LNW Energy & Carbon Reduction Implementation Strategy

LNW Route

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Approval and Authorisation

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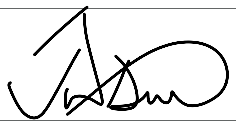
Authorised by:	James Dean	Director – Route Safety & Asset Management	

Document Identity and Metadata Information

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Implementation

This document's latest version shall supersede any previous versions.

Compliance

This document is mandated across the 'scope' detailed in section document identity, scope and metadata.

Dated from 7th July 2017

Specific authority not to comply with this document can be requested from the Approval Signatory using the Technical Query process found within the CDE.

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All references made within this document were considered correct at time of approval.

Supply

Copies of this document are available electronically via the Common Data Environment but shall be deemed uncontrolled once printed.

Table of Contents

Leave this Table of Contents for the IMS Assurance person to refresh prior to release for approval

1 Definitions, Abbreviations and Referenced Documents

1.1 Definitions

Term to be defined	Concise definition of term

1.2 Abbreviations

Abbreviation	Full terminology
ACOP	Approved Code of Practice
BREEAM	Building Research Establishment's Environmental Assessment Method
CDM 15	Construction (Design and Management) Regulations 2015
CoCP	Code of Construction Practice
CEEQUAL	Civil Engineering Environmental Quality Assessment Tool
ECA	Enhanced Capital Allowance
EMR	Environmental Minimum Requirements
ETL	Energy Technology List
HSE	Health and Safety Executive
HSRD	High Speed Rail Development
IP NP	Infrastructure Projects Northern Programmes
IP SNE	Infrastructure Projects Scotland & North East
IRR	Investment Rate of Return
KRA	Key Reporting Area
S&SD	Safety & Sustainable Development
QA	Quality Assurance
HSEA	Health, Safety, Environment and Assurance
RDD	Route Delivery Director
PD	Principal Designer
PC	Principal Contractor
RSSB	Rail Safety And Standards Board
SSSI	Site of Special Scientific Interest
SbD	Safe by Design
IP Central	Infrastructure Projects, Central Region
LSR	Life Saving Rules
NDS	Network Rail's National Delivery Service
NWEP	North West Electrification Project
NWCC	North West Coast Connections
GRIP	Governance for Railway Investment Projects

SHELT	Safety Health Environment Leadership Team
ISLG	Infrastructure Safety Liaison Group
FCP	Fair Culture Panel
CCS	Close Call System
CDM	Construction Design and Management
CSM	Common Safety Method
MBR	Monthly Business Review
STE	Safety, Technical and Engineering
ISO	International Organisation for Standardization

1.3 Referenced documents

Title	**Link / Reference**
Network Rail Energy & Carbon Strategy 2016 - 2019	https://safety.networkrail.co.uk/home-2/environment-and-sustainable-development/energy-and-carbon-management/energy-and-carbon-policy-and-strategy/
Network Rail Sustainable Development Strategy 2013 – 2024	http://16cbgt3sbwr8204sf92da3xxc5m-wpengine.netdna-ssl.com/wp-content/uploads/2016/11/sustainable-development-strategy.pdf
Network Rail Energy & Carbon Management Toolkit	https://safety.networkrail.co.uk/home-2/environment-and-sustainable-development/energy-and-carbon-management/
Guidance on non-Traction Energy Efficiency (RSSB) April 2017	https://safety.networkrail.co.uk/wp-content/uploads/2017/06/RSSB-non-traction-energy-guidance-04-01-2017.pdf
RSSB Sustainable Development Principles, May 2016	https://www.rssb.co.uk/improving-industry-performance/sustainable-development/rail-sustainable-development-prinicples
Network Rail Sustainability Charter	https://www.networkrail.co.uk/rail-sustainability-charter.pdf
Infrastructure Carbon Review, November 2013	cic.org.uk/download.php?f=infrastructurecarbonreview251113.pdf
Contract Requirements Environment & Social	http://networkrailstandards/BSI/Search.aspx?ref=env/100

COP21 Paris Agreement	https://ec.europa.eu/clima/policies/international/negotiations/paris_en

2 Purpose

Network Rail are one of the largest purchasers of energy in Great Britain with a total annual energy spend of over £360m, the majority of which is attributed to the UK rail industry as a whole and in providing this energy to the Train Operating Companies (TOCs), we are also one of the largest energy suppliers in the UK. Some £53m is attributed to Network Rail's own operations (non traction).

