



Customer-Led Network Revolution

Customer-Led Network Revolution Real Time Thermal Rating (RTTR) Cost Analysis

DOCUMENT NUMBER

CLNR-L252

AUTHORS

Ian Lloyd, Gayle Faine, Northern Powergrid

ISSUE DATE

22/12/2014



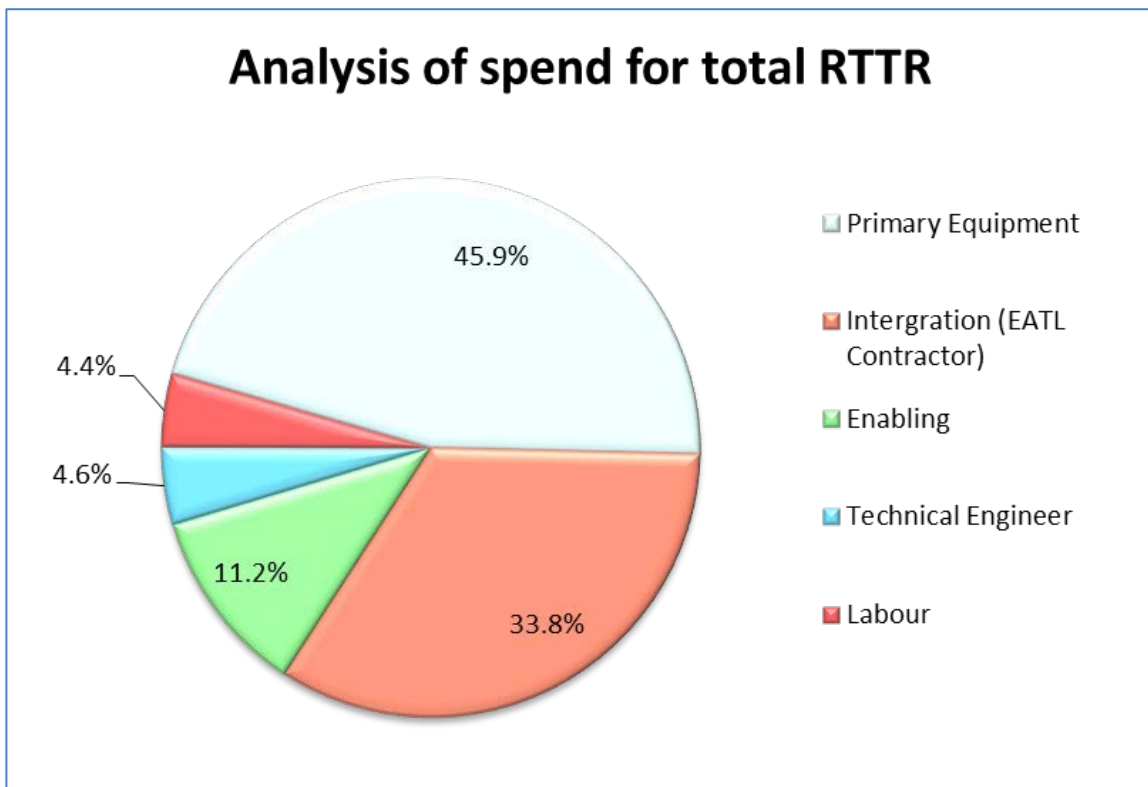
Document Purpose

The following report is a detailed breakdown of costs attributed to the design, modification and installation of thermal monitoring systems applied to;

- Primary and secondary transformers,
- Extra high, high and low voltage underground cables, and
- Extra high and high voltage overhead lines.
- Integration of all systems into the control scheme

The cost categories have been chosen to best illustrate the areas of work undertaken to safely install and commission the equipment on a UK DNO owned substation or conducting asset and to incorporate and trial it into the control scheme.

The total Northern Powergrid project cost for RTTR was just over £996k. A breakdown of the costs is presented in the charts below.



Cost Categories	Original Budget	Total spend to date	Budget v Spend Variance %
Primary Equipment		457,574	
Enabling		111,583	
Labour		43,768	
Total RTTR Costs	1,280,000	612,924	-52%
EATL contractor	485,000	337,112	-30%
Technical Engineer	267,000	46,319	-83%
Total	2,032,000	996,356	-51%

Primary Equipment

The primary equipment category captures the actual costs associated with the contract tendered to achieve the specification for the thermal rating system and its installation as delivered and deployed. It does not include the cost of scheduling operational usage or calling for a demand response action from the control system.

