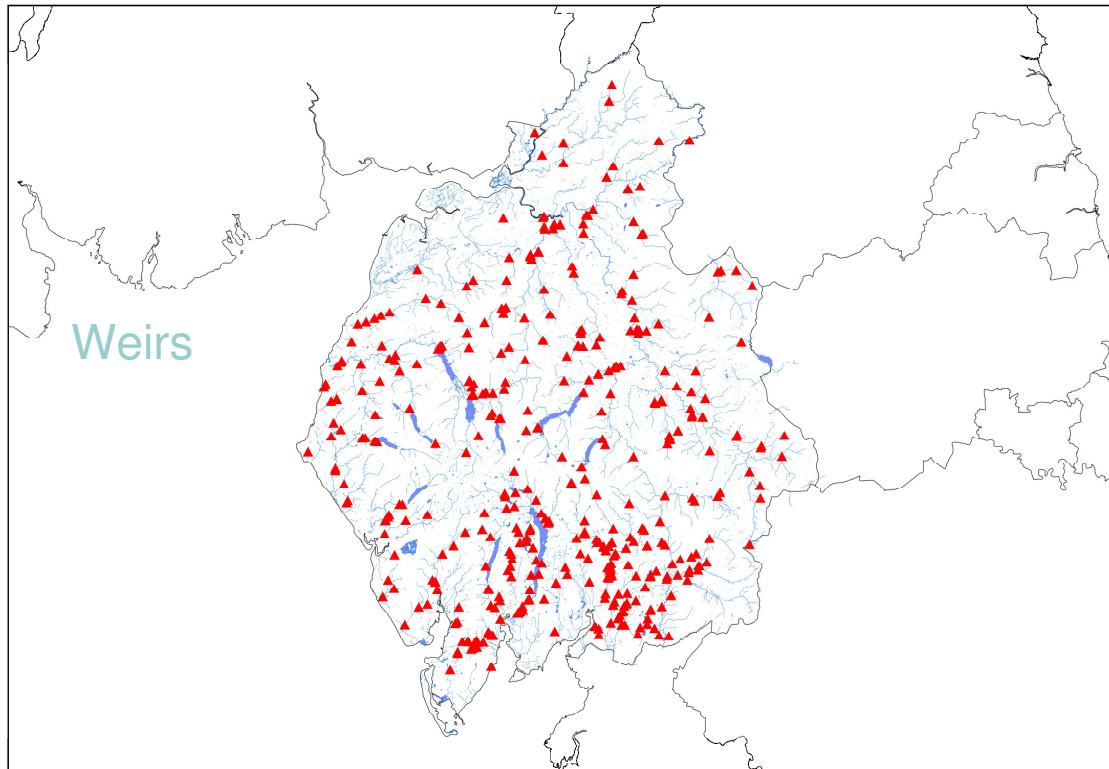
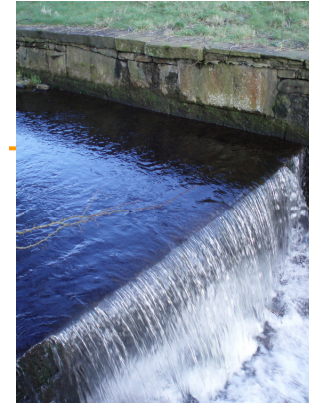
Estimated potential: UK hydropower

Hydro	Power Output	Potential new sites
Large	>100 MW	Only few
Medium	15 - 100 MW	C 5-15
Small	1 - 15 MW	C 20-80
Mini	100kW - 1MW	C 100 +
Micro	5kW - 100kW	C 1,000 +
Pico	300watts - 5kW	C 10,000 +

