Ground Source Heat in SEREN Project

16th Nov. 2011

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Overview

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SEREN Project Overview

Work Package 2 Plan - Achievements, Issues and Resolutions

- Data from on existing and new installations
- Developing numerical models and advance numerical simulation
- Producing software to aid design
- Testing novel technologies

Achievements – Where we stand

Plans for next year

ERDF
Llywodraeth Cymru
Welsh Government
Ewrop & Chymru: Buddsoddi yn eich dyfodol
Cronfa Datblygu Rhanbarthol Ewrop
Europe & Wales: Investing in your future
European Regional Development Fund

Seren
Sustainable Earth Energy

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Project Timelines

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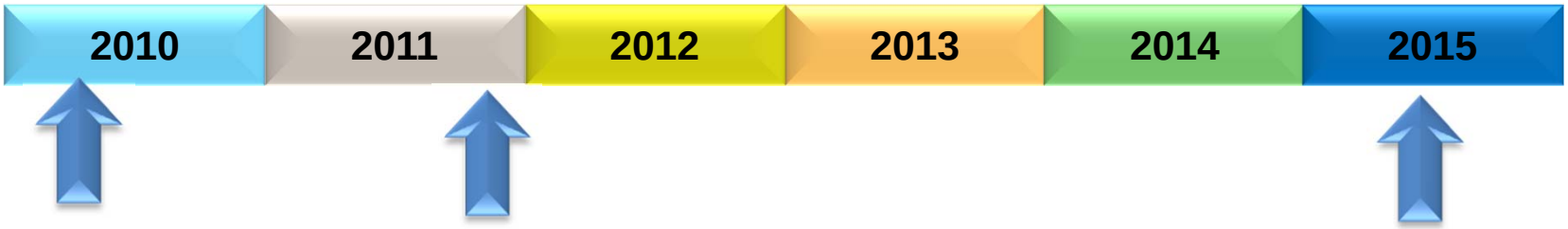
Total Project Cost £8.35m
Mainly staff costs

