World Water Congress XV
International Water Resources Association (IWRA)
Edinburgh, Scotland. 25th to 29th May 2015

Knowledge Transfer Partnerships
Technology Strategy Board
Driving Innovation

GCU Glasgow Caledonian University

Heat energy recovery from waste water

Kostas Ninikas - KTP Associate Researcher

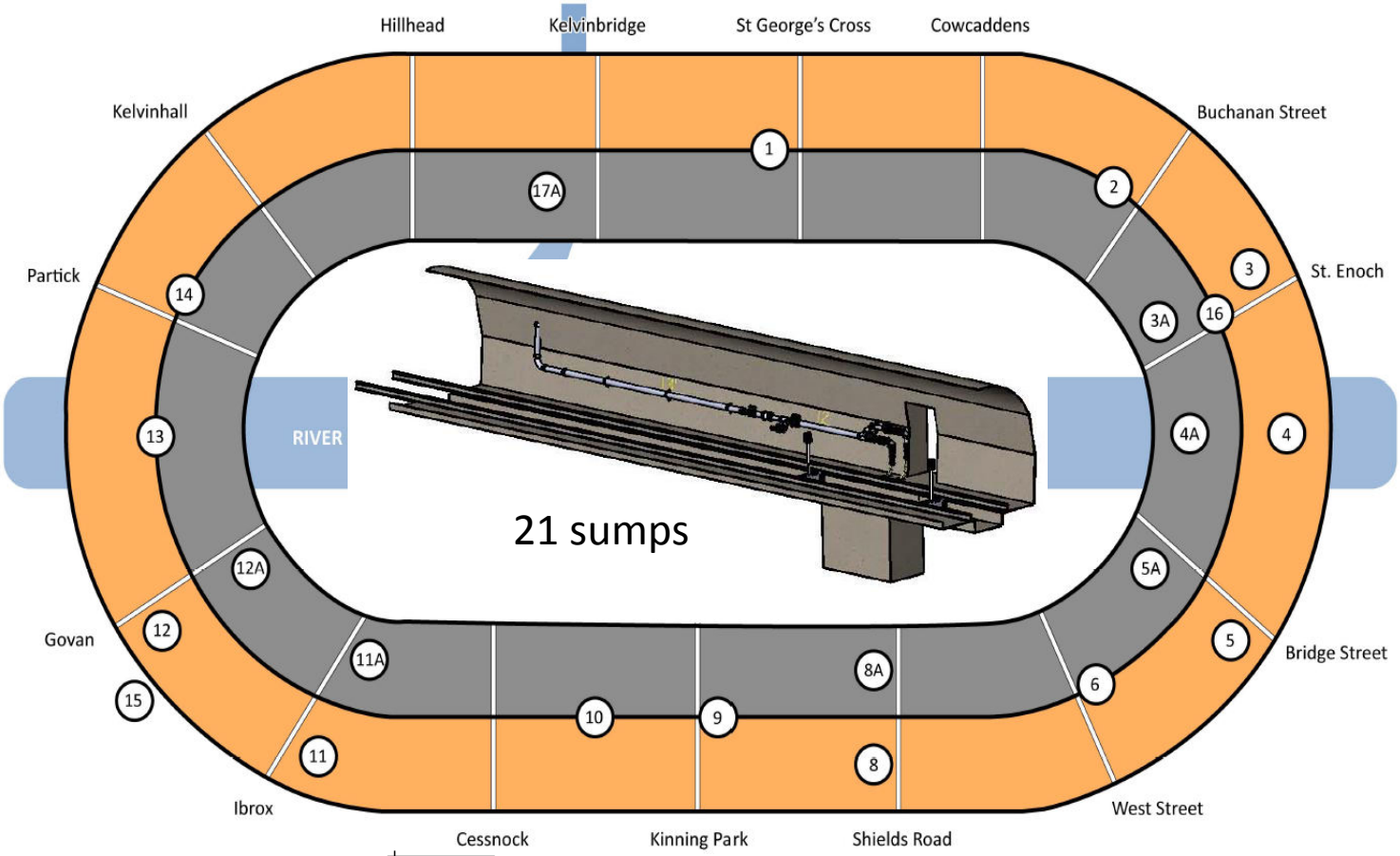
26.05.2015