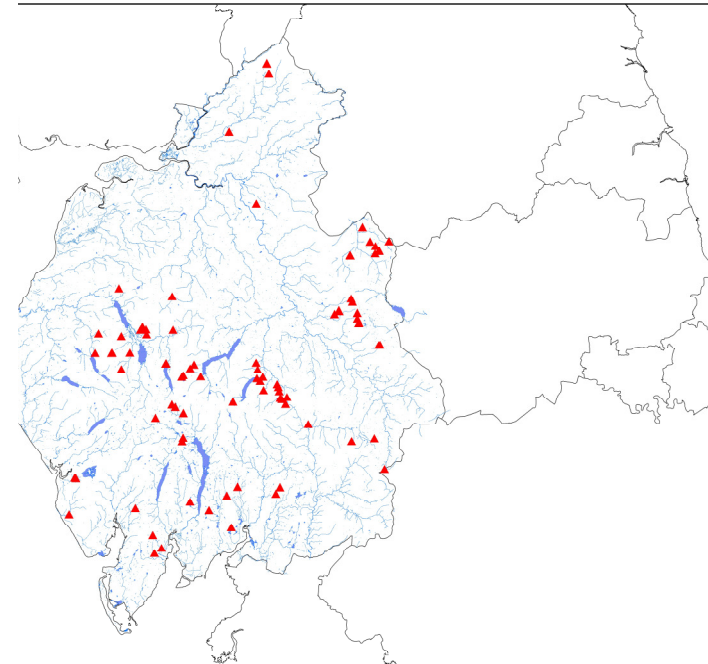


Lancaster University
Renewable Energy Group

Historical water use in Cumbria



Weirs



Dams



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Hydropower sites in the North West England



River Kent, Staveley



Church Beck, Coniston



Abbeystead Weir, Lancashire

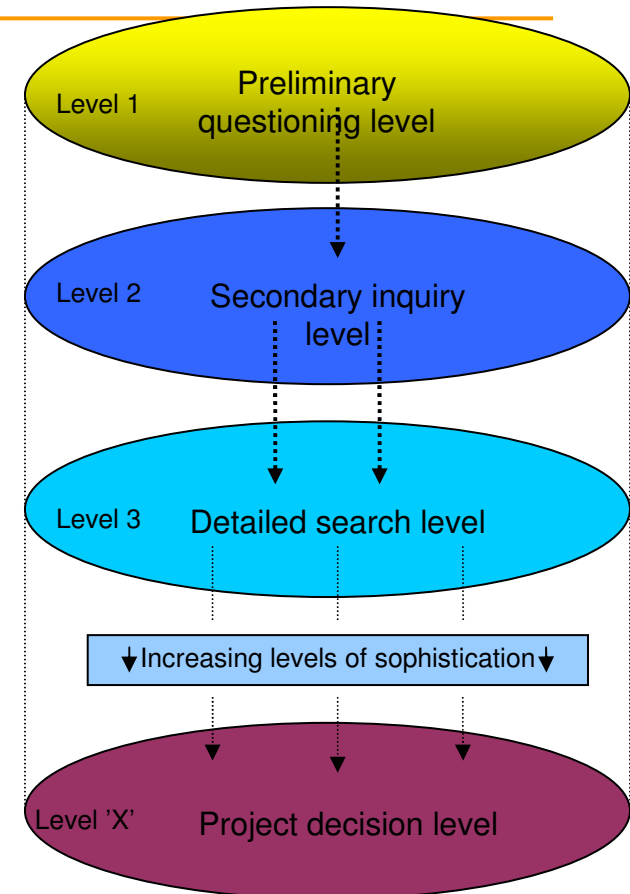
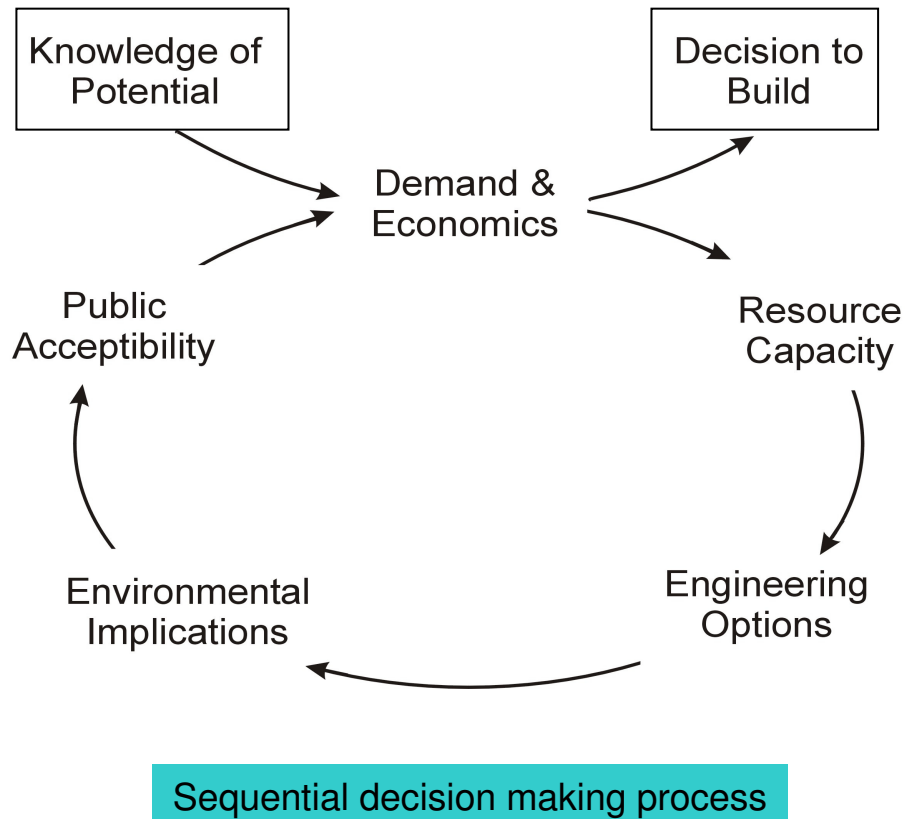