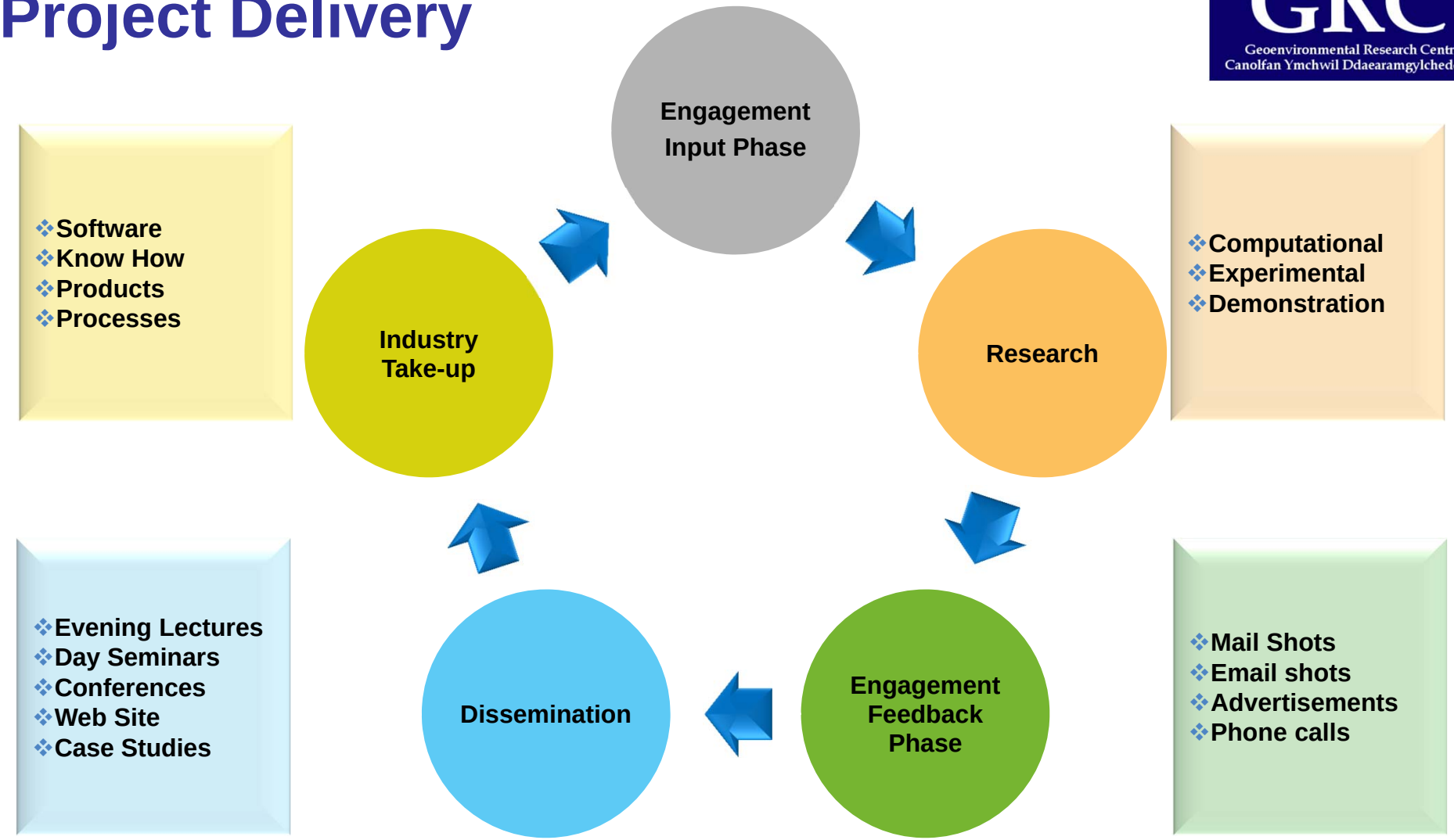


Project start
1st March 2010

Current Date
19th Nov 2011

Project End
31st June 2015

Project Delivery



Seren Geo-energy Themes

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Ground Source Heat

Underground Coal Gasification

Carbon Storage & Sequestration

Geoinformatics Toolkit

WP2 Plan

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Key Objectives

- To deliver new and innovative technologies in the emerging new industry of generating heat energy from the ground
- Development of new products which will result in the creation of new companies and jobs

Key Drivers

- Little operational data available in the UK
- Design 'know how' is limited to produce cost-effective designs
- Regional impact of increasing the use of ground source heat energy
- Exploitation of technologies to aid ground source energy

Scope

- Researching data collected on exiting and new installations
- Advanced numerical simulation of installations
- Producing software to aid design
- Testing novel technologies including new trial installations

Work Summary

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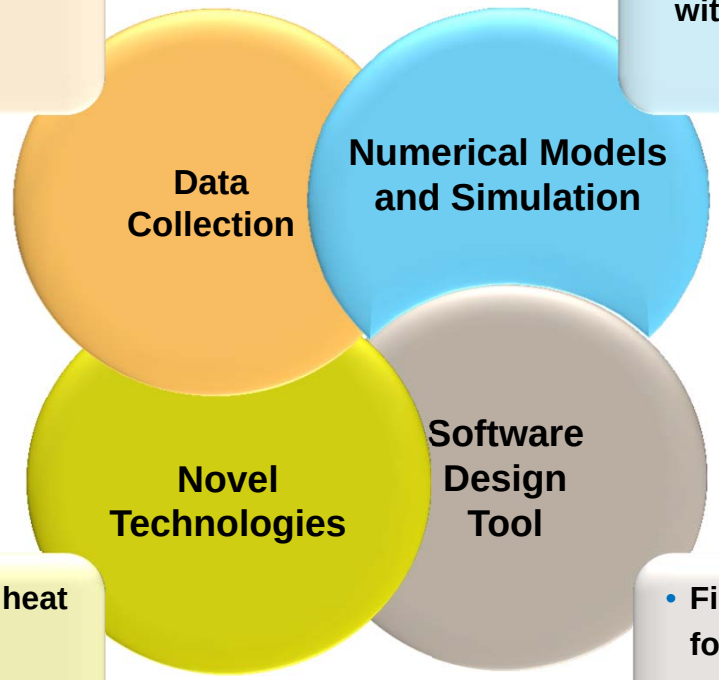
- First *full scale ground monitoring* is placed - In collaboration with Industrial partner (WDS Environmental Ltd)

- 3D Analytical model developed
- Working on solution to connect it with COMPASS Model



- Feasibility report on mine water heat technique will be submitted

- First software design tool developed for Horizontal ground loop - In collaboration with Industrial partner (WDS Environmental Ltd)