& Nicholas Hytiris, Rohinton Emmanuel, Bjorn Aaen, Paul L. Younger

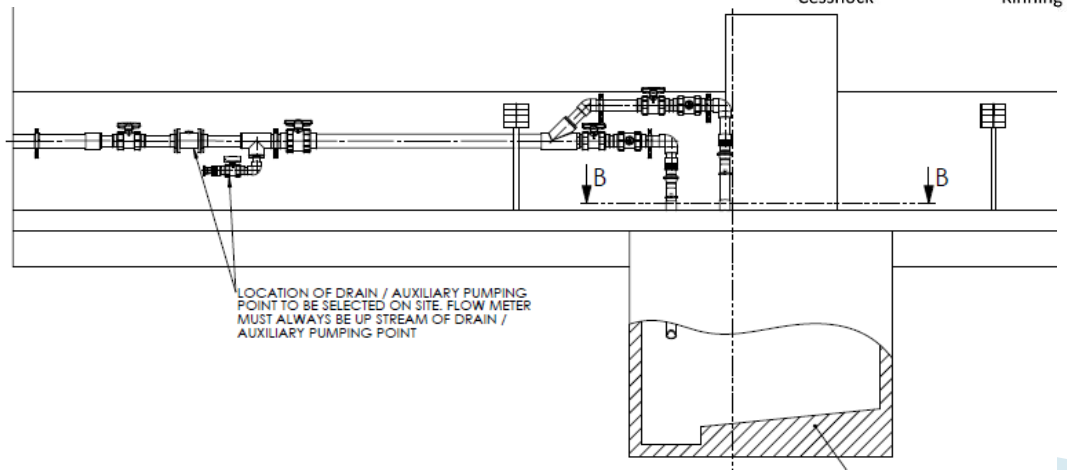
Overview

1. Scope summary
2. Surveys & technology research
3. Feasibility study & options
4. Future steps
5. Q & A

1. Scope summary



Subway System

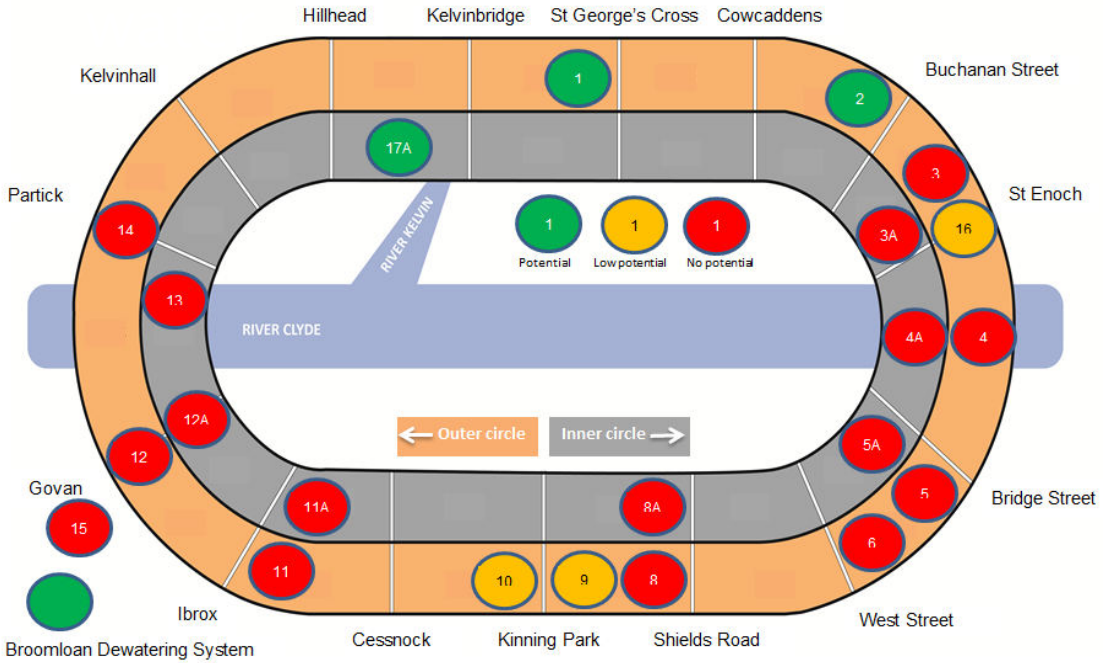


SPT Technology Strategy Board Driving Innovation Knowledge Transfer Partnerships GCU Glasgow Caledonian University