London North Western (LNW) route consumes over 102GWh of energy each year on the non-traction estate, resulting in a total energy bill of £10.8m.

Notwithstanding the challenges of carrying out complex and resilient operations and the ageing asset, we have an obligation to lessen our impact on the environment as well as a strong economic incentive. We have a regulated target to reduce our CO2e emissions by 11.2% over the course of Control Period (CP) 5 (2014/15 – 2018/19) against our CP4 exit baseline position. We must report progress against this target to the Office of Rail and Road (ORR) each year alongside our other mandatory carbon reporting obligations.

Targets for CP6 are already much more ambitious, set at 25% reduction in carbon and energy costs. Furthermore, work is commencing to develop robust Science-Based Targets to align with UK and global targets as laid out in the COP 21 Paris Agreement, with incremental targets stretching out to 2050 in order to limit Network Rail's impact on global temperature rise to within 2^{o}C.The LNW Route Energy and Carbon Management Commitment states to achieve our goals we shall need to:

- Set objectives around energy and carbon management and cascade them to route management teams
- Develop, implement and monitor an energy reduction management plan
- Periodically review and report energy use and carbon emissions to ensure suitability of energy objectives and progress towards targets
- Comply with all energy and carbon management legislation and Codes of Practice in existing operations, renewals and in new developments
- Seek to minimise impacts through management practices, continual improvement, training and the use of new technology
- Improve employee awareness, starting with the communication of this policy and encouraging the sharing of experiences and expertise
- Consult and work with other Network Rail functions, routes, the supply chain, customers and other stakeholders to facilitate improved energy management and address areas of common concern
- Strive to be industry leaders

As Network Rail continues to devolve day to day operational control to the Routes, all utilities budgets which were historically held centrally have devolved to the route. This means that responsibility for energy use and budgetary control now lies within the Routes. However challenging annual efficiency targets have been embedded which means that further improvements need to be made and we will work collaboratively with the Routes.

This plan sets out how the LNW route aims to help achieve the target for CO2e emissions of 11% and continue to prepare for further reductions in CP6.

3 Scope

The target for energy and carbon reduction relates to the emissions from Network Rail's operational non-traction estate – specifically purchased electricity, natural gas and gas oil for all the non-traction estate that includes;

- Stations
- Car Parks
- Control Centres
- Offices
- Depots
- Points Heating
- Signalling supplies
- Telecomms
- Manned / un-manned lineside buildings
- Back of house Network Rail assets

Emissions from traction energy are reported by UK plc as the UK rail industry's emissions, rather than being attributed to a single organisation and as such have been kept out of scope of activity for the immediate future. It is intended to develop a strategy for traction CO_2e reduction in CP6.

The Carbon and Energy Strategy states swift action is required in a number of key areas;

1. **Policy** – providing clear and concise guidance to the business on top level commitment and intention, to motivate and define direction
2. **Strategy** – clearly describing how the policy will be implemented and outlining responsibilities and accountabilities.
3. **Prioritisation** – concentrating immediate action on 5 quick-win projects that will contribute a large proportion towards our CO_2e reduction target and are estimated to achieve cost savings in the region of £15m per annum. Following up this initial action by implementing a detailed action plan of energy efficiency improvements.
4. **Continuous improvement** – aligning energy management activities to the ISO 50001 energy management standard to apply best practice and enable energy efficiency to become normal business behaviour.

Implementing these steps will provide the business with the top level commitment and strategic direction that is needed to stimulate action at point of use. In an upward-facing organisation, wide-ranging actions to reduce energy consumption, costs and carbon emissions will be limited without communication of commitment and intention from the Executive level.

Some progress has been made in raising the profile of energy and carbon management at Executive level, with Route Managing Directors recently confirming their commitment to progressing this agenda, setting Route targets and tracking local activity. This Strategy will reinforce top level commitment and will aim to guide the business in driving activity.

The Energy & Carbon Strategy is designed to guide the business in terms of immediate, short-term action and therefore is intentionally time-bound to the remainder of CP5. It does, however, prepare the ground for a more advanced strategic framework for CP6 and beyond which will stretch our efforts further. In future years, Network Rail will be expected to align not only to government carbon reduction targets but those of organisations who demonstrate best practice in this field. Public sector organisations have set carbon reduction targets of 32% on average in recent years, whilst UK plc must hit a reduction target of 38% by 2030 and 80% by 2050. The aspiration for Network Rail's CP6 Energy & Carbon strategy is a reduction of 25% and development of more stretching targets with an outlook to 2050 are due to be developed during the early stages of CP6.