Data from Existing and New Installations

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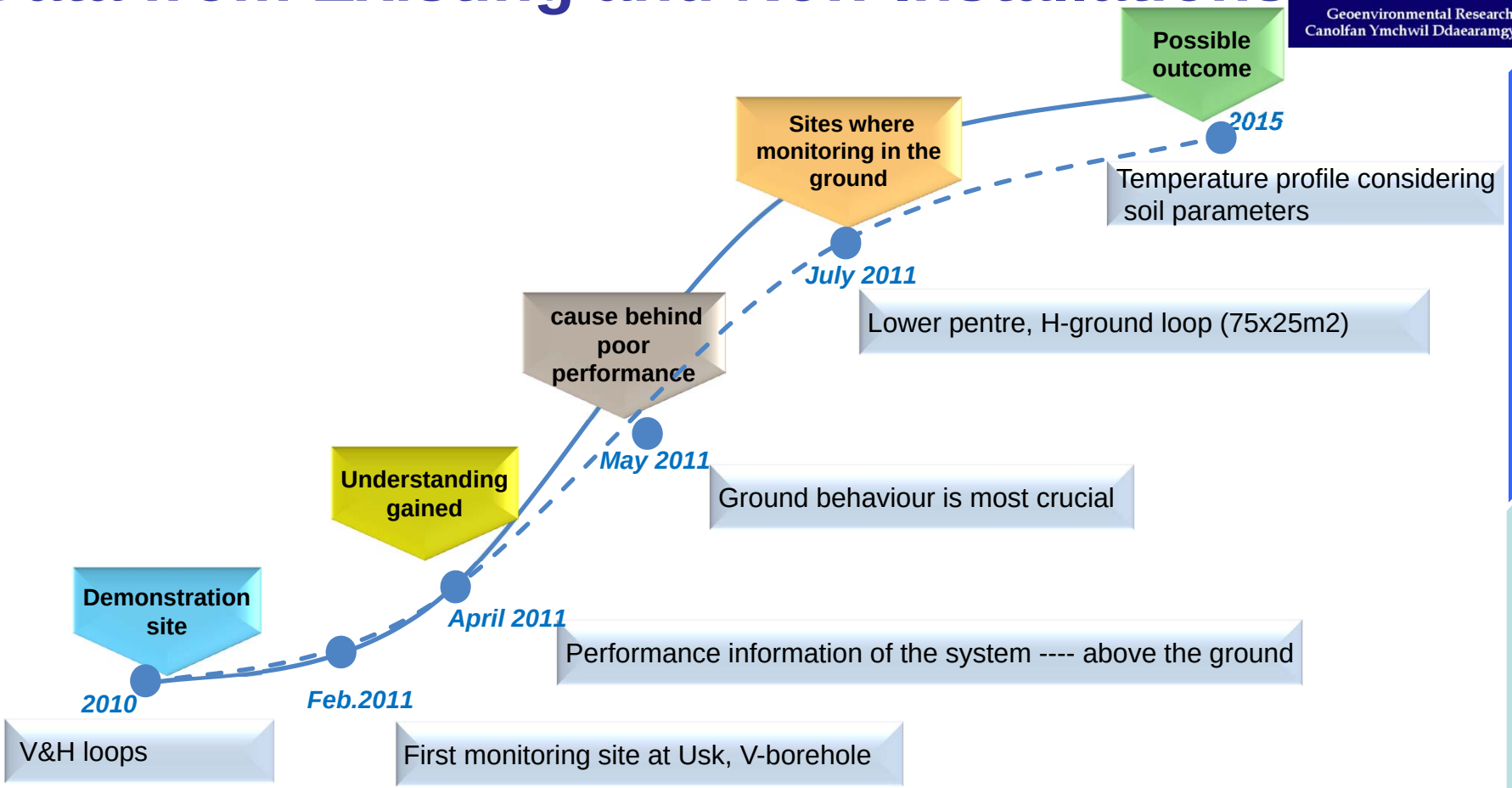


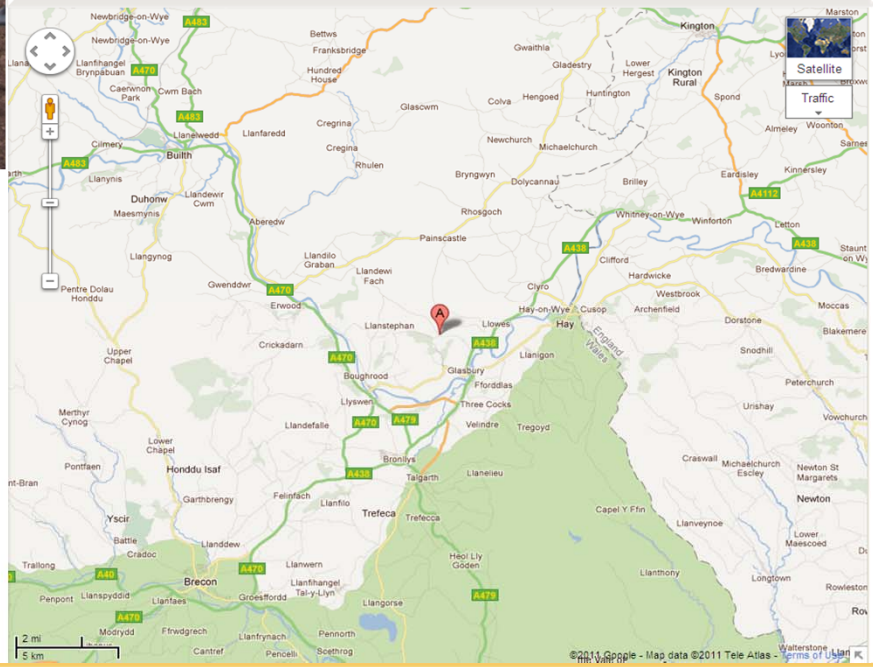
Ground temperature results will be highly informative with respect to the long-term performance

1. used to validate a numerical model for convective and conductive heat transport in the ground
2. the simulation for an operation over a 30-year period
3. will be fed to design code

Details of the Site – Lower Pentre

- Type of house- Refurbished old cottage
- Heat Loss Demand- 16kW

- Loop type- Horizontal ground Loop
- 5 Nos. 75 m long Trenches



- Monitoring temperature profile at one trench and at its far field
- In-situ Soil properties like thermal conductivity, moistures content, mineralogy, density is also tested
- Weather station will provide the information on ambient temperature, and precipitation data