1. Scope summary

Initial scope to manage the water by investigating the possibility to produce heat energy through this element (April 14)

Research – measurements – investigation (May to Nov. 14)



System's installation (exp. June 15)

Trial decided (Dec. 14)

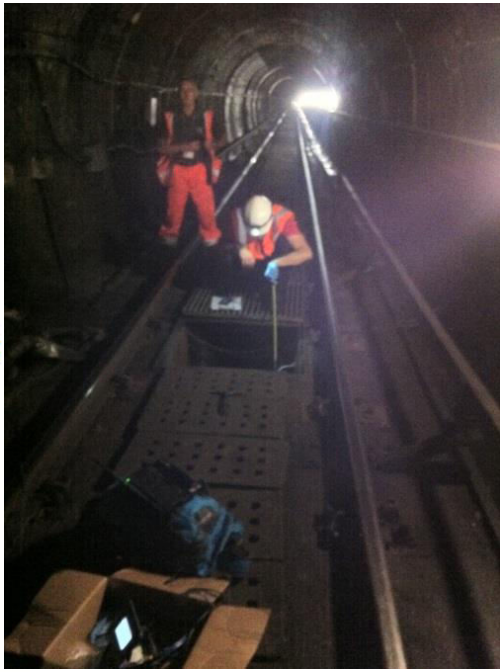
Feasibility study & options report (July to Nov. 14)

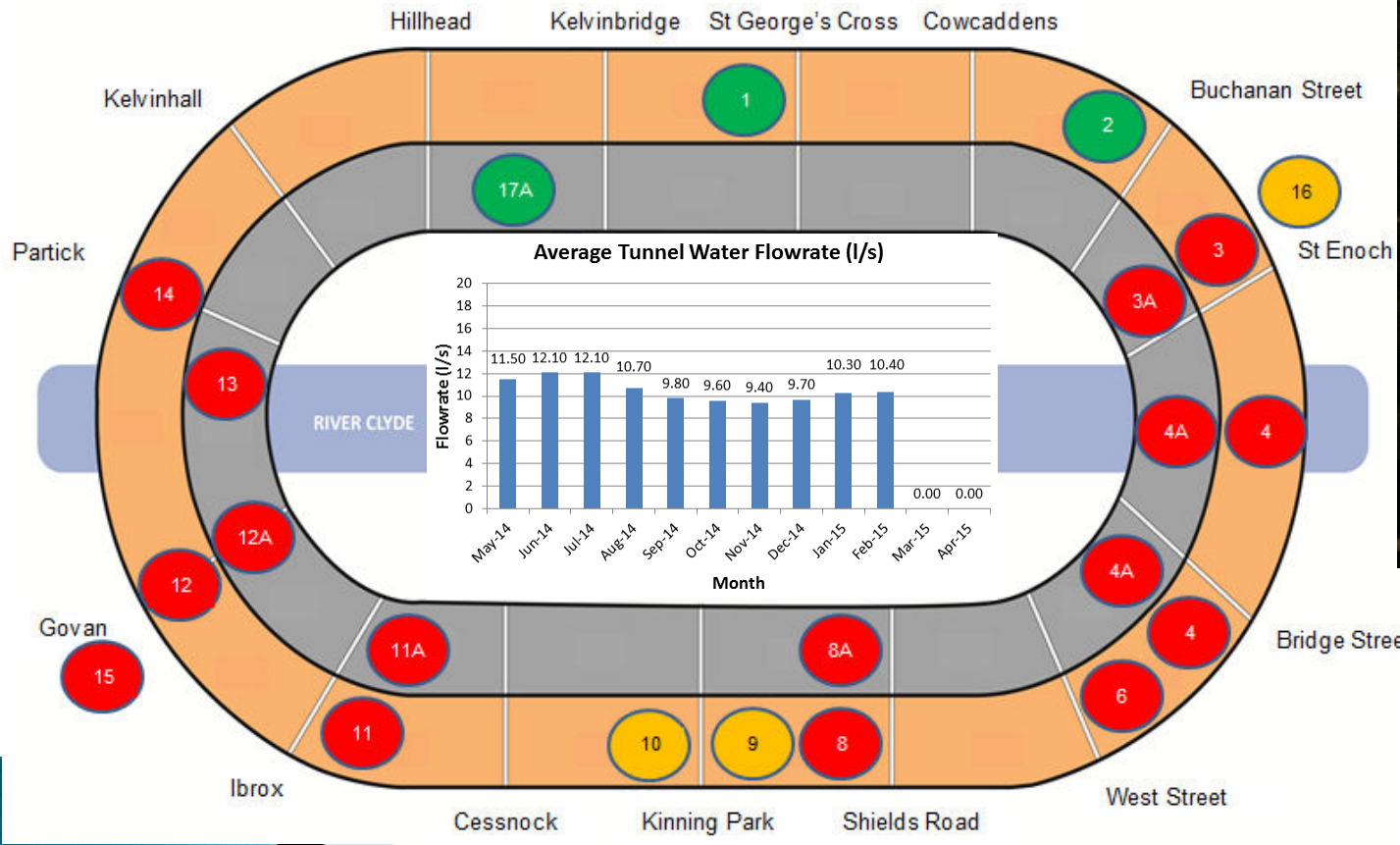
Technology Strategy Board
Driving Innovation
Knowledge Transfer Partnerships
Glasgow Caledonian University