There were variations to the original contract to either modify the thermal rating systems to comply with Northern Powergrid policies on both safety and protection, or to facilitate its integration with the remote control platform. This includes the application platform, its system design, warranty, logistics, haulage, delivery duty and project management of assisted installation and commissioning.

Integration (EATL Contractor)

The EATL contractor costs relate solely to fees incurred during the preparation for procurement, contract drafting and execution and configuring the test cells (for example defining the system specification, defining location and quantity of monitors and clarifying technical uncertainty), for each network trial with the integrated control system.

Enabling works

The prime activities carried out to enable each of the sites and the network technology; this includes site surveys, security improvements to perimeter protection and overhead line poles and towers, and interaction with local communities and local authorities.

Key examples of this were the partial discharge mapping of the 33kv and 6kv feeders into and out of Rise Carr Primary substation costing just under £4k, the creation of detailed hot glove work instructions for the deployment of OHL RTTR on our 20kv circuits without an outage costing just under £1k.

Technical Engineer

These costs were for engineering works associated with the systems design, redesign and debugging of the first of a kind product or technology. Costs were heavily affected by multiple visits to each deployed site and would reduce considerably for subsequent sites.

Labour

This is the measure of the amount of activity performed by Northern Powergrid employees that covers the activities of Northern Powergrid's program delivery department; it is inclusive of work done by field engineers, fitters, jointers, linesmen, craft attendants, safety auditors, supervisors, quality inspectors etc.

The following costs are associated with RTTR, but are consolidated within the costs for monitoring and enhanced automatic voltage control (EAVC) aspects of the CLNR project.

Installation and civil works

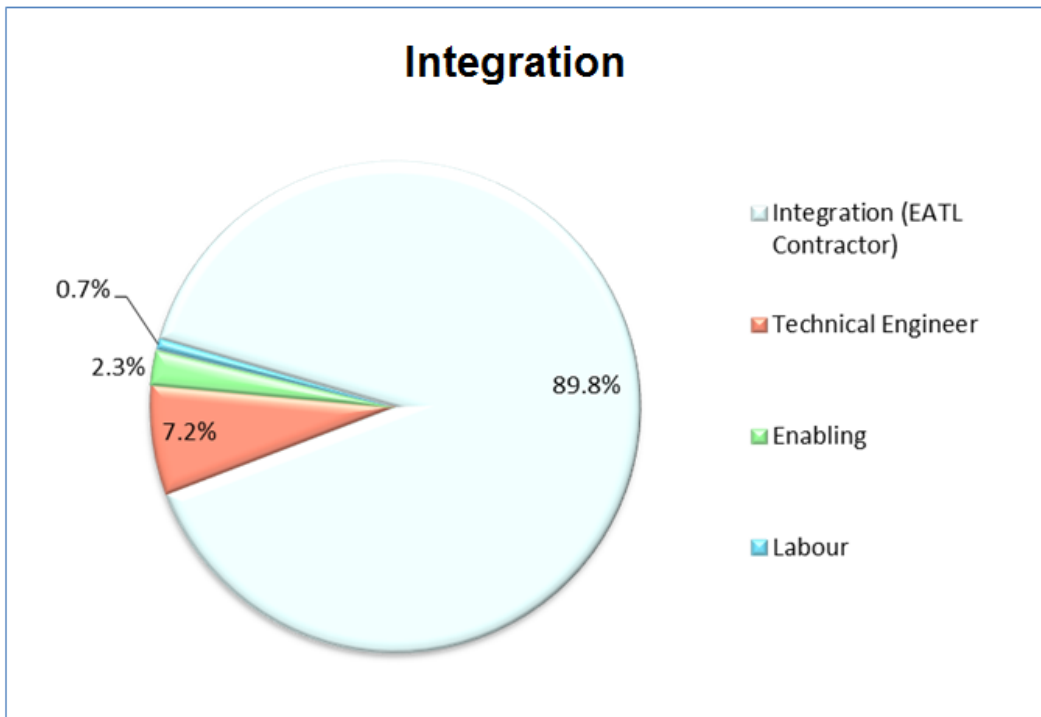
Installation and civil costs are a combination of activities associated with the physical installation of the equipment at the substation, underground conductor or overhead line, not covered by the equipment supplier contract and not performed by Northern Powergrid. This work forms part of the integration between the new control system, the RTTR monitoring system and the existing infrastructure at each site. Typical examples would be the configuration of the server head end, routing cables between equipment transducers and controllers and the configuration of auxiliary supplies.

