

# Response to Feed In Tariff consultation

## For the British Hydro Association

v8 12<sup>th</sup> October 2009  
Carl Crompton



# Proposal summary


1. A target return to investors of 5-8% is not sufficiently attractive to encourage large-scale investment into the sector – we recommend 10% IRR would be more appropriate
2. Long-term debt interest rates are in the range 7-8% - hence the use of debt could actually reduce equity returns - further reducing capital flow into the sector
3. Hydro Capex & Opex Costs are significantly under-estimated in the current consultation document
4. If the 5-8% IRR is maintained then actual costs should be taken into consideration
5. Unlike other technologies Hydro costs do not 'degress' but are actually inflating due to the best sites having already being "cherry-picked" and upward pressure on operating costs
6. In order to prevent inflation eroding the 'real' IRR below the 5-8% target, indexing of the tariffs should be implemented

# Proposal overview

1. **Proposal 1:** Increase the number of Hydro bands in order to reduce the propensity to “downsize” – so maximizing renewable energy generation
2. **Proposal 2:** Change the tariff prices to reflect the true Capital and Operating costs of Hydro, and the expected above-inflation increases of these costs
3. **Proposal 3:** Consider a target return of 10% in order to encourage large-scale investment into this sector
4. **Proposal 4:** If 5-8% return is maintained then all other aspects of the Feed-In-Tariff scheme should prevent further erosion of returns to equity investors
5. **Proposal 5:** Consider indexing the tariffs. With no indexing equity investors are exposed to inflation – eroding their real returns. If one of the main tenets of the Feed-In-Tariff is certainty of return, then indexing would provide this.

# Proposal 1 – increase number of bands

- Increasing number of Hydro bands will reduce the propensity to “downsize” (reducing the power rating from a project's true potential to capitalize on more generous lower bands)
- Propose increasing number of bands to 7 (from 4) as follows:

Current			BHA proposal	
Lower limit (kW)	Upper limit (kW)		Lower limit (kW)	Upper limit (kW)
0	10		0	15
10	100		15	50
100	1000		50	150
1000	5000		150	500
			500	1000
			1000	2000
			2000	5000

# Justification for new banding limits

1. **Band 1 (0-15kW):** There is a step change in the installation cost of systems at 11.5 kW on a 3-phase due to the transition from G83/1 connection to G59 connection with on-site testing requirements. So that this transition and extra cost does not become a false barrier, the tariff transition should be set a few kW above the G59 threshold (say at 15kW) to pay for G59 connections of 11.5 – 14.9 kW systems.
2. **Band 2 (15-50kW):** There is a natural limitation of system size at 50 kW: this is the largest system that can be connected to a single-phase line (source: SSE). Since single phase connections are more expensive than 3-phase connections this banding will maximize the uptake of the hydro potential in remote areas.
3. **Bands 3 (50-150kW), 4 (150-500kW) and 5 (500-1000kW):** Original band 100-1000kW too wide - economics very different at each extreme.

# Justification for new banding limits

4. **Band 6 (1-2mW):** large number of domestic "individual-owned" schemes in this range – this new band reduces likelihood of downsizing to below 1mW and also makes FiTs vs ROCs decision clearer.
5. **Band 7 (2-5mW):** territory of professional/experienced developers rather than domestic "individual-owned" schemes – likely to have experience of electricity trading and some negotiating power so likely to opt for ROCs rather than FiTs.

Note: it is currently proposed that the transition to ROC's is "smoothed" by making the economics of FiTs and ROCs very similar at the upper limits. We feel that this creates further uncertainty/procrastination/debate and feel that the decision should be made easier with a tariff system which encourages investors one way or the other depending upon kW output. Ie FiTs below 2mW and ROC's above 2mW.

# Proposal 2 – modify tariffs

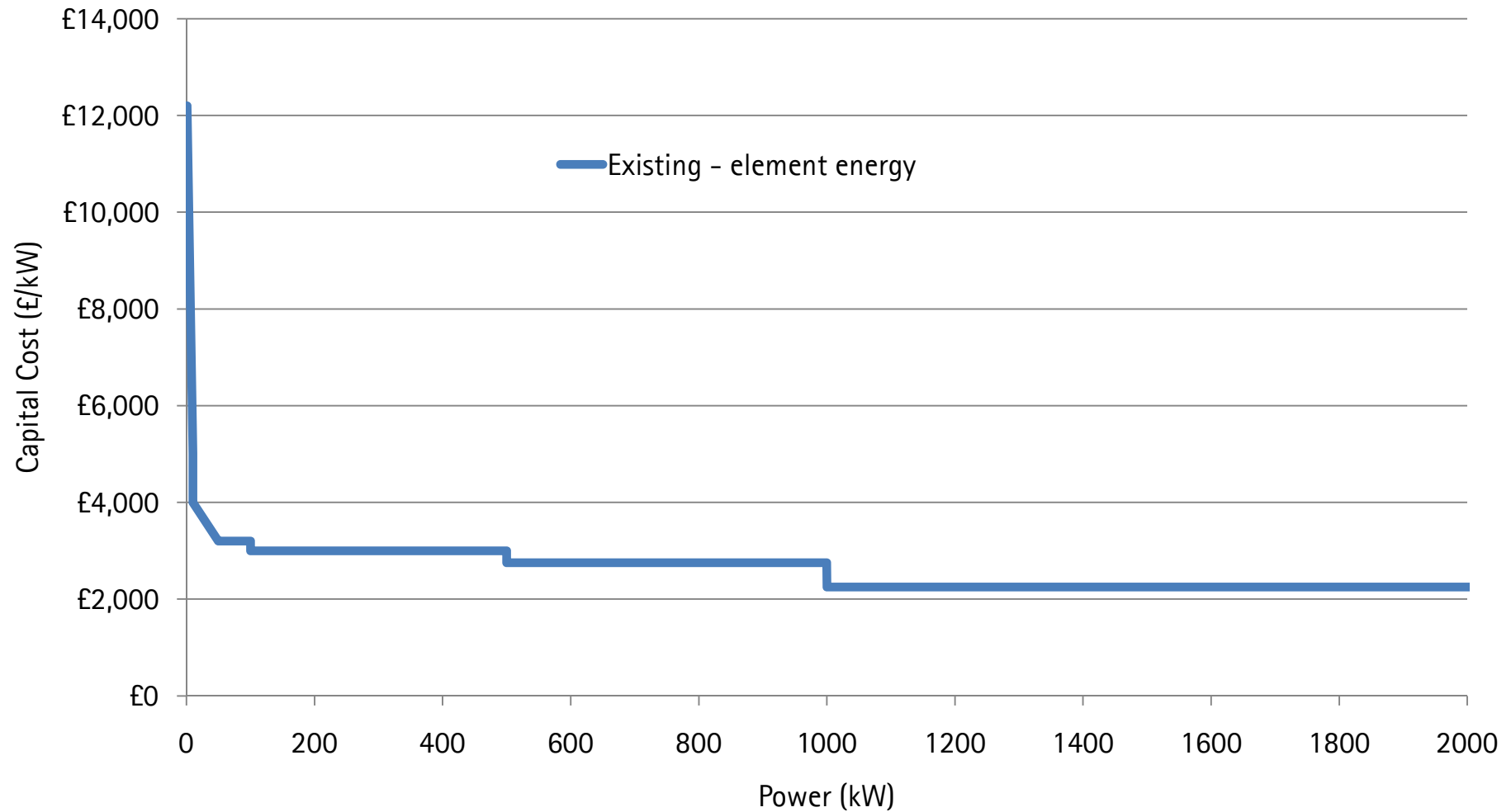
- Currently proposed Hydro tariffs based upon following Capex and Opex cost assumptions (and constant 30% Load Factor):

Current Capex and Opex costs from Element Energy report

		Capex		Opex
Lower limit (kW)	Upper limit (kW)	Fixed cost per site	Marginal cost (£/kW)	Annual maintenance cost
1	10	£8,000	£4,200	£440
10	50	£10,000	£3,000	£440
50	100		£3,200	£12,500
100	500		£3,000	£20,000
500	1000		£2,750	£50,000
1000	5000		£2,250	£50,000

# "Cost-curve" based upon Element/Poyry report

Capital Cost/kW vs kW



# Capex data collected on actual projects

- Capex data collected on 127 real projects
- These figures are based upon two data-sets:
  1. Schemes which are generating or under construction as of September 2009
  2. Schemes which are planned and have been costed but which are not yet under construction
- These numbers do not factor in upward pressure on costs from a number of areas (more on this later)
- Element/Poyry published Capex costs are too low based upon our collective experience