2. Surveys & technology research

Monthly measurements of the water flux and temperature in each sump (May 14 to date)

- Water flow survey



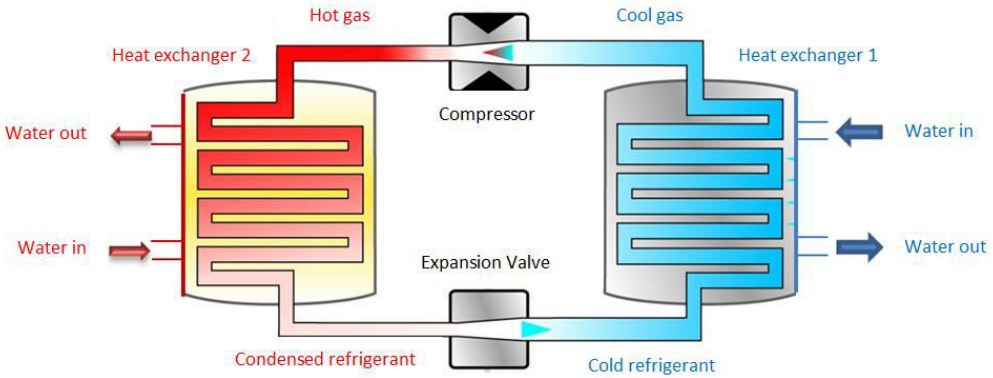


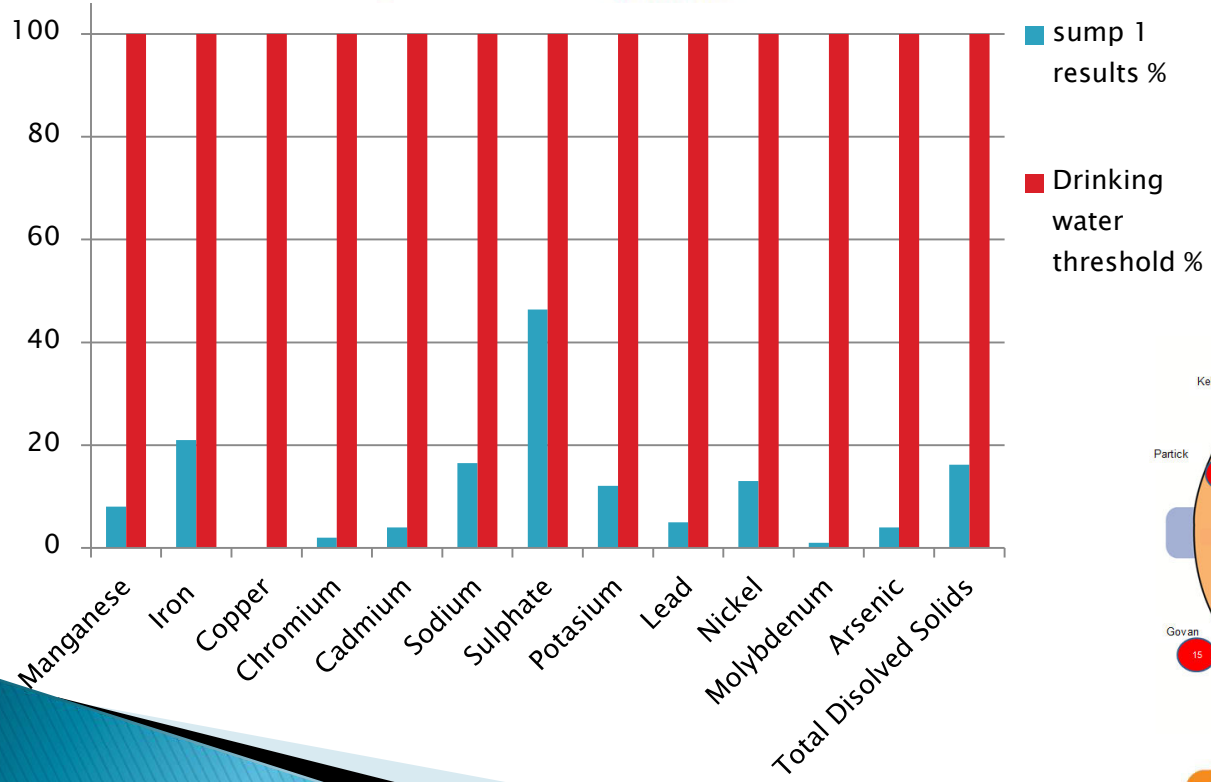
Subway System potential (%)