Integration

The integration of the components for the CLNR active network management scheme and dynamic thermal response systems coordination are included in a separate display to indicate the impact of how the designs required for the; transformer thermal rating solution, the cable thermal rating solution, the overhead line thermal rating solution, subsequent thermal rating system deployment, research and development and the development of planning tools and models that all combine to form a major activity in integrating the network technologies.

This category links together with control interfaces and enhanced automatic voltage control (EAVC) communications to enable the entire systems interoperability.

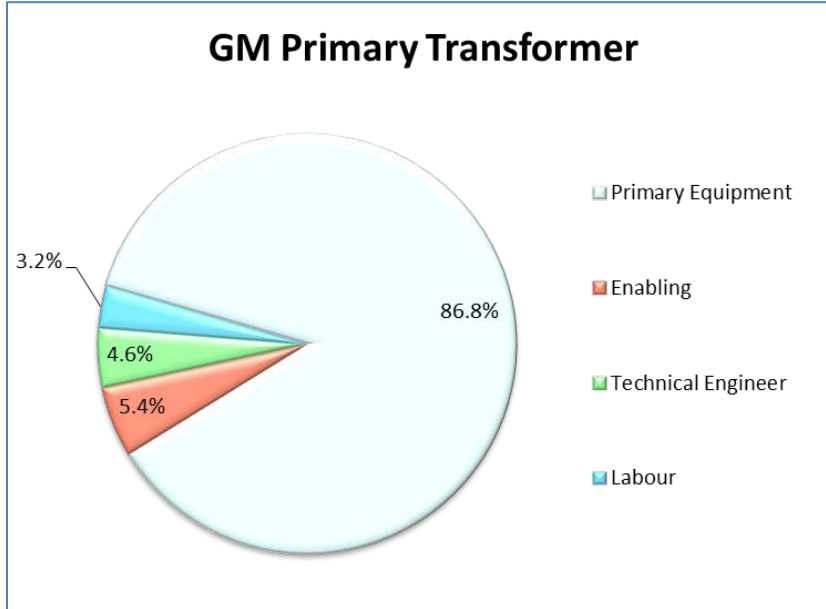
The total Northern Powergrid project cost for Integration was over £375k. A breakdown of the costs is presented in the charts below.



Integration (EATL Contractor)	Technical Engineer	Enabling	Labour	Total
£337,112	£27,055	£8,640	£2,616	£375,424

Ground Mounted Primary Transformer

The total Northern Powergrid project cost for GM Primary Transformer was just over £261k. A breakdown of the costs is presented in the charts below.



Primary Equipment	Enabling	Technical Engineer	Labour	Total
£226,819	£14,189	£11,927	£8,399	£261,334

Only four out of the ten relays purchased have been used. Six remain available for deployment with a value of under £59k.

The cost for one application is shown in the table below.