River Bela, Beetham



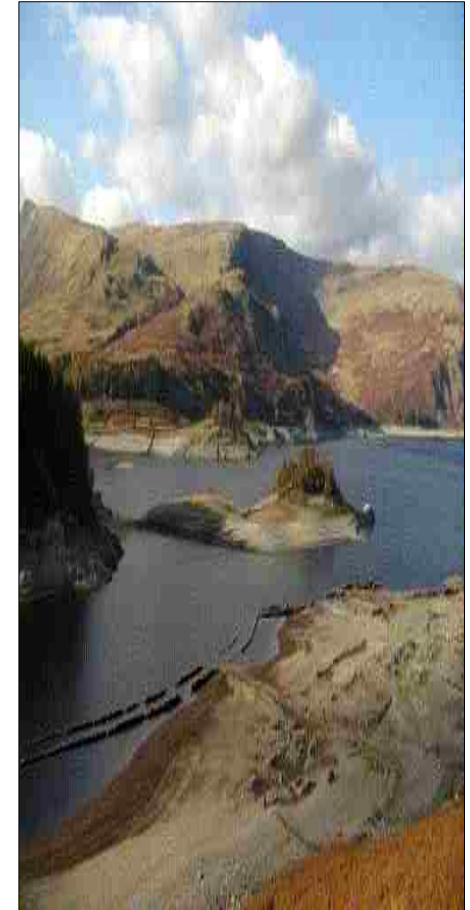
Sail Beck, Ennerdale

The Project: Hydro Resource Model



Objectives

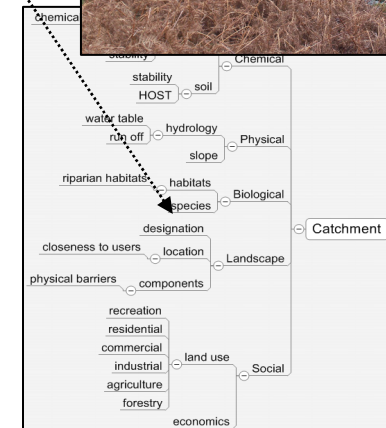
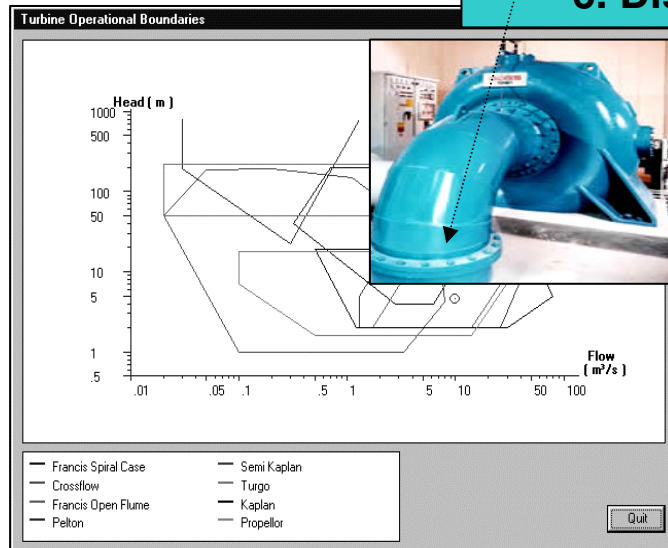
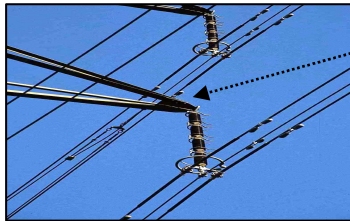
- ❖ Multi disciplinary
- ❖ Barriers to deployment of hydro power systems
- ❖ Integrated models
- ❖ Web based functional tool
- ❖ Benchmark output
- ❖ Collaborative partnerships