1	1	1
61% - 100%	31% - 60%	0% - 30%

SPT Technology Strategy Board Driving Innovation Knowledge Transfer Partnerships GCU Glasgow Caledonian University

2. Surveys & technology research





- Water chemical analysis

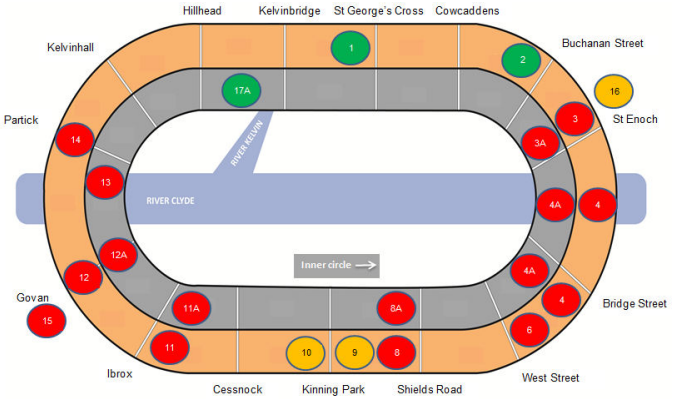
Samples were collected from all 21 sumps (July 2014)

↓

Water analysis was undertaken for 6 samples (July 2014)

↓

Results: No issue for special specs. for a heat pump (Aug. 2014)



Technology Strategy Board
Driving Innovation

Knowledge Transfer Partnerships

Glasgow Caledonian University

3. Feasibility study & options

- Heat load calculations

Station Name	Total design heat load		Station Name	Total design heat load	
	W	kW		W	kW
Hillhead	**6641**	**6.6**	Shields Road	**4189**	**4.2**
Kelvinbridge	**4755**	**4.8**	Kinning Park	**2983**	**3.0**
St. Georges Cross	**5185**	**5.2**	Cessnock	**4106**	**4.1**
Cowcaddens	**3369**	**3.4**	Ibrox	**3243**	**3.2**
Buchanan Street	**4778**	**4.8**	Govan	**30331**	**30.3**
St. Enoch	**4706**	**4.7**	Partick	-	-
Bridge Street	**4577**	**4.6**	Kelvinhall	**2599**	**2.6**
West street	**4029**	**4.0**	Buchanan Bus Station	-	-

Red: trial site

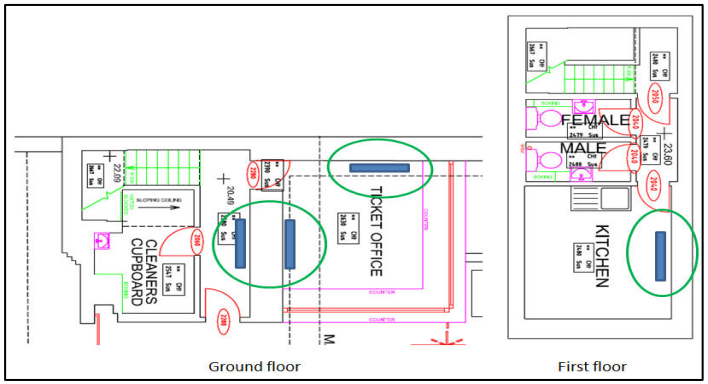
Calculations accord. BS EN 12831-2003 (Oct. – Nov. 14)