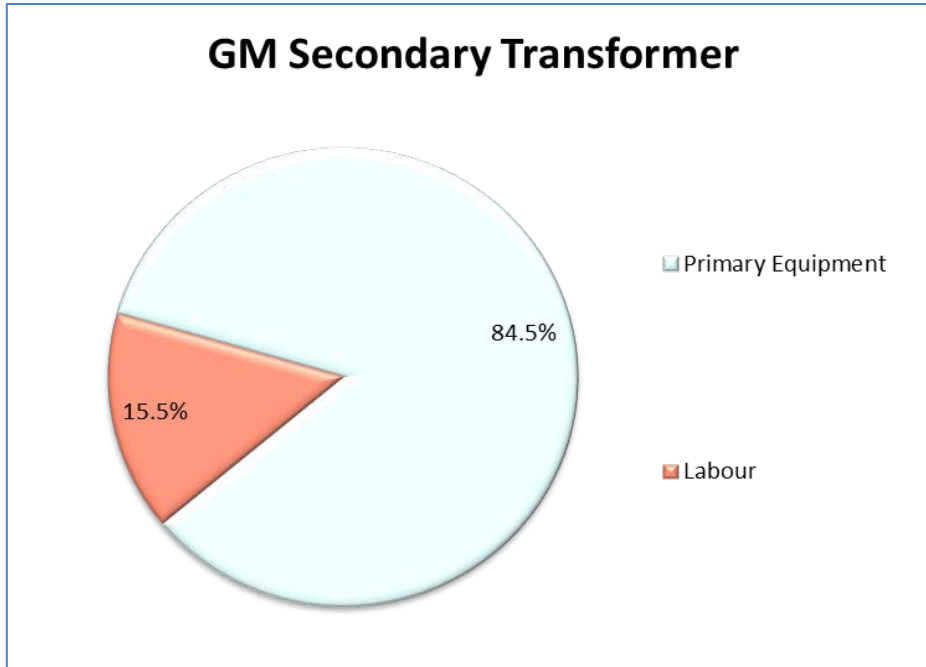
	Primary Equipment	Enabling	Technical Engineer	Labour	Total
Costs excluding the six relays	£168,139	£14,189	£11,927	£8,399	£202,654
Six available relays (excluding installation and commissioning)	£58,680				£58,680
Cost of one unit (including installation and commissioning)	£42,035	£3,547	£2,982	£2,100	£50,664

This technology would not be incorporated to the business as is installed. The Trafoguard unit utilised encountered issues with our requirement for the calculation and output of ampacity, though integration with the control scheme was successful. Due to these issues we have assisted the manufacturer to develop the next generation which will now need to be tested. The costs per deployed unit are expected to be the same at around £51k and could be available following testing around 2018 to allow specification delivery and trialling for a full year. We believe that operating costs would be minimal.

The solution developed for the secondary transformer also proves a suitable alternative for the primary transformers. Further integration work but less enabling costs is required than as installed, to model the secondary device for a dual primary transformer use. We would propose this solution in the future at an estimated cost of £20k per site inclusive of the local control platform.

Ground Mounted Secondary Transformer

The total Northern Powergrid project cost for GM Secondary Transformer was just under £33k. A breakdown of the costs is presented in the charts below.



Primary Equipment	Labour	Total
£27,820	£5,088	£32,908

There are 21 applications across the Northern Powergrid network.

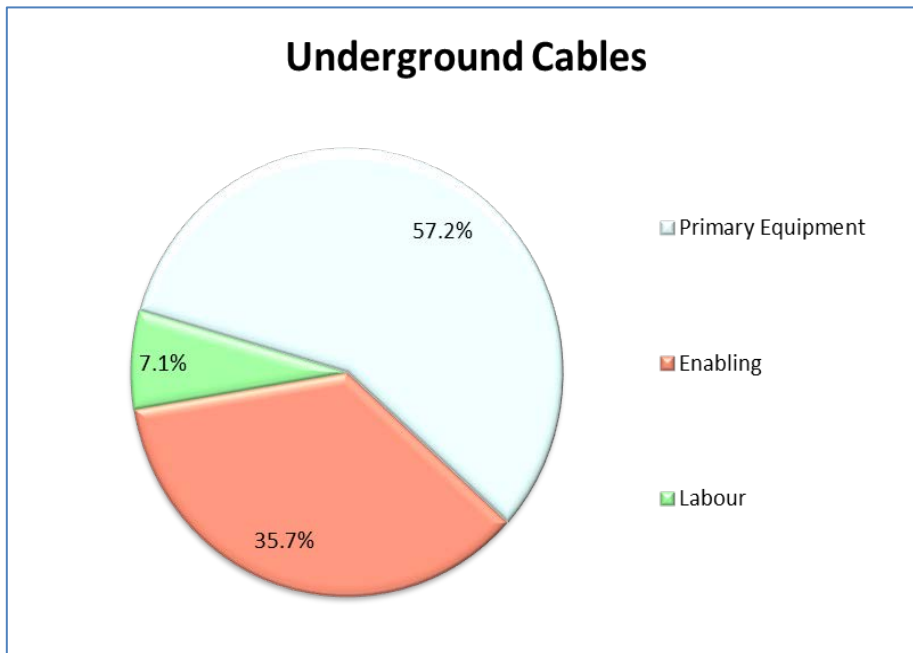
The cost for one application is shown in the table below.