# Capex data collected on actual projects

Project	Power (kw)	Total Capex (£)	Capex/kW (£/kW)
Project 1	15	£90,000	£6,000
Project 2	430	£1,500,000	£3,488
Project 3	100	£400,000	£4,000
Project 4	300	£1,400,000	£4,667
Project 5	146	£550,000	£3,767
Project 6	63	£300,000	£4,762
Project 7	20	£125,000	£6,250
Project 8	4.5	£100,000	£22,222
Project 9	30	£165,100	£5,503
Project 10	273	£1,375,000	£5,037
Project 11	535	£1,500,522	£2,805
Project 12	482	£1,300,000	£2,697
Project 13	40	£219,886	£5,497
Project 14	100	£453,000	£4,530
Project 15	230	£950,000	£4,130
Project 16	270	£1,550,442	£5,742
Project 17	21	£262,000	£12,476
Project 18	25	£275,000	£11,000
Project 19	3.7	£25,000	£6,757
Project 20	12	£106,000	£8,833
Project 21	130	£450,000	£3,462
Project 22	50	£210,000	£4,200
Project 23	220	£750,000	£3,409
Project 24	35	£200,000	£5,714
Project 25	500	£1,400,000	£2,800

Project	Power (kw)	Total Capex (£)	Capex/kW (£/kW)
Project 26	3.6	£28,000	£7,778
Project 27	1.8	£23,000	£12,778
Project 28	50	£255,677	£5,114
Project 29	195	£430,000	£2,205
Project 30	295	£896,457	£3,039
Project 31	9	£45,000	£5,000
Project 32	11	£65,000	£5,909
Project 33	12	£50,000	£4,167
Project 34	20	£190,000	£9,500
Project 35	2.5	£31,000	£12,400
Project 36	57.5	£232,000	£4,035
Project 37	100	£453,000	£4,530
Project 38	3.5	£30,000	£8,571
Project 39	9.5	£50,000	£5,263
Project 40	100	£450,000	£4,500
Project 41	50	£210,000	£4,200
Project 42	39	£95,000	£2,436
Project 43	4.2	£40,000	£9,524
Project 44	3.7	£45,000	£12,162
Project 45	180	£456,000	£2,533
Project 46	25	£95,000	£3,800
Project 47	5.5	£32,000	£5,818
Project 48	47	£206,000	£4,383
Project 49	45	£213,000	£4,733
Project 50	11	£75,000	£6,818

# Capex data collected on actual projects

Project	Power (kw)	Total Capex (£)	Capex/kW (£/kW)
Project 51	150	£430,000	£2,867
Project 52	11.5	£84,000	£7,304
Project 53	25	£160,000	£6,400
Project 54	11.5	£70,000	£6,087
Project 55	8.4	£65,000	£7,738
Project 56	20	£127,000	£6,350
Project 57	49	£178,000	£3,633
Project 58	69	£218,000	£3,159
Project 59	46.2	£186,000	£4,026
Project 60	2.1	£36,000	£17,143
Project 61	10	£94,000	£9,400
Project 62	45	£199,000	£4,422
Project 63	100	£525,000	£5,250
Project 64	750	£2,117,000	£2,823
Project 65	600	£1,838,000	£3,063
Project 66	1700	£4,878,000	£2,869
Project 67	900	£2,268,569	£2,521
Project 68	700	£2,085,000	£2,979
Project 69	650	£2,680,000	£4,123
Project 70	800	£3,000,000	£3,750
Project 71	40	£300,000	£7,500
Project 72	63	£349,020	£5,540
Project 73	500	£1,885,000	£3,770
Project 74	3.7	£34,000	£9,189
Project 75	48	£146,000	£3,042

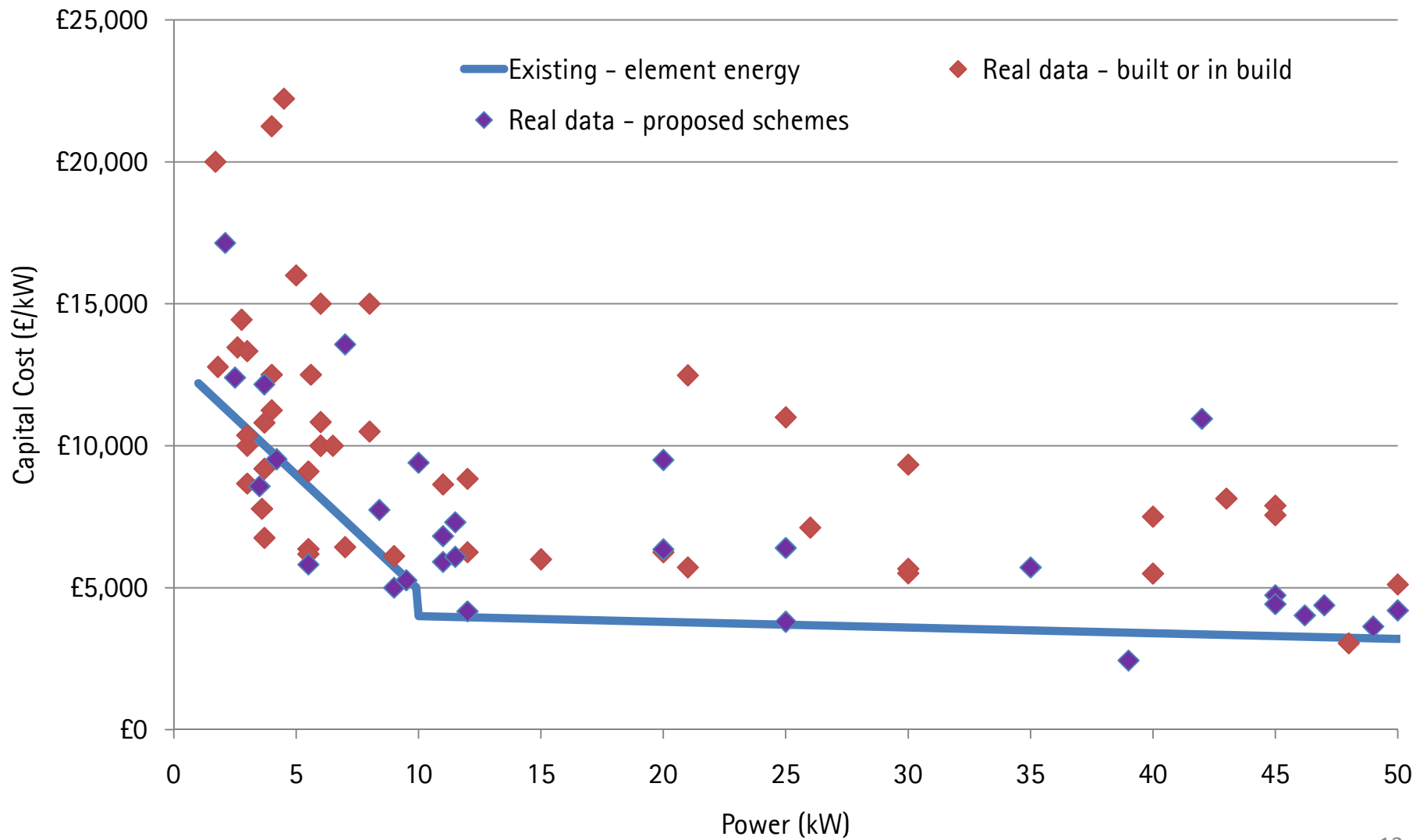
Project	Power (kw)	Total Capex (£)	Capex/kW (£/kW)
Project 76	5.5	£35,000	£6,364
Project 77	21	£120,000	£5,714
Project 78	6	£90,000	£15,000
Project 79	3	£26,000	£8,667
Project 80	5.5	£34,000	£6,182
Project 81	5.5	£50,000	£9,091
Project 82	2400	£5,059,000	£2,108
Project 83	4000	£8,000,000	£2,000
Project 84	750	£2,555,000	£3,407
Project 85	3500	£7,000,000	£2,000
Project 86	3400	£6,600,000	£1,941
Project 87	2500	£4,782,000	£1,913
Project 88	1350	£3,140,800	£2,327
Project 89	12	£75,000	£6,250
Project 90	6	£65,000	£10,833
Project 91	5.6	£70,000	£12,500
Project 92	6.5	£65,000	£10,000
Project 93	3.7	£40,000	£10,811
Project 94	2.6	£35,000	£13,462
Project 95	6	£60,000	£10,000
Project 96	11	£95,000	£8,636
Project 97	4	£50,000	£12,500
Project 98	8	£120,000	£15,000
Project 99	6	£60,000	£10,000
Project 100	43	£350,000	£8,140

# Capex data collected on actual projects

Project	Power (kw)	Total Capex (£)	Capex/kW (£/kW)
Project 101	26	£185,000	£7,115
Project 102	2.77	£40,000	£14,440
Project 103	3	£40,000	£13,333
Project 104	8	£84,000	£10,500
Project 105	4	£85,000	£21,250
Project 106	45	£355,000	£7,889
Project 107	3	£30,000	£10,000
Project 108	30	£280,000	£9,333
Project 109	42	£460,000	£10,952
Project 110	153	£650,000	£4,248
Project 111	70	£410,000	£5,857
Project 112	7	£95,000	£13,571
Project 113	110	£520,000	£4,727
Project 114	254	£763,225	£3,005
Project 115	112	£450,225	£4,020
Project 116	100	£446,225	£4,462
Project 117	74	£481,225	£6,503
Project 118	165	£990,000	£6,000
Project 119	122	£854,000	£7,000
Project 120	9	£55,000	£6,111
Project 121	3	£31,100	£10,367
Project 122	7	£45,000	£6,429
Project 123	4	£45,000	£11,250
Project 124	5	£80,000	£16,000
Project 125	30	£170,000	£5,667
Project 126	1.7	£34,000	£20,000
Project 127	45	£340,000	£7,556