Structure

Work Packages:

1. Demand & economics
2. Resource capacity
3. Engineering Options
4. Environmental Implications
5. Public engagement
6. Dissemination and Outreach



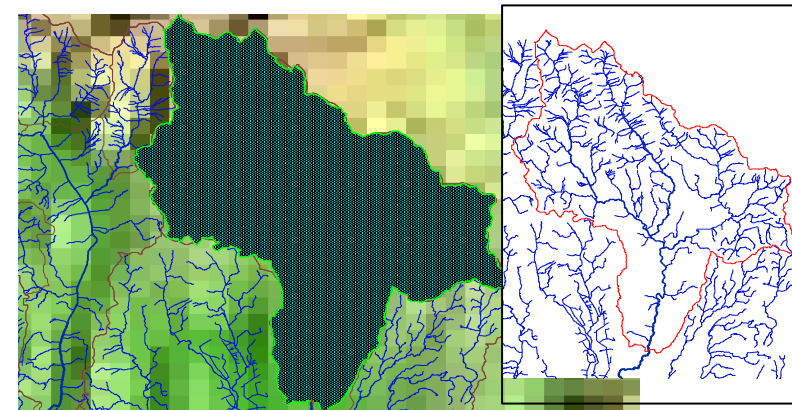
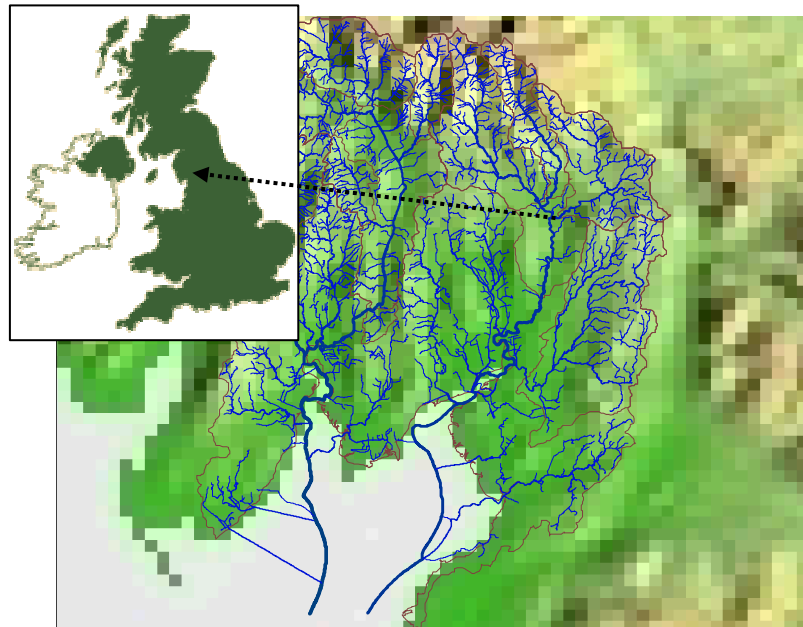
Mindmap output



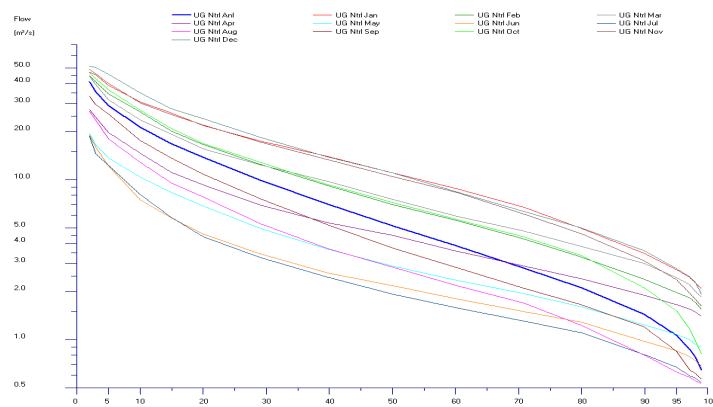


Assessing Hydro Availability:

Catchment characteristics



River Kent catchment & topographical characteristics



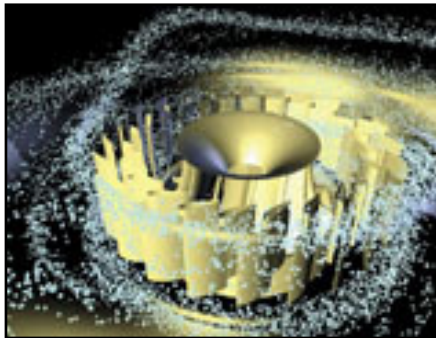
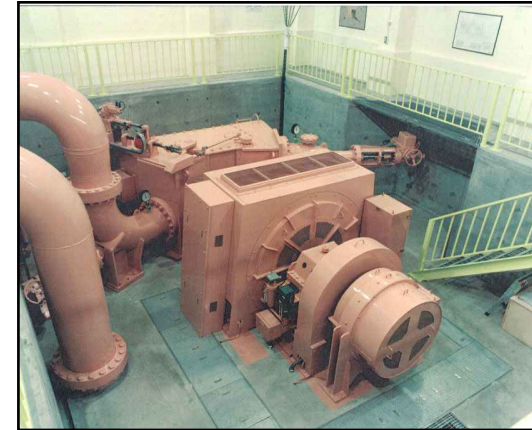
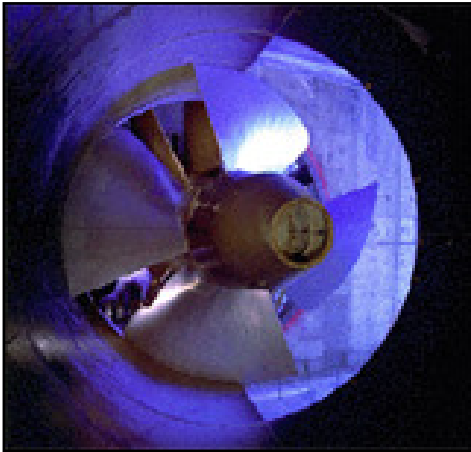
Mean annual & monthly flow duration curves

Outputs
from **Low
Flows**
software

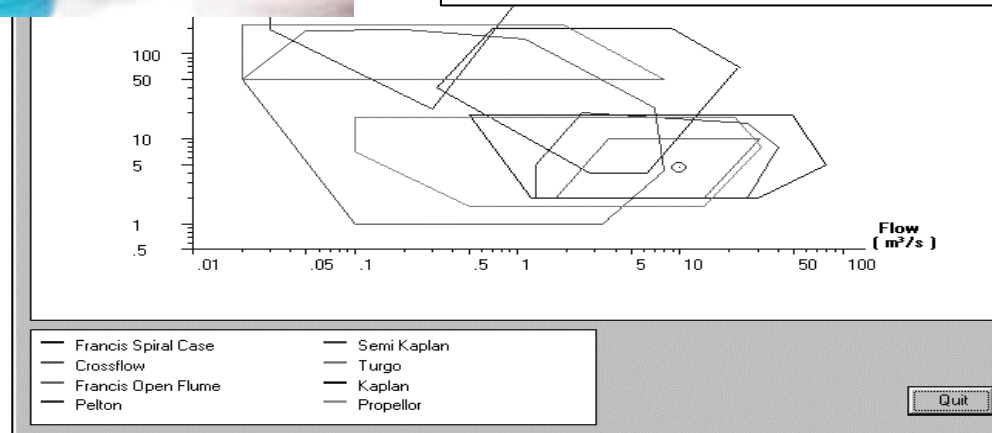
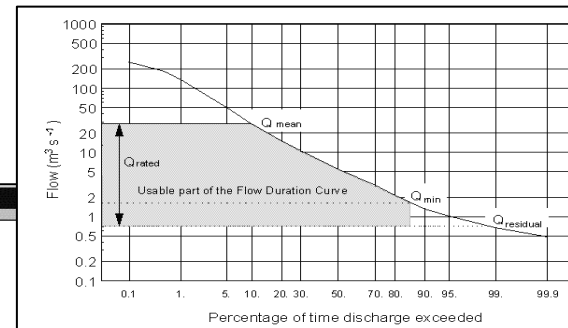
(Hydro
Solutions
Wallingford)