Monitoring Layout

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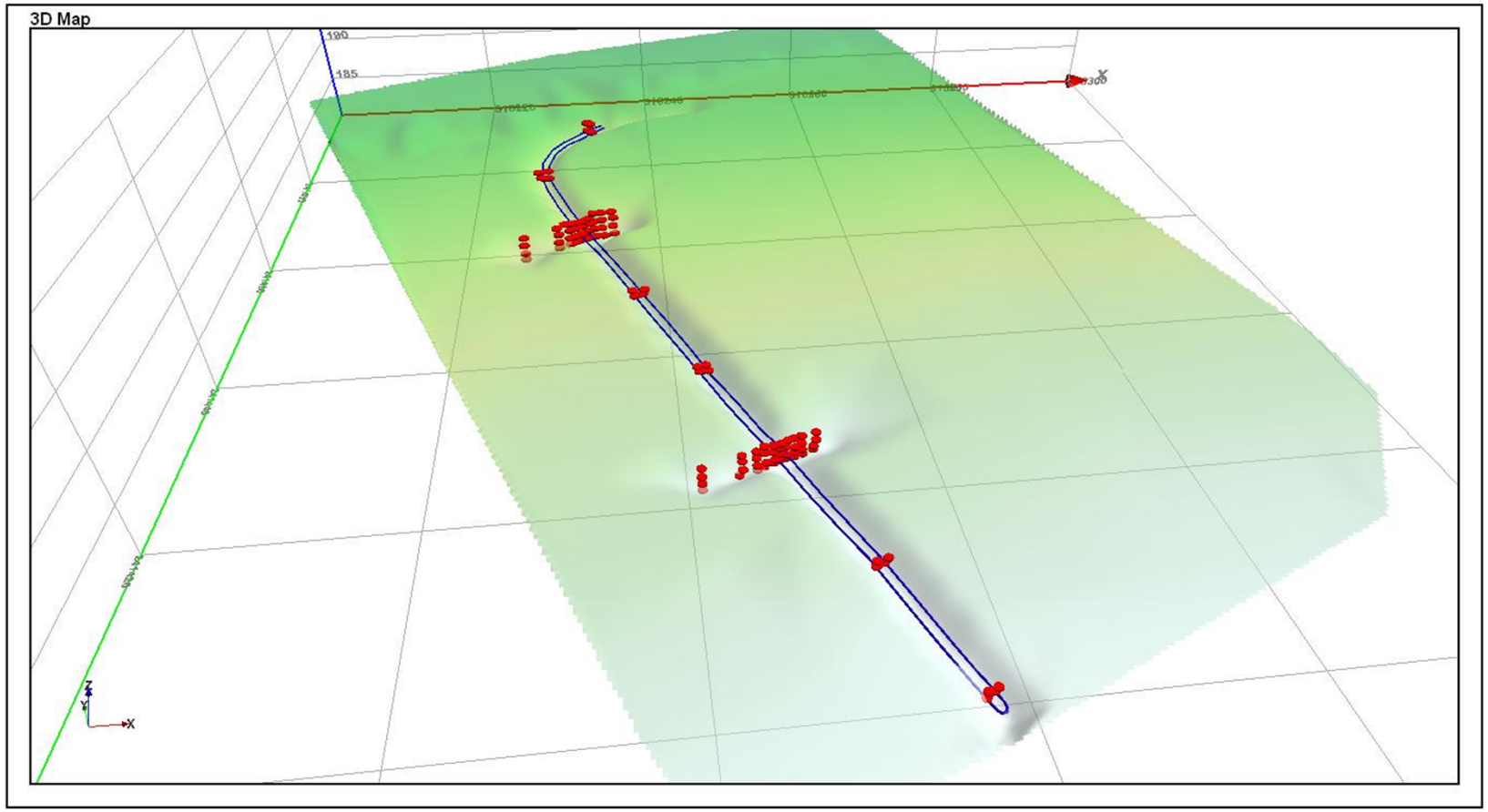

3D view of sensor positions (along and across the trench)