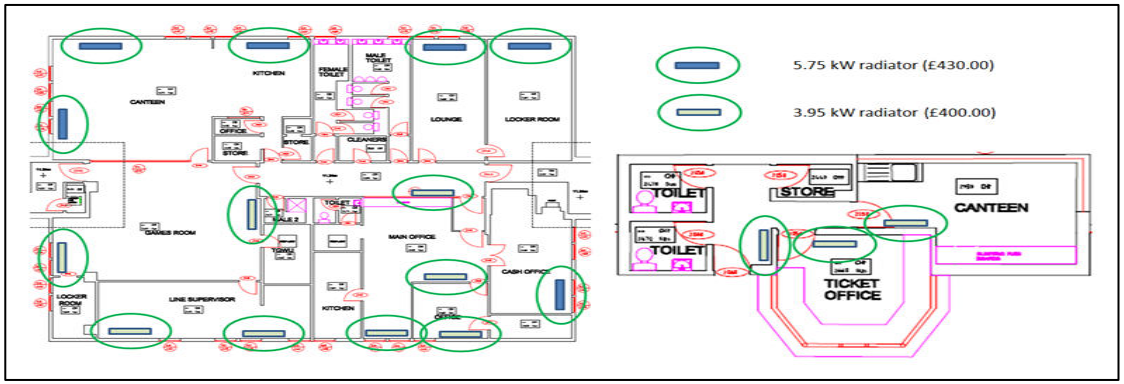
↓

Establish thermal need for each station (Nov. 14)

↓

Define the appropriate system (Nov. 14)



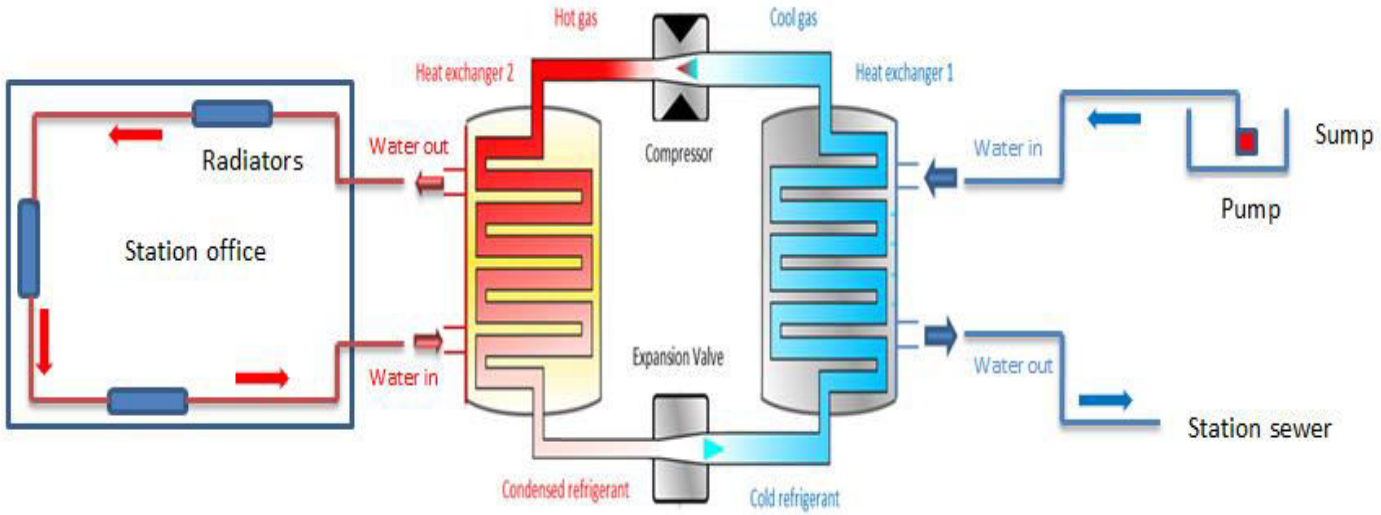


Govan station drawings with proposed radiators after heat load calculations

SPT Technology Strategy Board Driving Innovation Knowledge Transfer Partnerships GCU Glasgow Caledonian University