The scope of the Energy & Carbon Strategy is Network Rail's own operational energy use and CO_2e emissions. This is, essentially, the non-traction portfolio as it is this portfolio that comprises Network Rail's own costs and responsibilities.

This LNW Energy & Carbon Implementation Strategy seeks to embed best practice in capturing accurate energy data across the asset base of LNW, using the correct systems and processes to ensure our house is in order and then focus upon behaviour and culture change before opportunities can be identified and implemented to save carbon and energy. This strategy shall provide the governance and areas of action and processes for implementing the corporate Energy & Carbon Strategy in LNW route, and identify the areas of focus.

In pursuit of this aim the LNW management team intend to work towards and align with the principles of ISO50001. This international best practice standard provides a framework for continuous improvement in energy management and is proven to directly influence energy and carbon reduction when implemented.

4 Success Example in Sustainable Development – Birmingham New Street Station

Refurbishing a 1960s structure to meet modern day sustainability requirements in a busy city centre was very challenging and provides a good example of best practice in sustainable and low carbon development for a Network Rail project. The New Street team collaborated with the designers, regulatory bodies and other stakeholders to deliver sustainable and low carbon solutions and as a result gained many sustainable credentials for the project through various initiatives.

Key facts and achievements

- Low energy and high efficiency LED lighting with dimming facility via detection during non-occupancy
- 60% of the toilet flushing demand provided by a rainwater recycling system
- Efficient water spray taps for water conservation
- Energy efficient lifts and escalators
- Sub-metering for all water, heating and cooling to monitor energy consumption
- Natural daylight for the concourse and natural ventilation where possible to minimise energy consumption
- Responsibly and legally sourced materials including timber
- Use of alternative materials with low environmental impact such as carpet tiles with the yarn made from recycled fishing nets
- Network Rail's first ever station to incorporate a standalone Combined Heat and Power (CHP) plant with the station electricity taken from the plant and waste heat transferred into a city district heating scheme
- Recycle / re-use waste to avoid 99% of 40,000 Tonnes of non-hazardous waste from landfill
- Array of pulsed output sub-meters to monitor consumption and trends
- Full BMS system to monitor building performance
- Sub-meter and monitor construction energy usage and water
- First BREEAM 'Very Good' rated station
- Enhanced ecology and biodiversity, including a 325m^2 'Green wall' containing 25 different species and new planters in the Public Realm
- First BREEAM 'Excellent' rated trackside accommodation building for train operators.

The above scheme has been hailed as good practice in energy efficiency measures, due to the expansion of the station being four times the previous size; the energy costs are far less than expected despite 28 additional escalators and 14 additional lifts.

5 Leadership

The role of the LNW leadership team is critical to the success of this strategy. From strategic direction and investment decision-making through to simply demonstrating and advocating good energy efficient behaviour, the actions of leaders throughout the route organisation will directly impact how the strategy is delivered and the tangible measure of energy and carbon reduction.
LNW's Statement of Commitment is signed by the Route Managing Director [to append to Appendix upon signing] and other members of the senior leadership team as a demonstration of their personal investment. This commitment will be circulated widely throughout the route structure and all members of the LNW team are expected to follow the principles of the statement.

The leadership team have also set the responsibility and accountability for the implementation of this strategy, and this is discussed in the next section.

6 Responsibility and Accountability

6.1 RACI

The Responsibility Assignment Chart (RACI) in Appendix A describes the participation and commitment required by various roles in the Route Asset team for completing tasks or deliverables as set out in ISO 50001 required in reducing operational energy and carbon. The RACI chart and the roles identified are key to the success of this implementation plan. Performance against the RACI shall form part of the Network Rail annual and regular appraisals.

Please see Appendix A for the complete RACI chart.

6.2 Resources

It is accepted that the implementation of this strategy will require sufficient resource allocation, both for the deployment of individual improvement projects and for the co-ordination, management and monitoring of progress of actions. Where it is appropriate activities will be undertaken within existing structures, embedding energy efficiency interventions into business as usual activities. This is the most efficient and effective way of enabling continuous improvement whilst also reinforcing the ethos that energy efficient behaviour and activity is everybody's responsibility. Where additional resource requirements are identified, these will be considered in line with normal business process.