View from site

Site Mapping with GPS technique

Thermal Conductivity With KD2 in –situ Probe

Thermistor string for temperature monitoring

Producing Software to Aid Design

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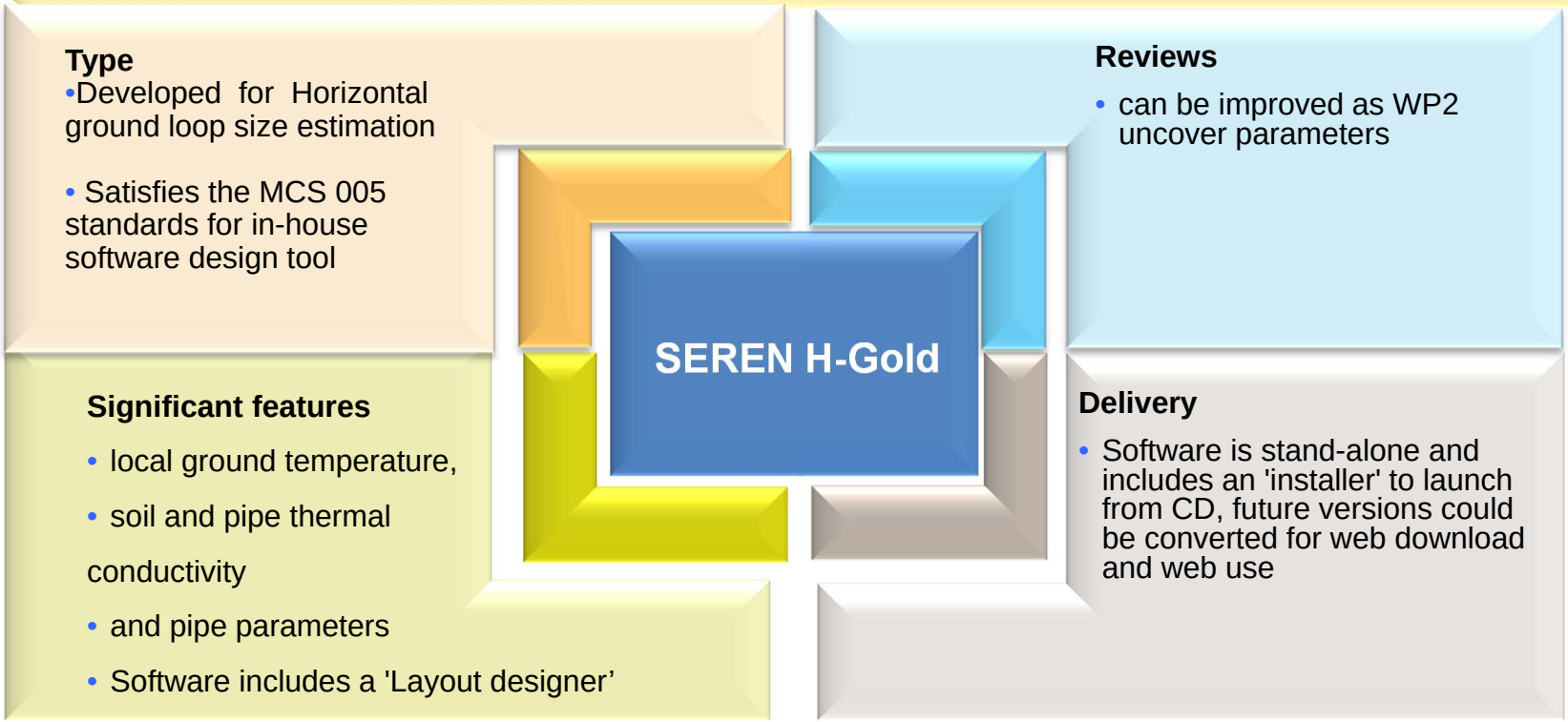
- Software as tool for Welsh companies new to GSHP Market
- Solicit 'collaborative R&D' partner
  - New products/services launched
  - Companies assisted



Screen shot of H-Gold ...

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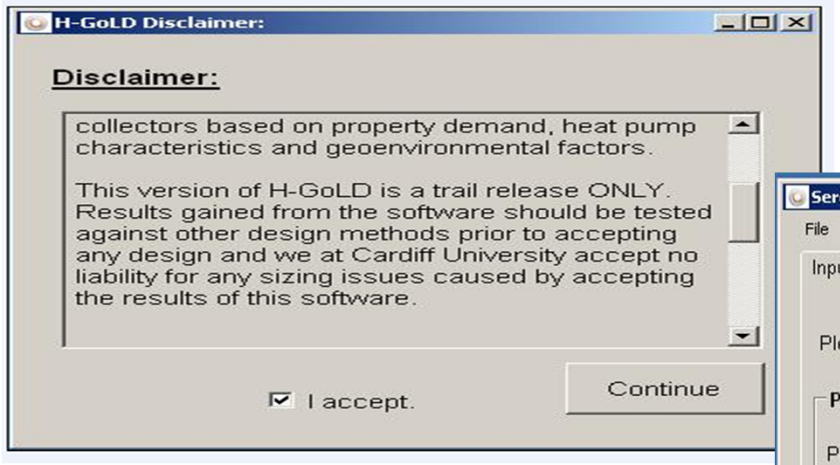