3. Feasibility study & options

Water sourced solution



Feasibility study & options report (Nov 14)

↓

Options workshop (Dec 14)

↓

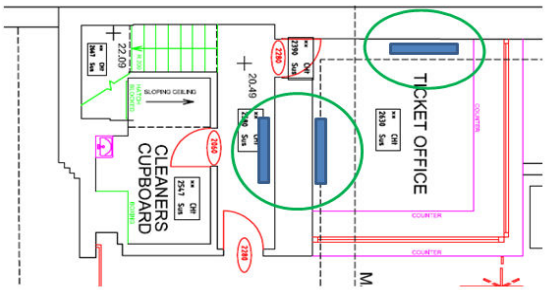
Trial site selected (Dec 14)

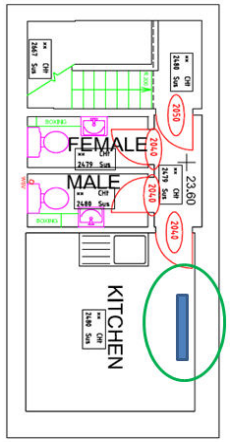
↓

Water

3. Feasibility study & options

- Design & specifications for trial location (St. George's Cross)



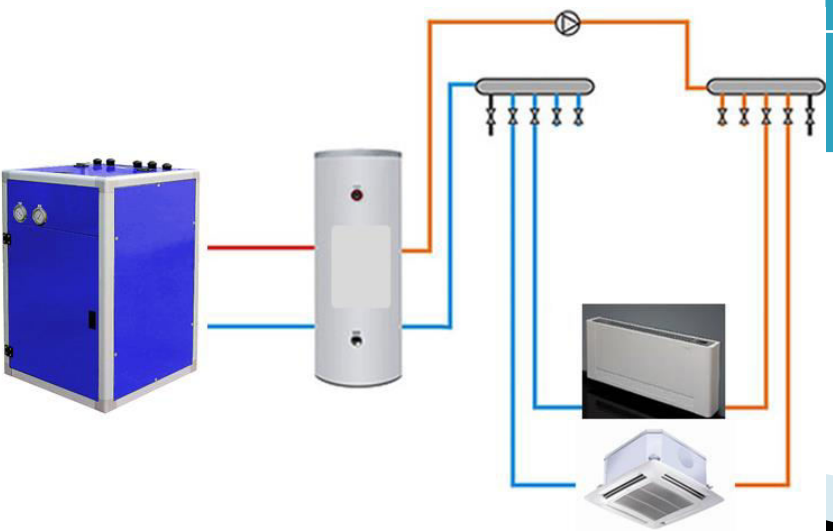


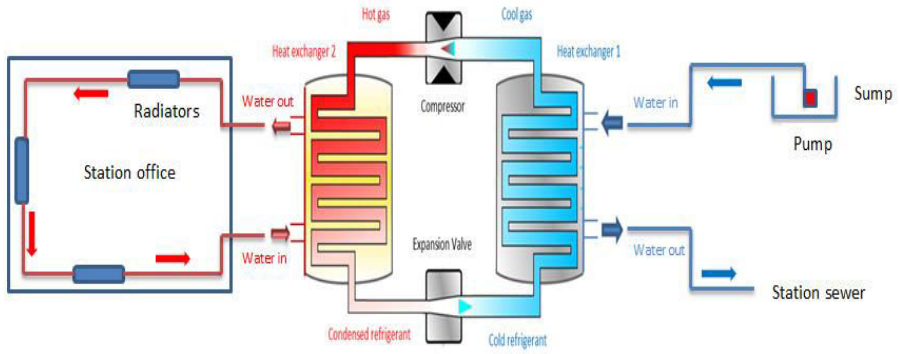
High level supply costs

	Unit	Cost / Unit	Total cost
Water source heat pump	1 piece	£12000	£12000
Radiators	4 pieces	£400	£1600
Civil works	30m	£60	£1800
Total (± 20 %)			£15400