Basin details: Basin area:		215.55 km ²
Rainfall (average annual):		1700 mm
Potential evaporation (average annual):		475 mm
Runoff (average annual):		1317 mm
Base-Flow Index:		0.52
Mean Flow Statistics		
	(m³/s)	Q95 (m³/s)
Annual	9.005	1.061
January	14.51	2.727
February	10.90	1.964
March	10.99	2.433
April	6.641	1.659
May	4.674	1.081
June	3.711	0.851
July	3.623	0.672
August	5.233	0.628
September	7.074	0.845
October	11.21	1.504
November	13.98	2.371
December	15.51	2.780

Technologies: Water Turbines & Grid Connection



Turbine options using HydrA-HP



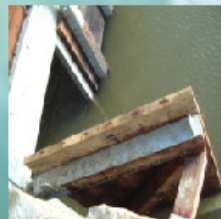
Hydra-HP will provide the maximum power generation and net annual energy generation for a prospective site

In order to calculate the hydropower potential at a given potential site the user is required to provide the dependable flow, the residual flow, the hydraulic head and the number of turbines

Environmental Concerns

ENVIRONMENT AGENCY FISH PASS MANUAL

ENVIRONMENT AGENCY FISH PASS MANUAL



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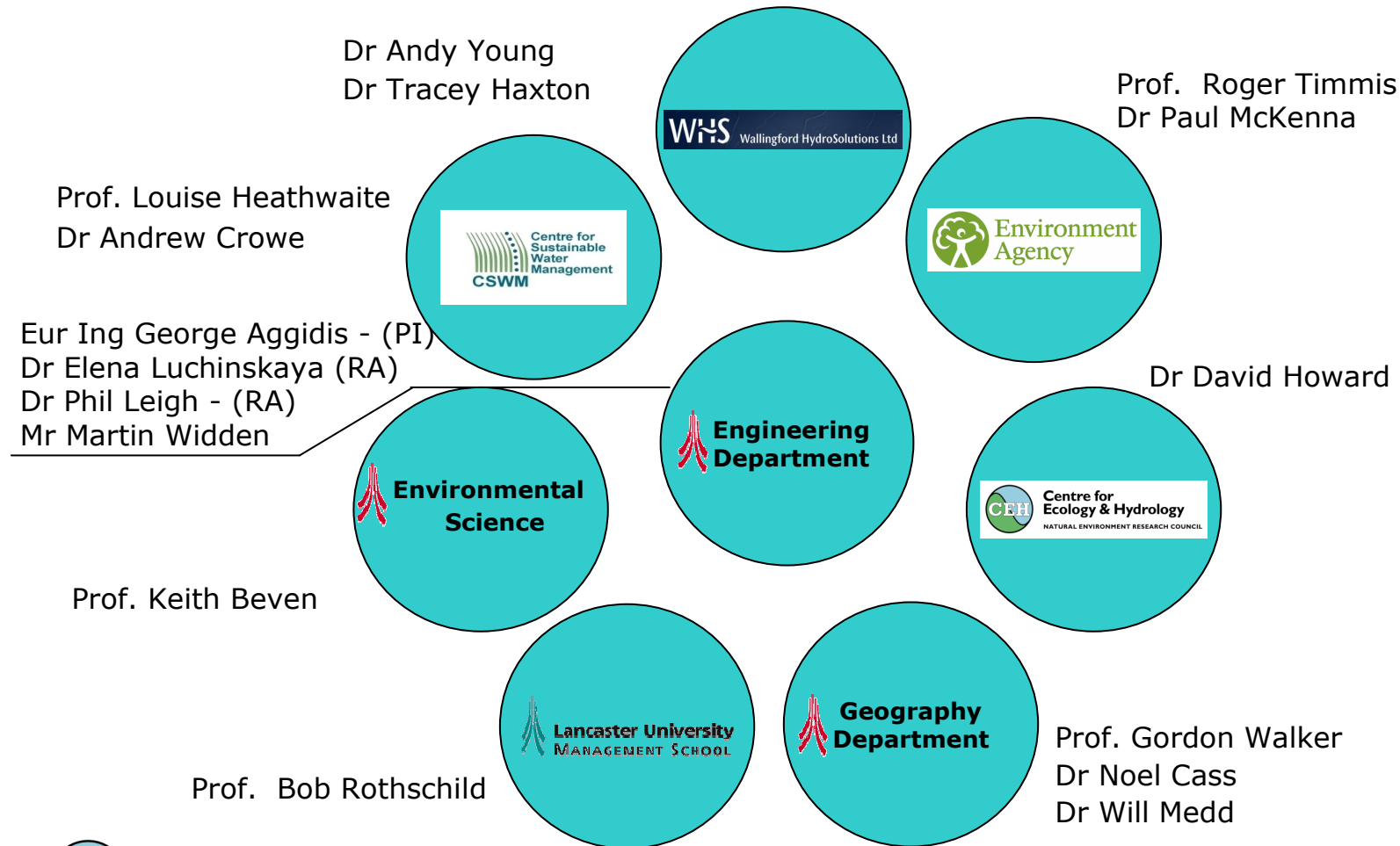