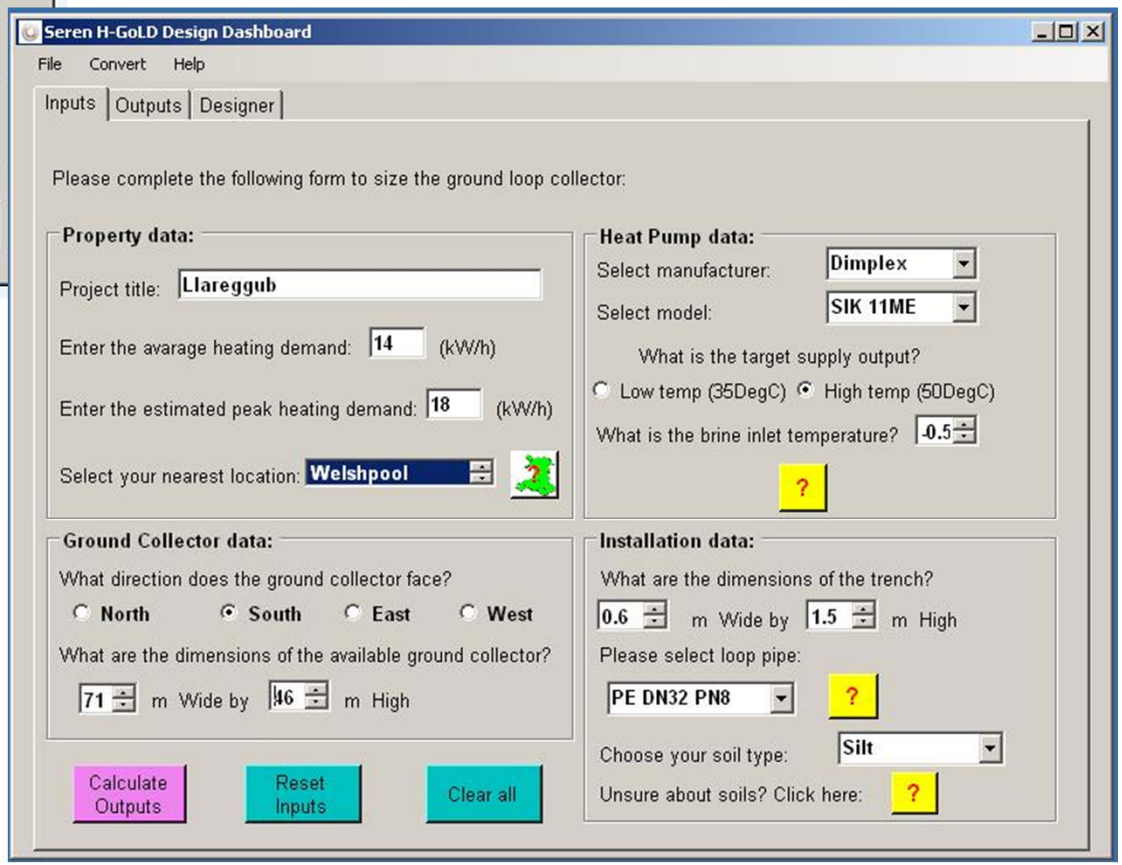

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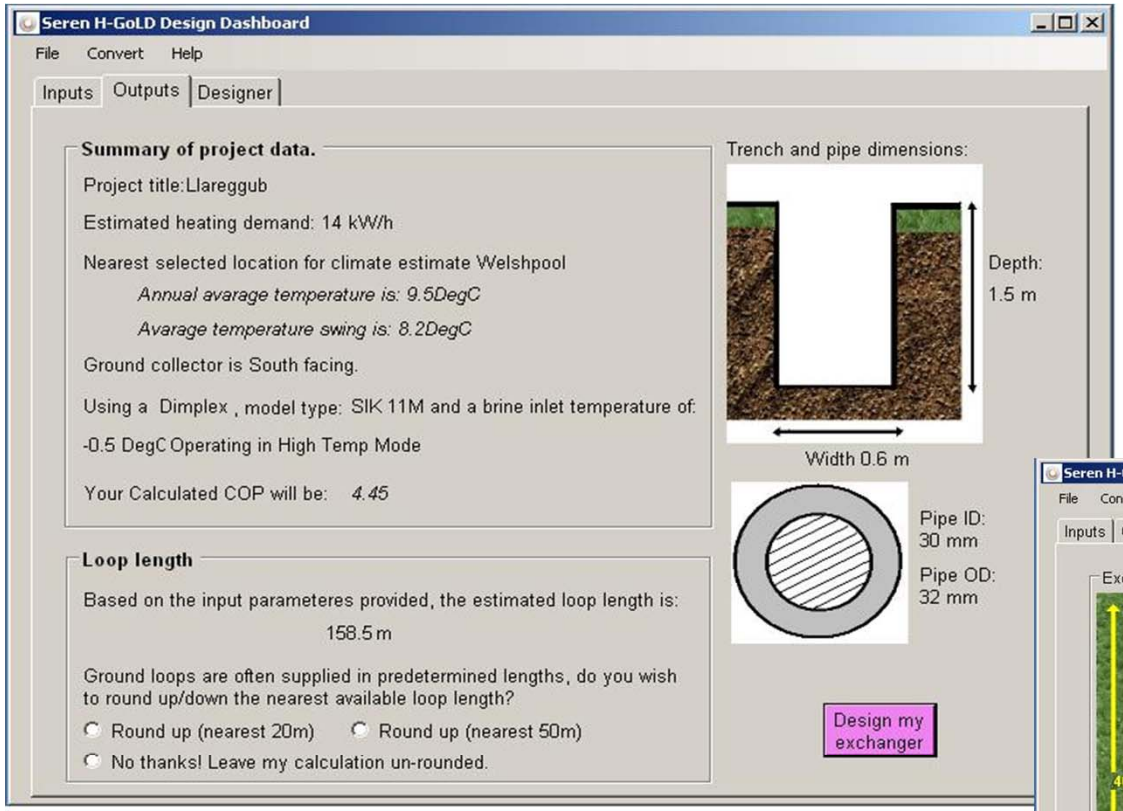