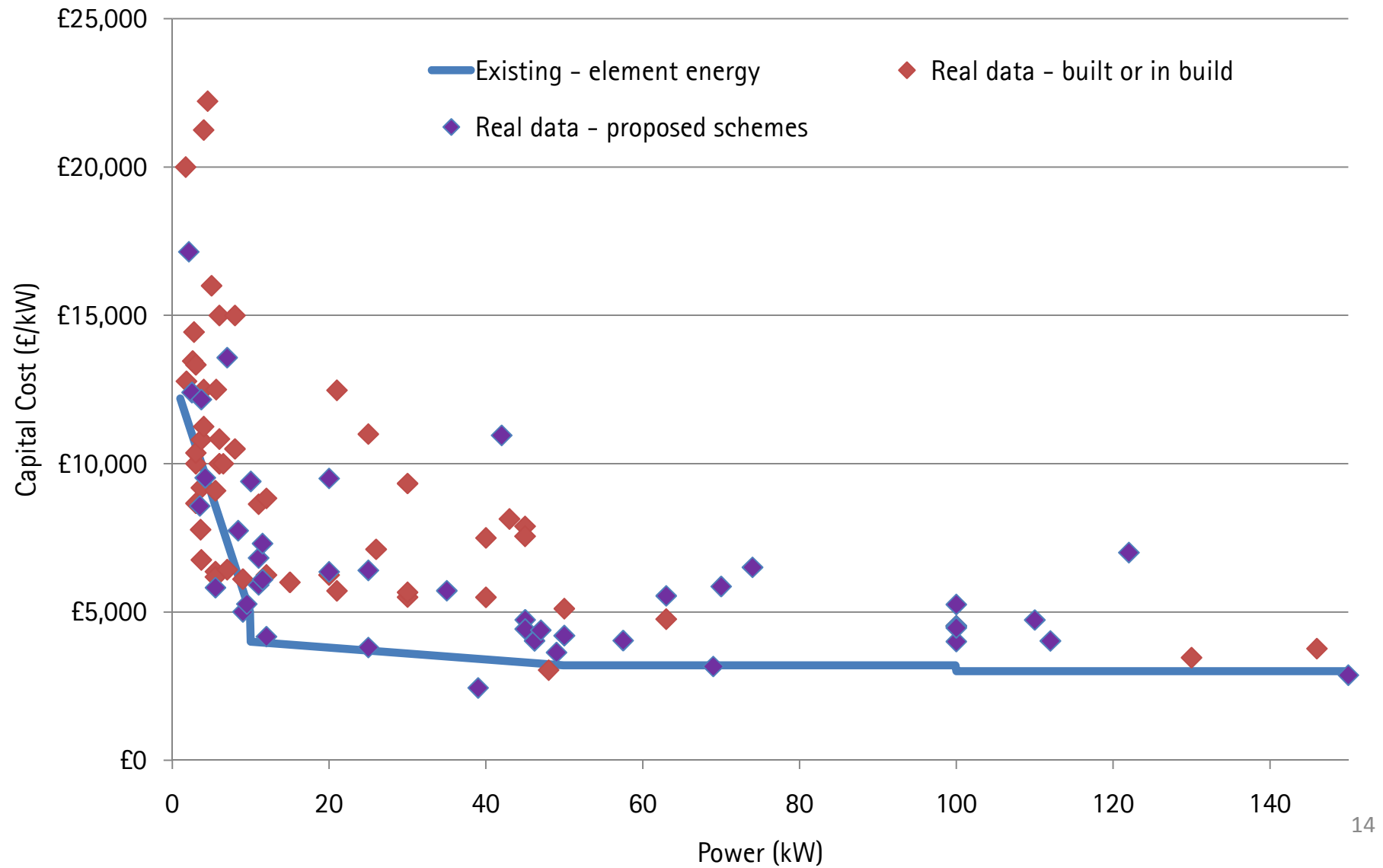
# Capital "Cost-curve" with real data

0-50kW range



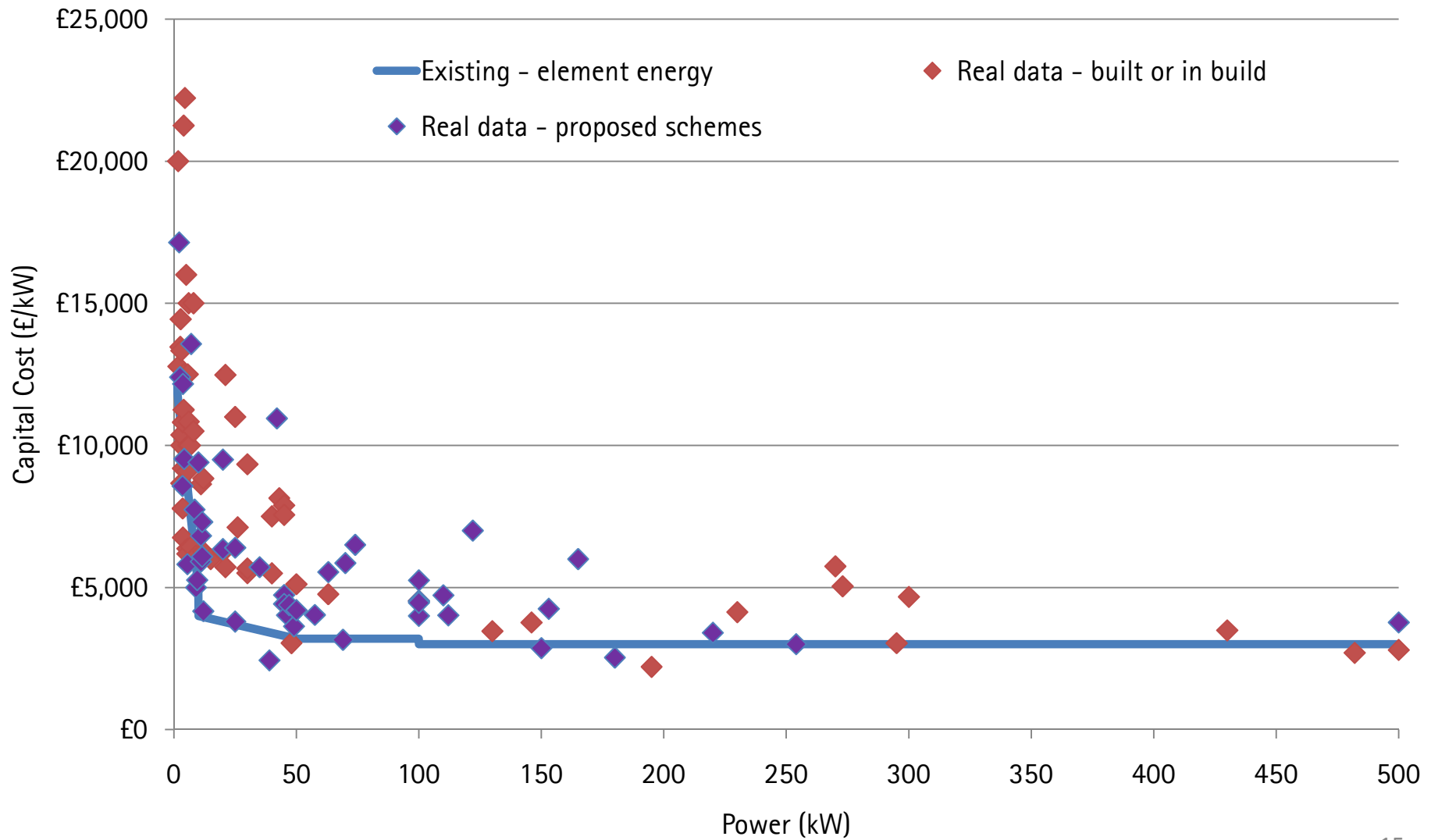
# Capital "Cost-curve" with real data

0-150kW range



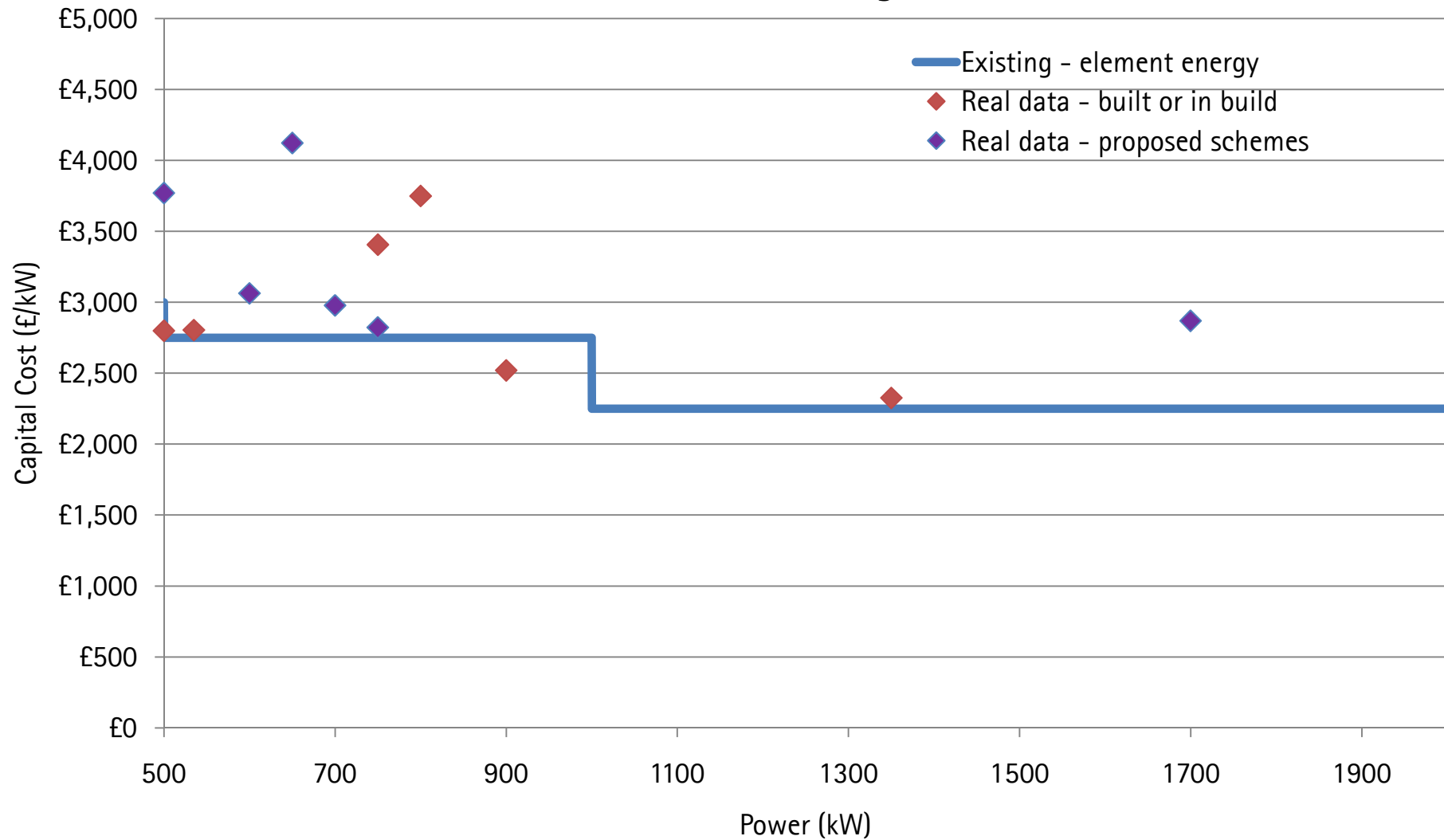
# Capital "Cost-curve" with real data

0-500kW range



# Capital "Cost-curve" with real data

500-2000 kW range



# Opex data collected on actual projects

Project	Power (kw)	Annual Opex (£)
Project 126	1.7	£200
Project 121	3	£350
Project 123	4	£300
Project 124	5	£1,200
Project 122	7	£250
Project 120	9	£200
Project 20	12	£1,000
Project 1	15	£2,500
Project 17	21	£2,700
Project 18	25	£2,900
Project 125	30	£1,500
Project 24	35	£4,500
Project 22	50	£7,500
Project 28	50	£17,000
Project 3	100	£7,500
Project 63	100	£23,000
Project 21	130	£10,000
Project 29	195	£18,240

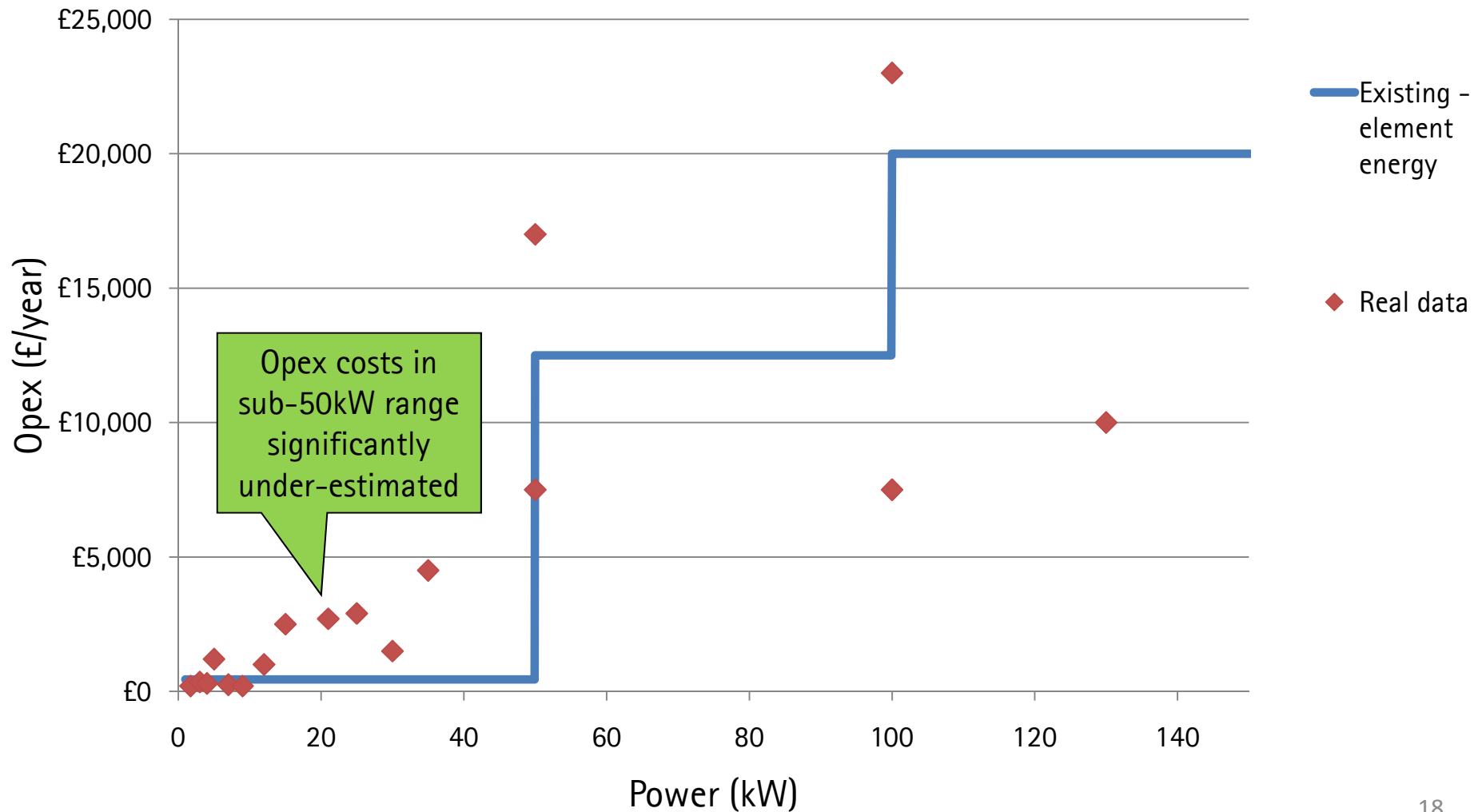
Project	Power (kw)	Annual Opex (£)
Project 23	220	£20,000
Project 30	295	£20,035
Project 2	430	£30,000
Project 25	500	£48,000
Project 65	600	£25,000
Project 69	650	£39,500
Project 68	700	£39,500
Project 64	750	£30,000
Project 84	750	£110,000
Project 70	800	£60,000
Project 88	1350	£120,000
Project 66	1700	£92,701
Project 82	2400	£200,000
Project 87	2500	£160,000
Project 86	3400	£260,000
Project 85	3500	£240,000
Project 83	4000	£260,000

- These figures are based upon actual costs today (of schemes which are generating or in-build as of September 2009)
- Although less data on Opex is available the evidence suggests that the Element/Poyry published Opex costs are also too low

- Sudden step change of Element/Poyry figures at 50kW not logical
- Doesn't factor in upward pressure on Opex costs from a number of areas (more on this later)