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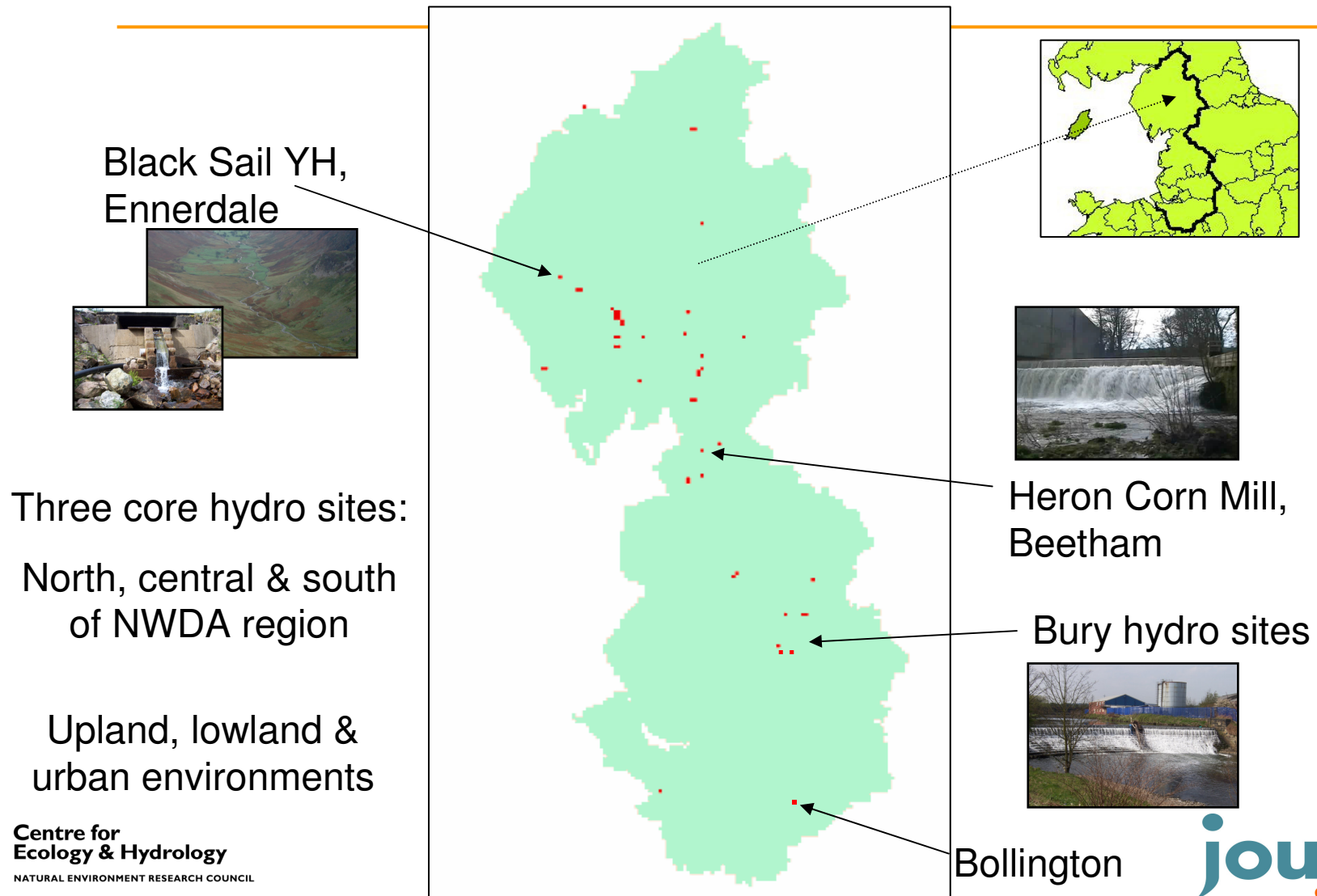
- To identify key factors which shape perceptions and potential patterns of adoption or resistance.
- To develop processes of engagement which are appropriate for different technologies, scales and contexts of installation.