	Primary Equipment	Labour	Total
Cost of one application	£1,325	£242	£1,567

This equipment can be installed to monitor a single transformer for this cost; for the calculation of ampacity, the system requires connection to a local controller with a thermal calculation engine, we estimate that this local control platform installed would cost an additional £14k per transformer.

Underground Cables

The total Northern Powergrid project cost for Underground Cables was just over £244k. A breakdown of the costs is presented in the charts below.



Primary Equipment	Enabling	Labour	Total
£139,780	£87,303	£17,254	£244,337

There are 3 applications on underground cables. The enabling work only relates to Extra High Voltage (EHV) and High Voltage (HV).

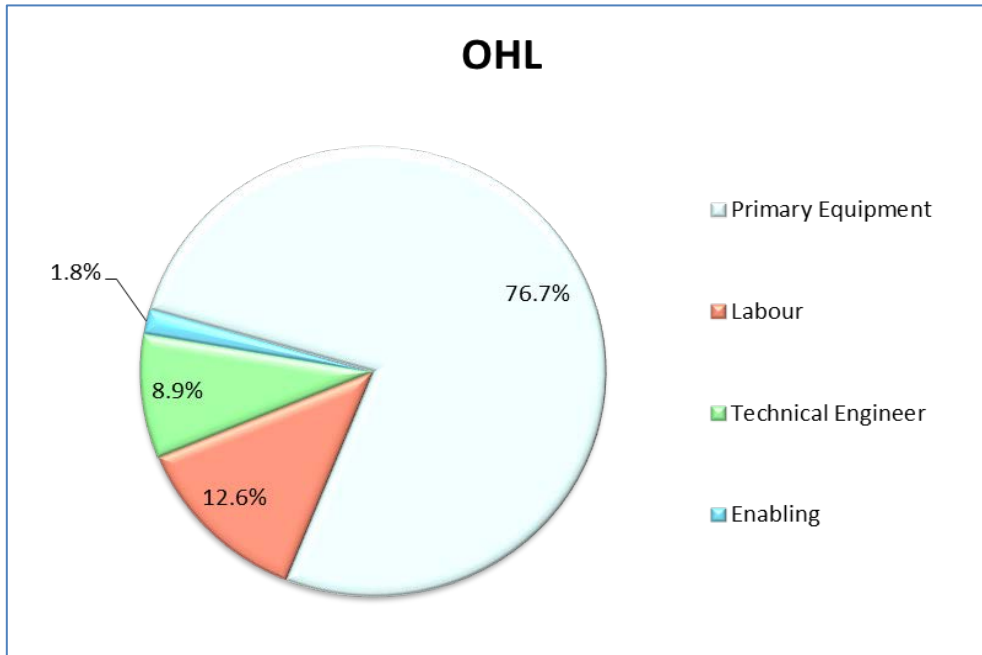
The cost for one application is shown in the table below.

	Primary Equipment	Labour	Enabling	Total
EHV or HV	£23,297	£29,101	£2,943	£55,341
LV	£23,297		£2,808	£26,105

Based on learning from the project we would not buy this product again and we would not develop an alternative solution.

Over Head Lines

The total Northern Powergrid project cost for RTTR OHL was just over £82k. A breakdown of the costs is presented in the charts below.



Primary Equipment	Labour	Technical Engineer	Enabling	Total
63,155	10,411	7,337	1,450	£82,353

The cost of one application for HV and EHV are shown in the table below.

There are four HV units each containing three sensors and there are two EHV units each containing six sensors that are on the Northern Powergrid network.

	Primary Equipment	Labour	Technical Engineer	Enabling	Total
HV	£9,473	£1,562	£1,101	£150	£12,285
EHV	£12,631	£2,082	£1,467	£428	£16,609

We are confident in these prices and don't feel there is any scope for a reduction in costs.



For enquires about the project contact
info@networkrevolution.co.uk
www.networkrevolution.co.uk