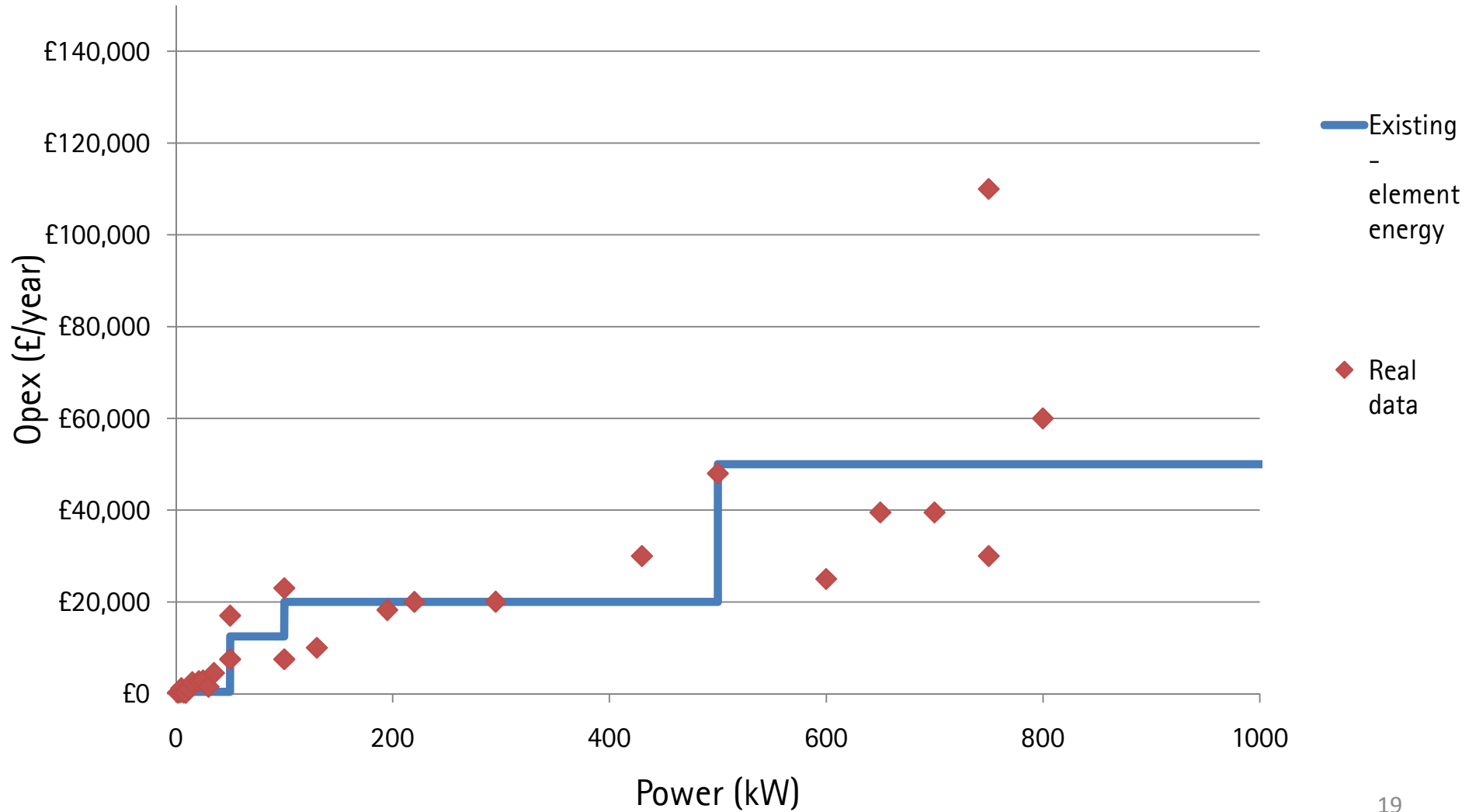
# Operating costs are also under-estimated

Opex Cost (£/year) - 0-150kW range



# Operating costs are also under-estimated

Opex Cost (£/year) - 0-1000kW range



# Justification for modifying costs – Capex

- Element/Poyry published Capex costs are too low based upon our evidence from 127 actual Hydro schemes.
- Hydro is a mature technology and is not subject to economies of scale or learning curve effects – each scheme is bespoke to a certain extent
- The best schemes have already been 'cherry-picked' and capital costs are generally inflating rather than degressing due to:
  1. Increased civil costs (more difficult terrain)
  2. Increased grid connection costs (further distances /less developed territory)
  3. Increased permitting, planning and environmental costs
  4. New legislation in pipeline from DEFRA making fish-pass construction obligatory – recent examples:
    1. £35k additional Capex for small 20kW scheme
    2. "The costs for complex fish pass facilities can amount to £250,000 each" – Source: DEFRA impact assessment 15 Jan 2008
    3. Osbaston Hydro, Monmouth 150kW £500,000 scheme – additional cost of fish-pass = £600,000

# Justification for modifying costs – Opex

- Opex costs are underestimated and rising:
  1. Business rates in England have risen by a factor of 3x in the period 2000-2005 and current proposed increases are in the range 2x to 4x over the period 2005 – 2010. Rateable values should not take into account FiT payments – it clearly does not make sense to tax subsidies intended to stimulate the uptake of renewable technologies.
  2. £440 per annum is far too low for sub 50kW taking into account insurance, business rates, network/metering charges, routine caretaker/maintenance and service, remote monitoring, consumables etc.
  3. Landowners are demanding higher and higher rental charges – recent examples up to 20% of revenue. More multiple-landowner sites will be necessary as single-owner sites are developed – pushing rental payments up further.
  4. Experience suggests Opex costs are rarely below 20% of revenue for all size schemes rising to higher % for smaller schemes.

# New Capex and Opex costs

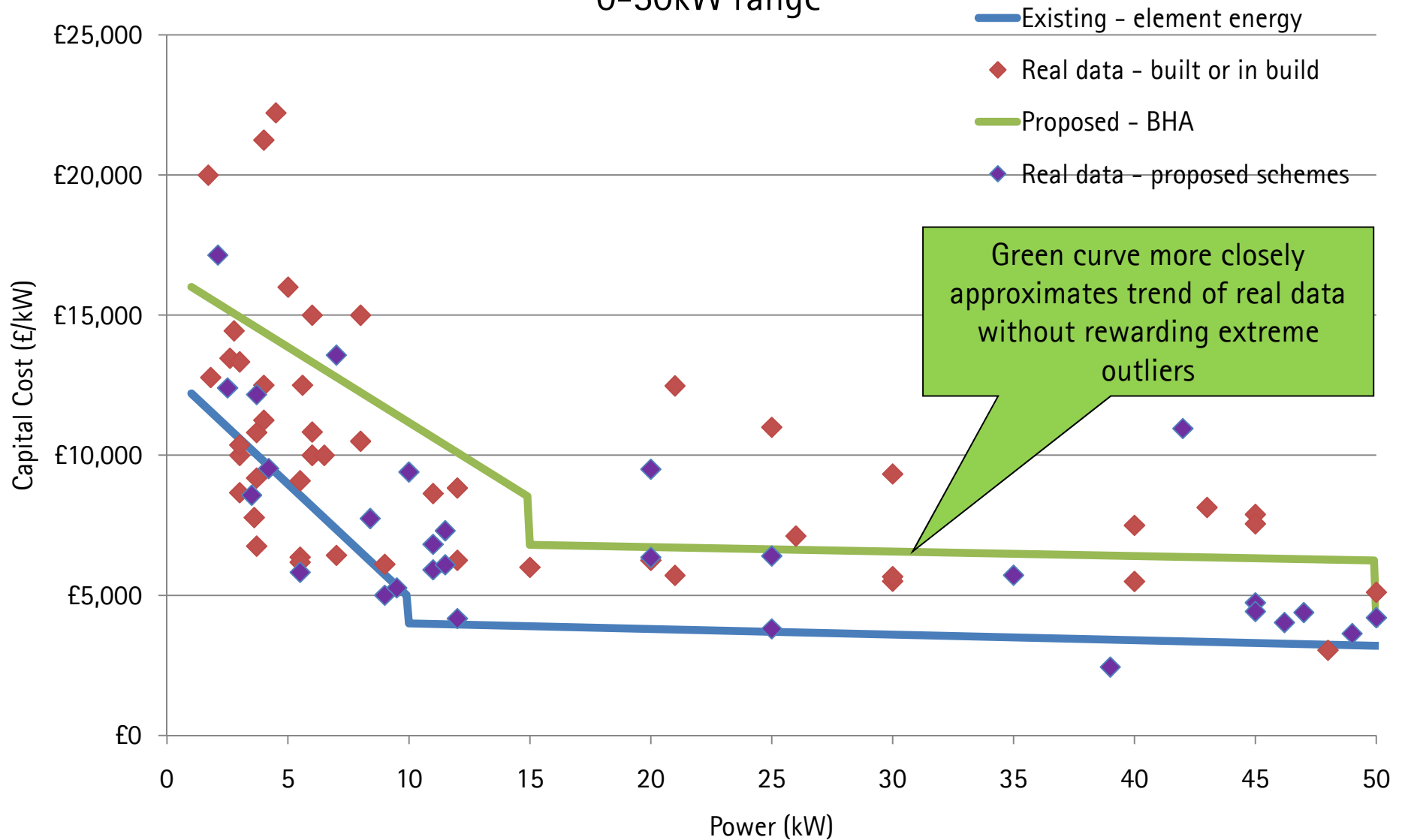
- Proposed new costs based on evidence from real projects