Staff



The opportunities to benefit the North West Region



Dissemination

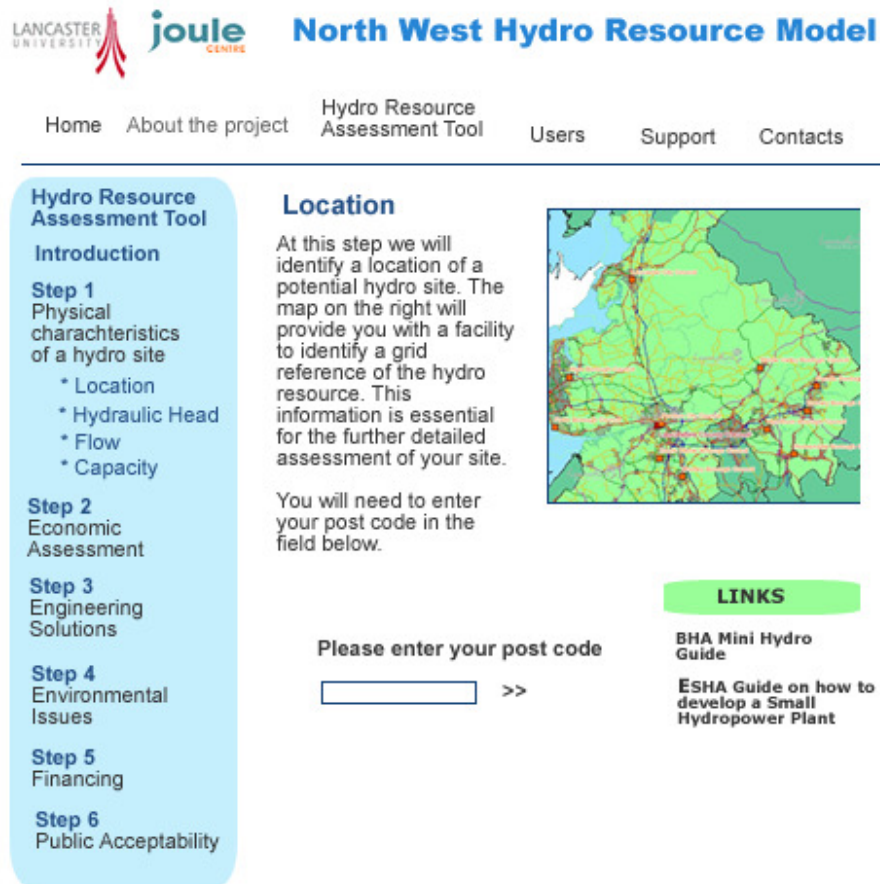
Conference

Publication

Collaboration

Student Project

Website



The screenshot shows the 'North West Hydro Resource Model' website. The header includes the Lancaster University logo, 'joule CENTRE', and the title 'North West Hydro Resource Model'. Navigation links are: Home, About the project, Hydro Resource Assessment Tool, Users, Support, and Contacts. The main content area is divided into a left sidebar and a main section. The sidebar, titled 'Hydro Resource Assessment Tool', lists six steps: Step 1 (Physical characteristics of a hydro site), Step 2 (Economic Assessment), Step 3 (Engineering Solutions), Step 4 (Environmental Issues), Step 5 (Financing), and Step 6 (Public Acceptability). The main section, titled 'Location', contains a map of the North West region of the UK, a text description of the location step, and a form to enter a post code. A 'LINKS' section on the right lists 'BHA Mini Hydro Guide' and 'ESHA Guide on how to develop a Small Hydropower Plant'.



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