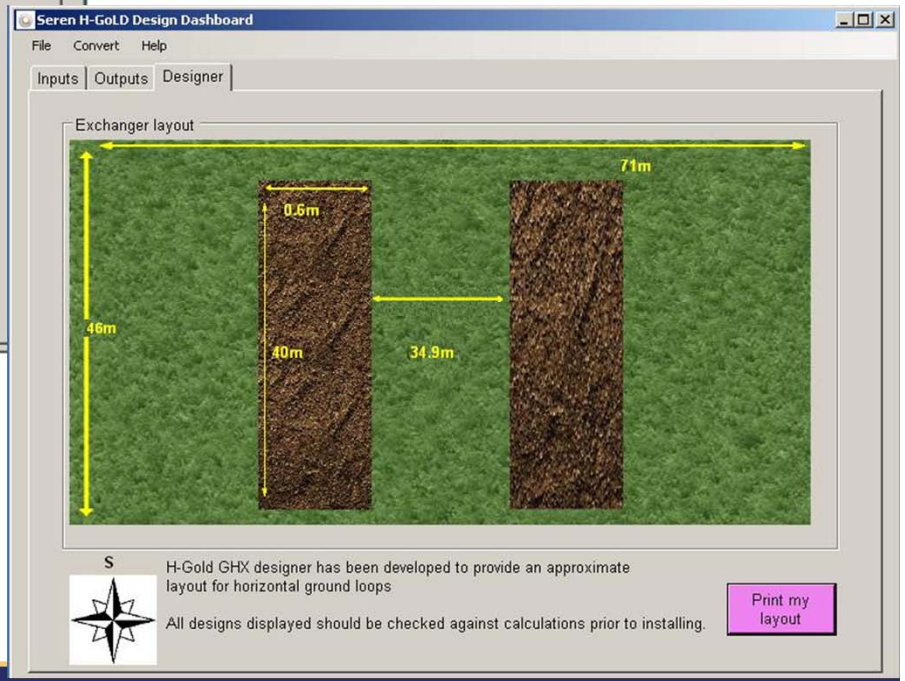

Developing Models and Advance Numerical Simulation

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Objectives

- Analytical solutions to predict the thermal distributions around boreholes
- Investigate the influencing factors using simulations
- Simulate the effects of multiple systems in a small region and the seasonal influence

Steps taken

2D models

- Initial modelling carried out with regards to vertical ground source heat exchangers
- A number of initial 2D models were produced

Fundamental knowledge

- COMPASS's structure and working was investigated

3D analytical model

- Simulating the borehole interaction with the surrounding earth has been produced

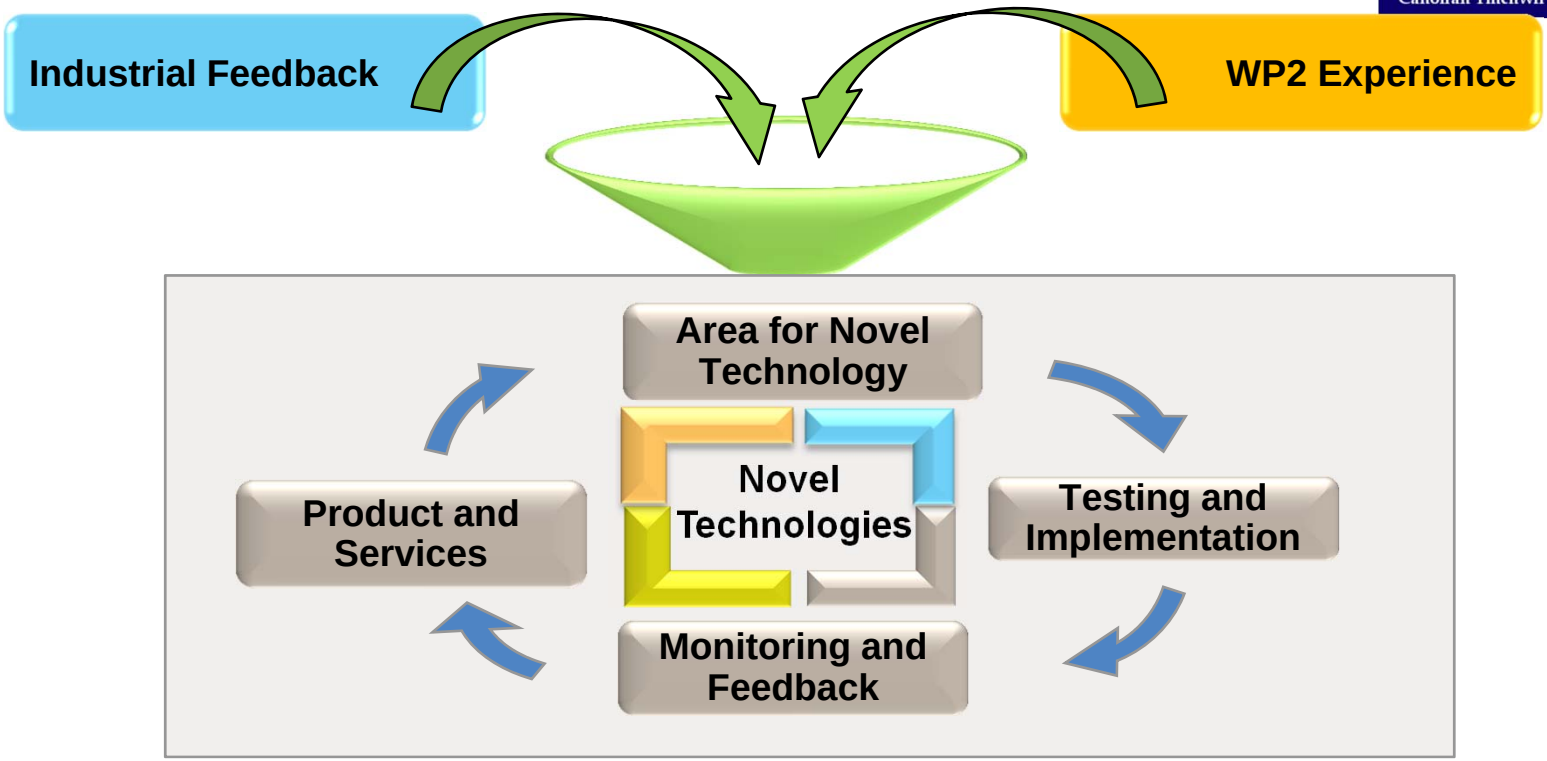
Model Features

- Simulates the fluid moving around the ground loop
- creating a semi-analytical-numerical model
- Retains the geometric features of the borehole
- Can simulate any heat load imposed by the heat exchanger