## New BHA proposal - Capex and Opex costs

		Capex		Opex
Lower limit (kW)	Upper limit (kW)	Fixed cost per site	Marginal cost (£/kW)	Annual maintenance cost
0	15	£8,000	£8,000	£2,500
15	50	£12,000	£6,000	£5,000
50	150	£4,250		£15,000
150	500	£3,750		£35,000
500	1000	£3,500		£50,000
1000	2000	£3,250		£50,000
2000	5000	£2,250		£50,000

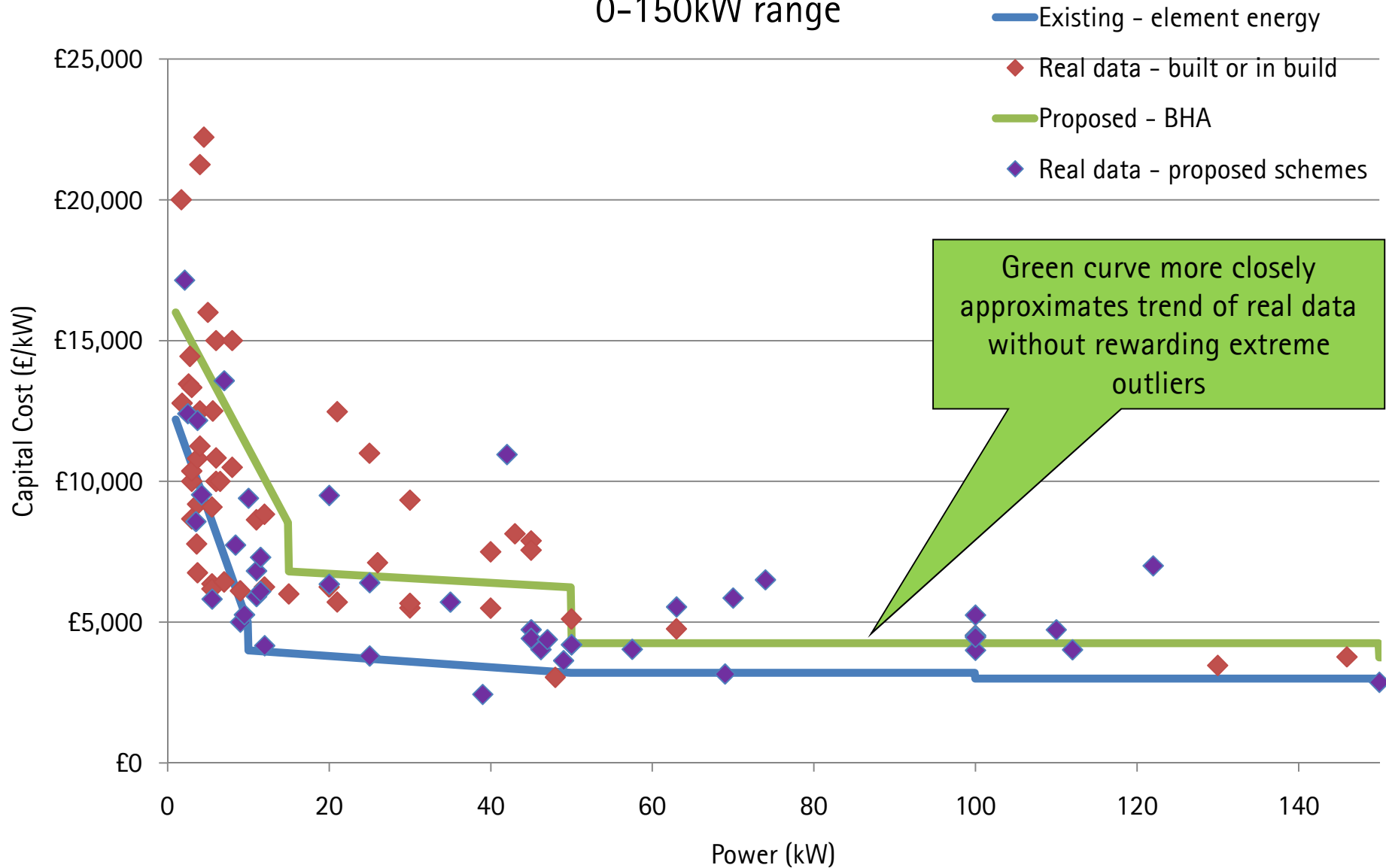
# New Capital "Cost-curve" based upon revised costs

0-50kW range



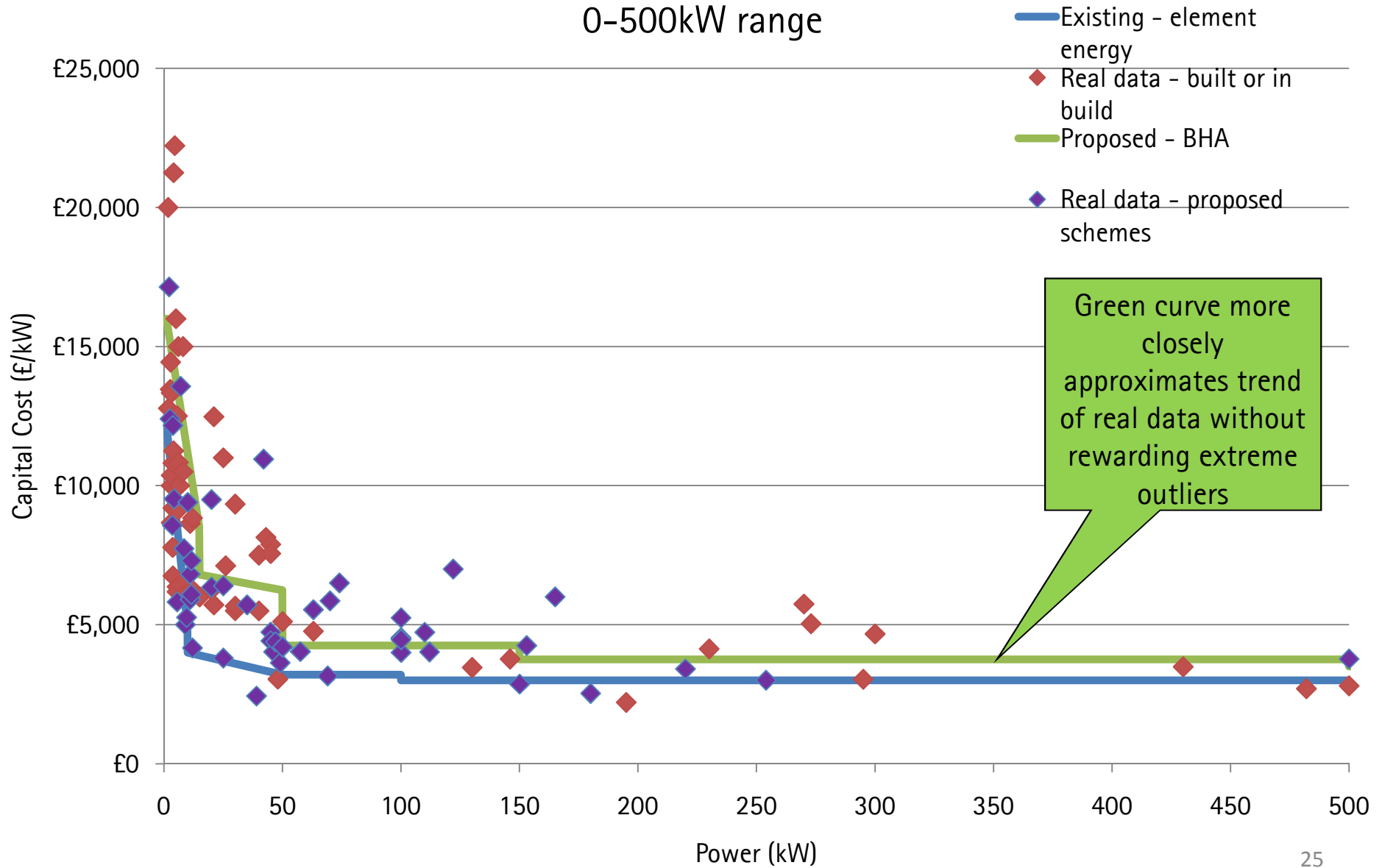
# New Capital "Cost-curve" based upon revised costs