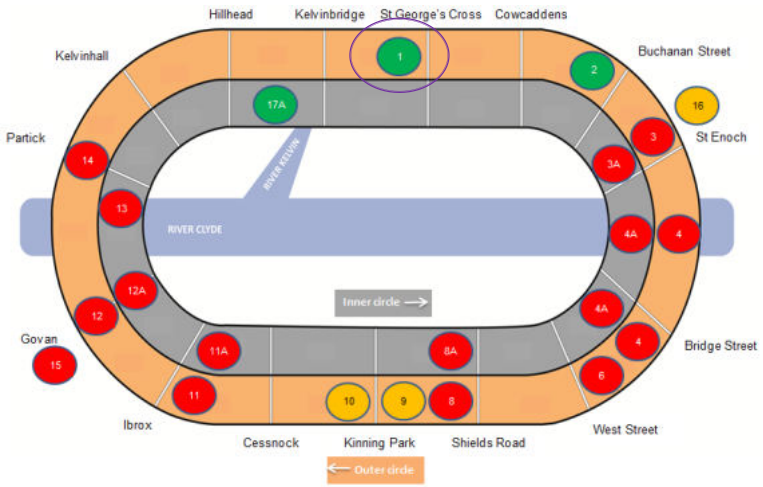
VAT and installation cost in not included

St. Georges Cross	Thermal needs (kW)	Input (kW)	Output (kW)	Cost / year (210 d 16h/ days)	CO_2 emissions (kg/kW)	By-product	Payback period (years)
4 electric radiators	5.2	12	12	£4050	0.47	-	-
GSHP (sump 1)		3	8	£510	0.16 (65% less)	Air conditioning	8



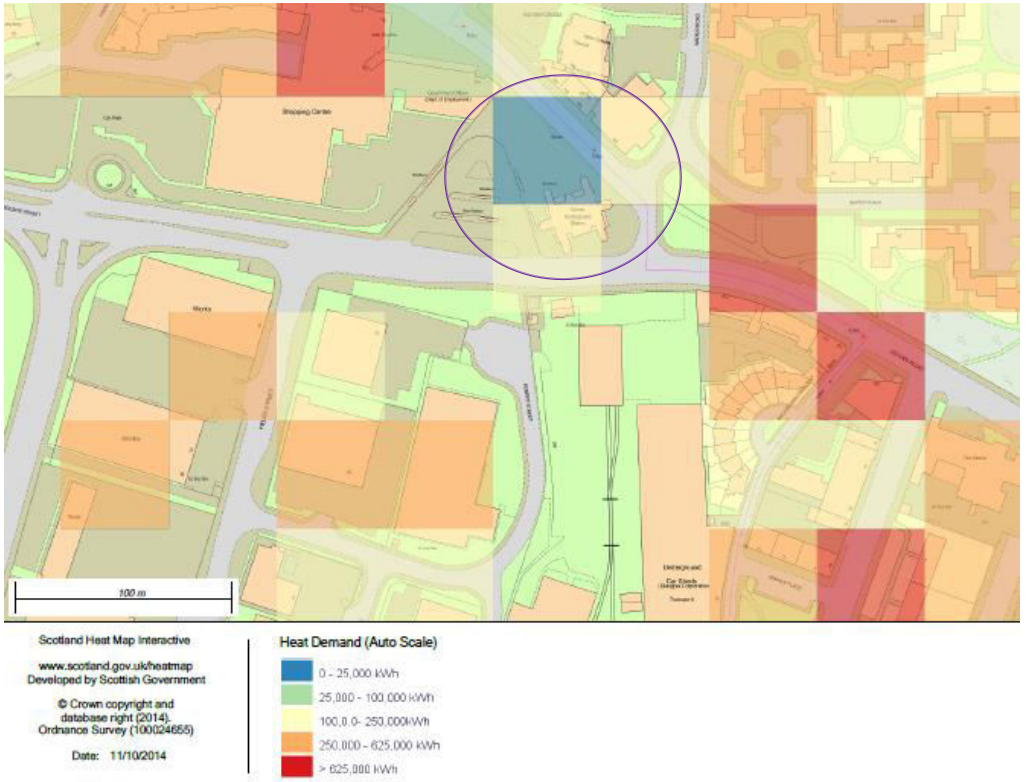


4. Future steps



1. Monitoring – feedback
2. Lessons learned
3. Energy use assessment
4. Scale it up to further stations

- Energy use assessment using the heat map (St George's Cross)



6. Q & A

Thank you