Future developments

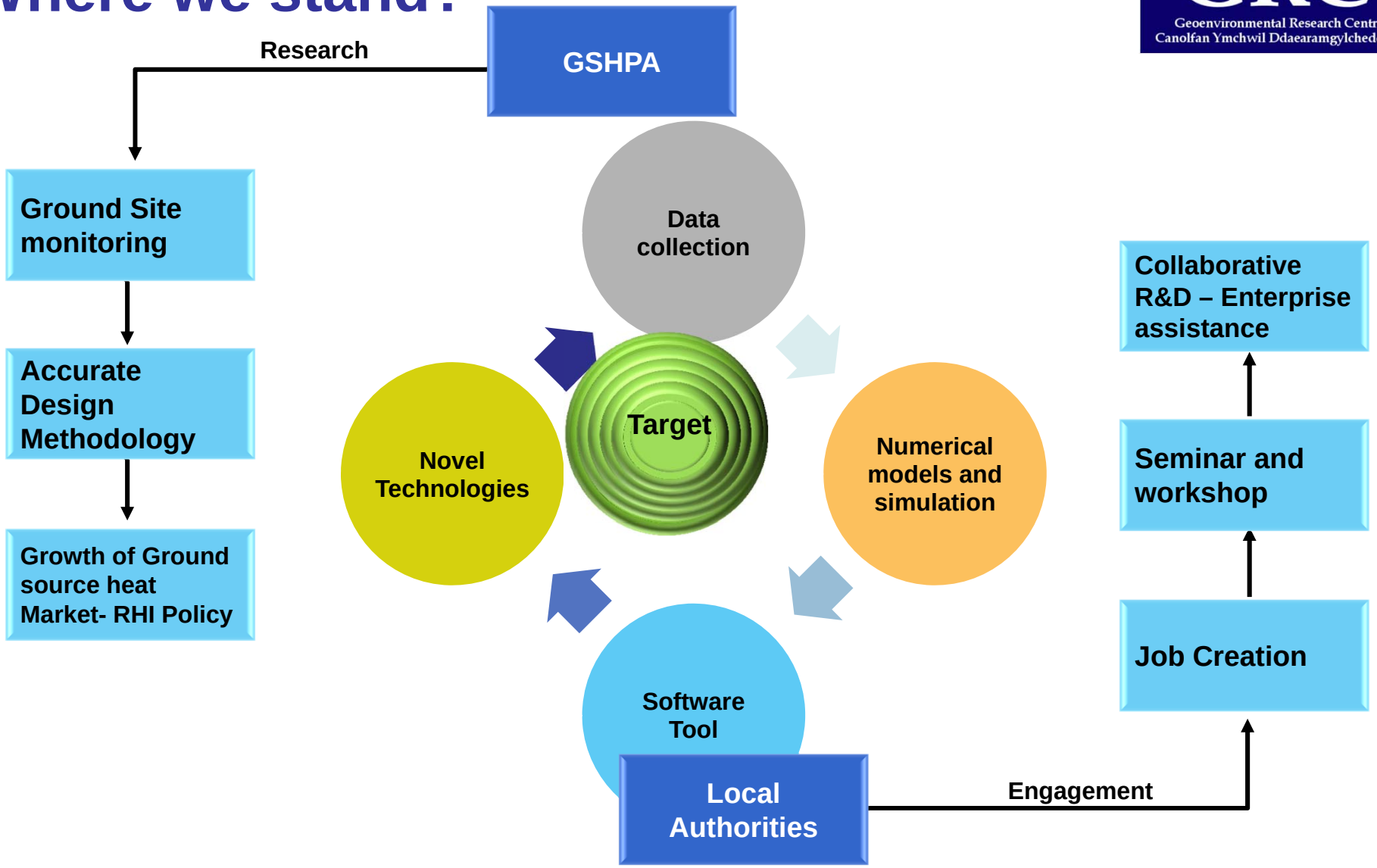
- Refine the current solution, improving the connection to COMPASS
- Include groundwater flow in future models

Novel Technologies



- Key Novel Technology areas identified:
  - Ground heat storage tanks (UTE)
  - Linking with solar energy heat recharge
  - Thermal piles
- This kind of work will be taken from end of next year, after understanding the major concept of ground source heat system

Where we stand?



Scorecard for year 2011-2012

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Enterprise Assisted	4/20	Outputs
Collaborative Projects	4/10	
Gross Job Created	0/25	Results
Enterprise Created	2/2	
New/improved Product/Processes/services	1/8	
Investment induced	£0/2m	

What Next?

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Work Package 2 Plan - Research and Engagement

- Installation of more full scale monitoring system
- Understanding of whole system performance
- Linking Welsh work with UK work (DECC)
- Conducting Seminars/workshop as per the need of industry

THANK YOU FOR LISTENING

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