0-150kW range



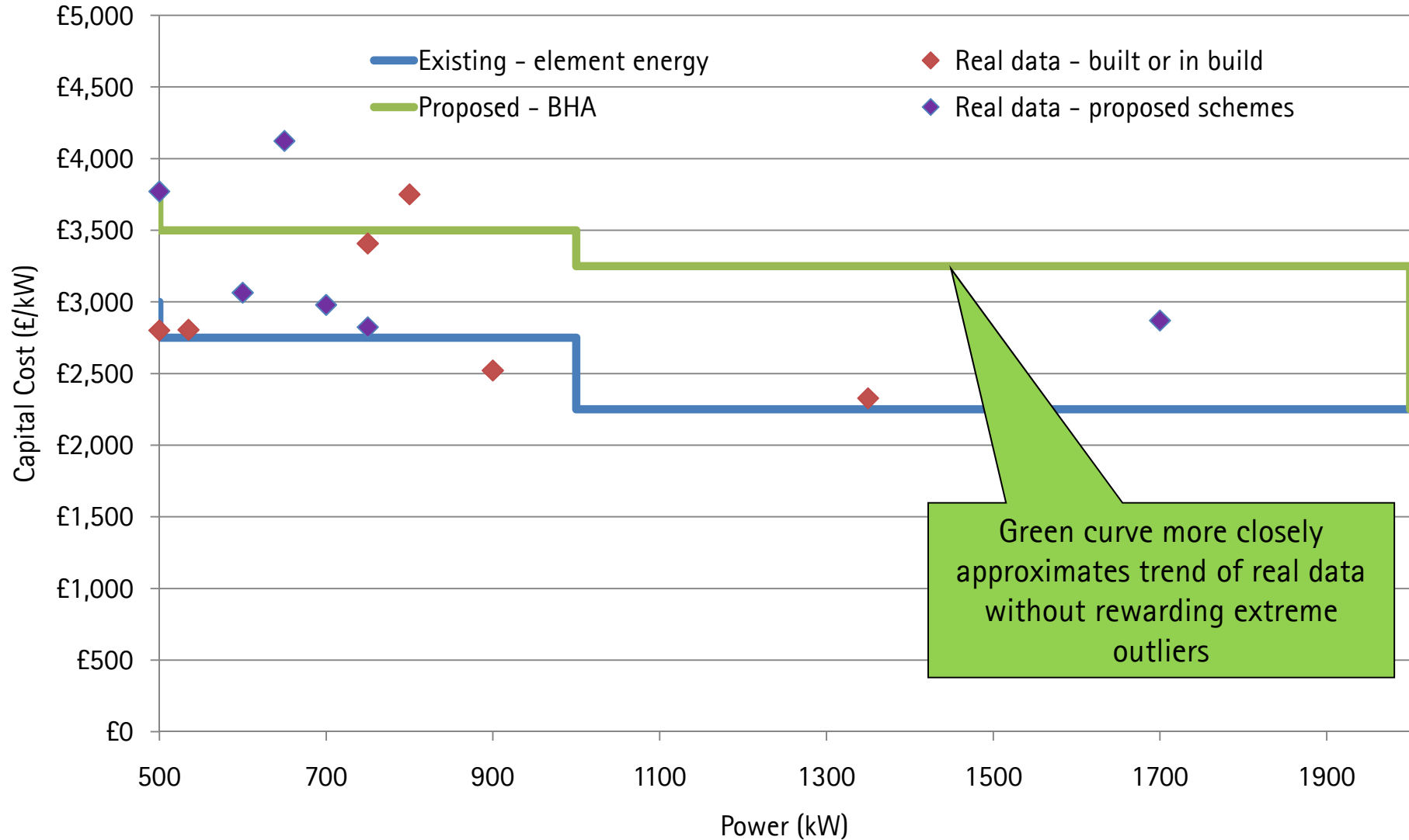
# New Capital "Cost-curve" based upon revised costs

0-500kW range



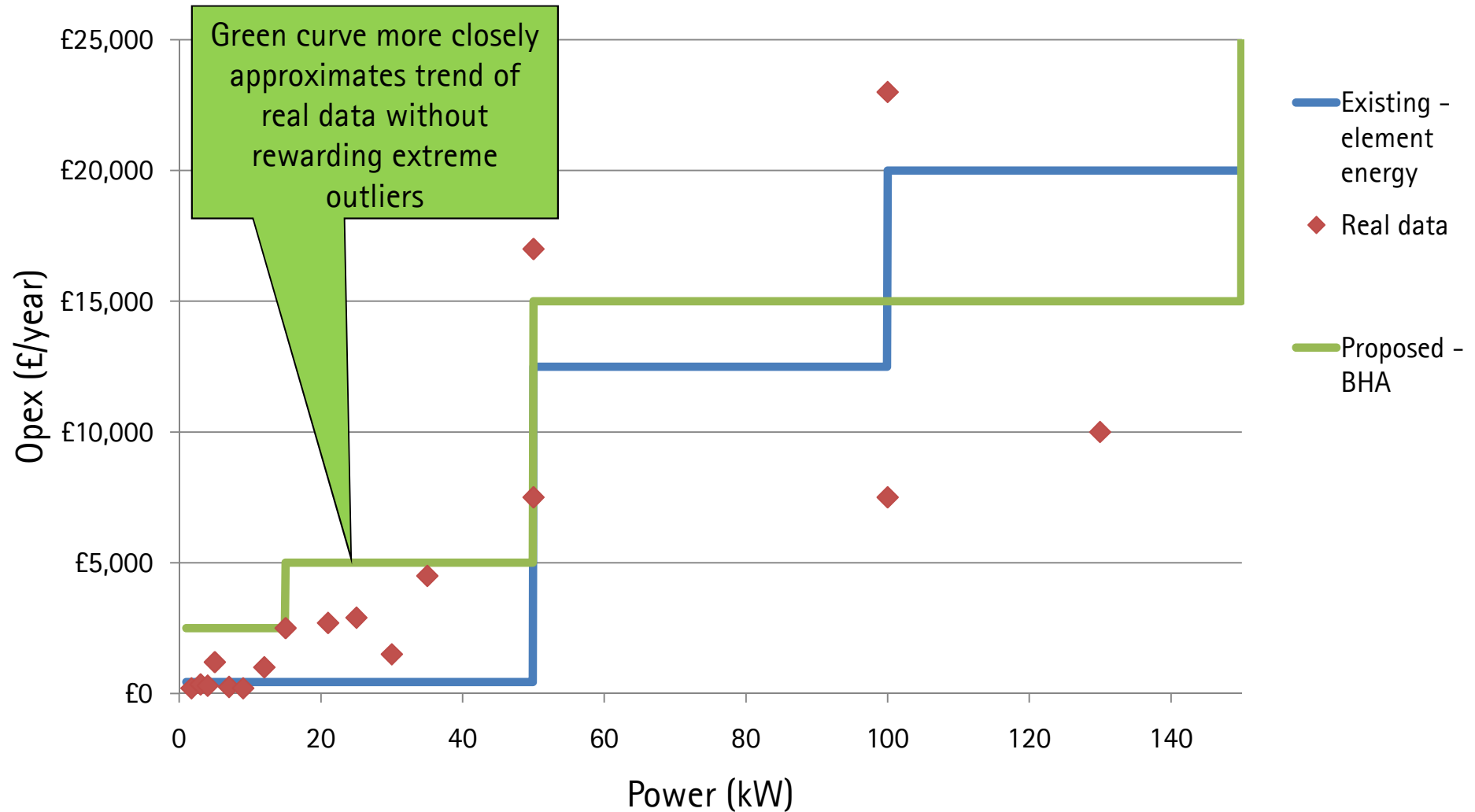
# New Capital "Cost-curve" based upon revised costs

