Science and Technology Facilities Council

ITRF - LhARA

Power consumption & Cost model for full infrastructure ITRF WP2 & LhARA WP1.6

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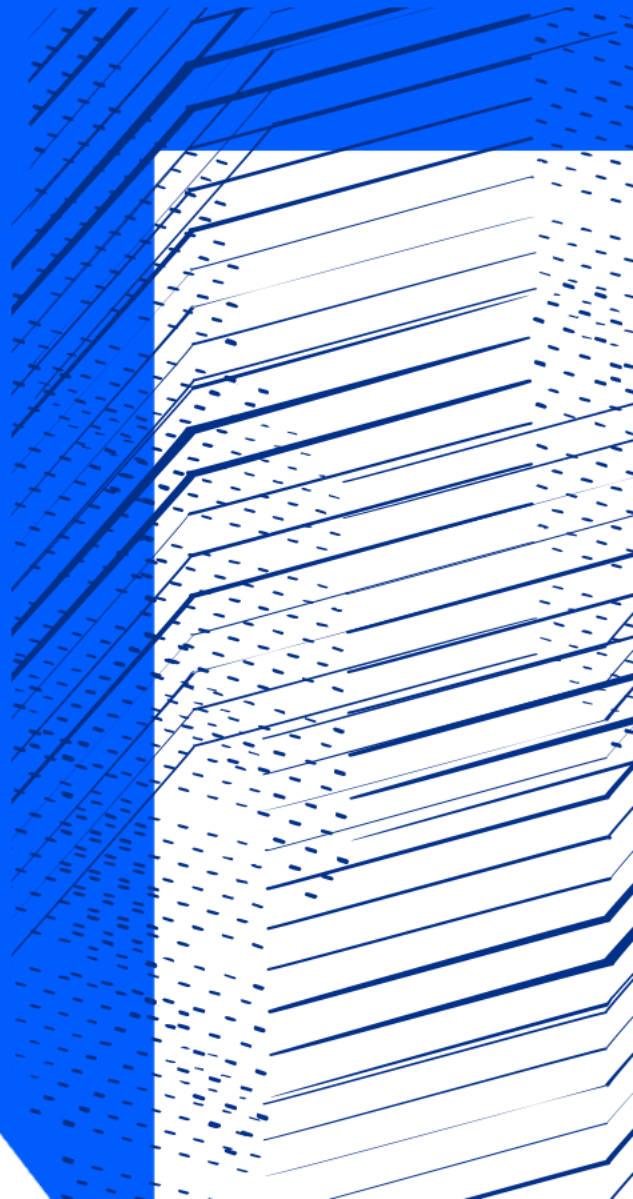

Power Consumption Estimate

1272-pa1-pm-est-0001-v1.0-power-consumption-est-2023-08-23

- Work in progress
- Total power consumption estimated is 3580kW
- 2 x 2.5MVA transformers to be accounted for in full infrastructure cost model
- Line 4 is for a Solenoid only configuration
- Comparison required for Gabor Lense configuration
- Estimate probably on the high side and likely to reduce with more accurate information as the CDR and TDR phases develop.

	Technical Equipment	No of racks	Power/rack	Total load kW	Comment
1	Laser	4	12	48	Racks in annex room
2	Target	4	2	8	
3	Radio Frequency	5	n/a	186	
4	Gabor Lenses (solenoid only configuration)	14	n/a	658	
5	Pulse Power	4	n/a	14	Racks in accelerator
6	Power converters (magnets)	12	n/a	1411	
	Controls & Instrumentation:				
7	Laser				See 1.
8	Vacuum	6	2	9	2 racks in each RR
9	Diagnostics	9	1	9	3 racks in each RR
10	Personnel Safety	3	1	3	1 rack in each RR
11	Network/control	3	1	3	1 rack in each RR
12	RF Control & Auxiliaries	3	2	6	Located near RF Amplifiers
13	Motion Control	6	2	12	2 racks in each RR
14	End stations			0	
	Total number of racks	65		2367	
	Services				
15	Lighting			10	
16	Climate Control			110	
17	Chiller System			688	
18	Water pumps			60	
19	Compressed Air			5	
20	Offices/Laboratories			15	
	Total ancillary load (kW)			887	
	Total ITRF operational electrical load			3254	
	Total ITRF Electrical Infrastructure Requirement (10% contingency)			**3580**	

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Full Infrastructure Cost Model

- Work in progress
- Some lines based on pre-CDR with inflation and energy cost increases
- Laser cost update from recent ASTeC procurement exercise
- Building estimate from STFC Estates building cost model
- Integration requires an update. Power consumption tables will help
  - Electrical infrastructure
  - Cooling
  - HVAC
  - Vacuum
- R&D zero because prototyping is included in PA2 proposal
- Staff based on % of procurement. A more detailed breakdown is required later.

CBS	Description	Estimate
1	*Laser System*	£ 4,434,696
2	*Capture*	£ 1,190,000
3	*Stage 1 Accelerator Systems*	£ 1,265,000
4	*Stage 2 Accelerator Systems*	£ 10,190,000
5	*End Stations*	£ 1,797,900
6	*Integration*	£ 7,075,000
7	*R&D*	£ -
8	*Radiation Protection*	£ 2,810,000
9	*Building*	£ 22,254,694
10	*Installation*	£ 2,950,000
	Total excluding VAT & contingency	£ 53,967,290
	Contingency (0%)	£ -
	Total excluding VAT	£ 53,967,290
	VAT	£ 10,793,458
	Total including VAT	£ 64,760,748
11	*Staff (238 staff years @ £130K/sy) over 4 years*	£ 30,940,000
		£ 95,700,748
	Equipment - building	£ 73,446,054
	Staff to equipment ratio	42%

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