500-2000 kW range



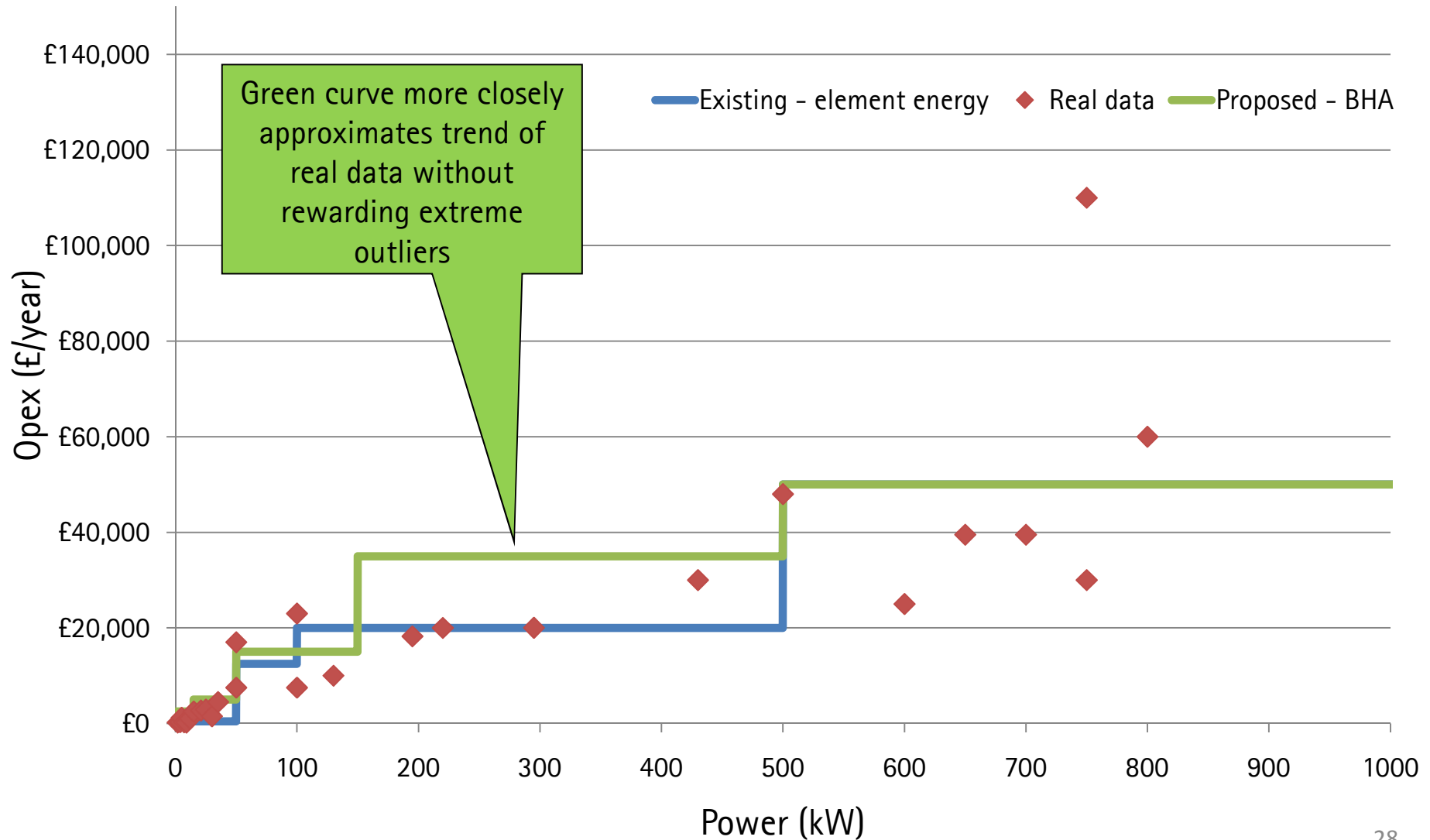
# New Opex "Cost-curve" based upon revised costs

Opex Cost (£/year) - 0-150kW range



# New Opex "Cost-curve" based upon revised costs

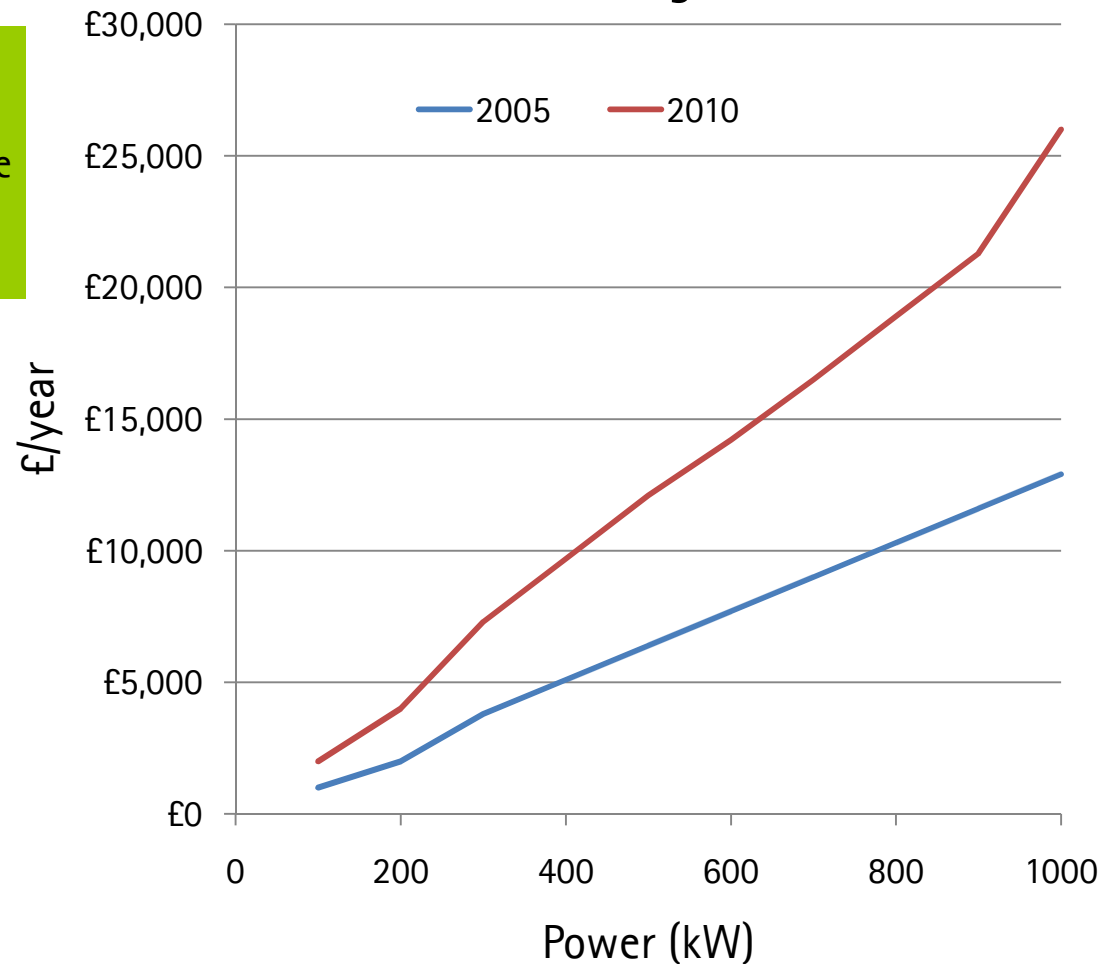
Opex Cost (£/year) – 0-1000kW range



# Business Rates (estimated increases 2005 – 2010)

Estimated Business Rates (£/year) 100 – 1000kW range

Rating (kW)	2005 Estimated Business Rates (£/yr)	2010 Estimated Business Rates (£/yr)	Difference 2005 - 2010
100	£1,000	£2,000	£1,000
200	£2,000	£4,000	£2,000
300	£3,800	£7,300	£3,500
400	£5,100	£9,700	£4,600
500	£6,400	£12,100	£5,700
600	£7,700	£14,200	£6,500
700	£9,000	£16,500	£7,500
800	£10,300	£18,900	£8,600
900	£11,600	£21,300	£9,700
1000	£12,900	£26,000	£13,100



# Business Rates (estimated increases 2005 – 2010)

## Opex Cost (£/year) with 2010 rates



# Proposed new tariffs

- Calculate IRR for each band using new costs and modify tariffs to provide 5-8% return

Original:

Lower limit (kW)	Upper limit (kW)	Proposed generation tariff (p/kWh)	Annual degression (%)	Proposed export tariff (p/kWh)	Total (p/kWh)
0	10	17	0	5	22
10	100	12	0	5	17
100	1000	8.5	0	5	13.5
1000	5000	4.5	0	5	9.5

New proposal:

Lower limit (kW)	Upper limit (kW)	Proposed generation tariff (p/kWh)	Annual degression (%)	Proposed export tariff (p/kWh)	Total (p/kWh)
0	15	34	0	5	39
15	50	22	0	5	27
50	150	15	0	5	20
150	500	12	0	5	17
500	1000	10	0	5	15
1000	2000	8	0	5	13
2000	5000	4.5	0	5	9.5

Note: for simplicity of calculation IRR formula here uses net profit before financing costs and corporation tax and with no inflation applied – therefore real IRR to equity investors could be lower than target 5-8%

# Conclusions and summary

1. The current tariff structure for Hydro proposed in the consultation document provides insufficient returns to encourage investment and also presents perverse incentives. Specifically:
  1. The number of bands is too small incentivizing 'downsizing'
  2. The pricing is based upon Capex and Opex costs which are too low
2. A new banding structure and new Capex and Opex costs are suggested - new tariffs are calculated to provide a sufficient return based upon these new costs
3. A target return of 10% and indexing of tariffs are encouraged in order to prevent erosion of real returns
4. The new proposal will:
  1. Provide sufficient incentives to invest in Hydro projects
  2. Unlike Wind provide the incentive to develop efficient, well-positioned projects with high Load Factors = ultimately less cost for consumer
  3. Reduce the propensity to downsize
  4. Make the ROCs vs FiTs decision clearer (ie FiTs below 2mW)