7 Energy Management Plan - LNW

Network Rail's Energy & Carbon Strategy states robust energy data from our assets are crucial to success, and without them it will not be possible to demonstrate the tangible benefits of our efforts, or to assure the business is compliant with its legislative and regulatory obligations in reducing carbon and energy.

7.1 LNW Route Energy Data

The first steps should be to review our data across the assets, and any previous actions undertaken to determine the current status of energy management. This shall form the baseline against which future progress can be measured.

Energy data shall be held and controlled centrally via a portal (Energy-Link) to maximise consistency and integrity, but made available widely in simple, easy-to-understand formats so that efficiency opportunities are easily identifiable and the business is incentivised to act upon them.

Network Rail's Energy-Link provides energy consumption (electricity and gas) data across multiple assets and presents data in different formats, importantly identifying trends in consumption per asset, important for Asset Managers post intervention measures.

All utility supplies within LNW should not contain any long term estimated readings and therefore owners shall assigned who will be responsible for ensuring and checking actual metered data is being collected for supplies within their scope of responsibility.

A Cloud Share (Sharp Cloud) portal is being developed for collating all real time energy data alongside Energy Link.

Figure 1. Example screenshot of Energy Link for Data view

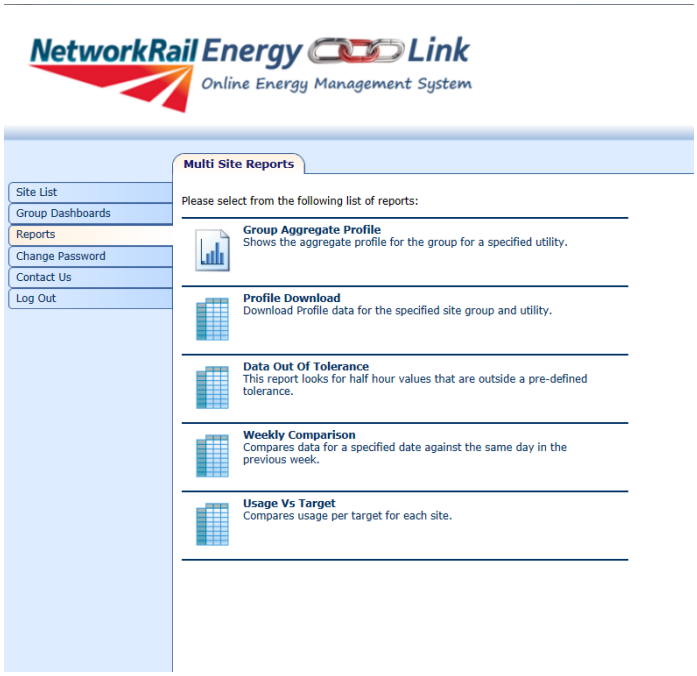


Figure 2. example of site reports available from Energy Link

Whilst the Energy-Link online portal is useful for local analysis to enable good energy management practices, use of the back-end system of Energy-Link will enable easier portfolio overview and reporting and more in-depth analysis to be undertaken. Limited licenses will be used for the back-end system and will be utilised with support from the Energy Bureau and the STE Energy & Carbon Strategy Team.

Training on the Energy-Link online portal and the back-end system is provided by the STE Energy & Carbon Strategy Team and simple guidance and advice is available for cascade.

7.2 LNW Route Energy Management Plan

The LNW Asset Management team shall implement good practice set out in this plan to adhere to the principles of ISO 50001 (Energy Management) so that a robust set of energy management practices and procedures are created that can survive organisational changes, such as people leaving the company. The energy management system and processes set out in this plan shall also be a part of Network Rail's wider environmental management system in line with ISO 14001 (Environmental Management System).

Following guidance set out in ISO 50001, an **Energy Management Plan** shall be devised for the LNW Route that contains a list of all asset types and provide an investment plan for energy efficiency savings. This plan shall be referenced as the '**Register of Opportunities'** collated across the LNW estate and shall be regularly updated (Appendix B).

Figure 3 shows the energy management system model following the principles of ISO 50001 for LNW route showing the overall structure and process for the system commencing from the Network Rail Carbon & Energy Strategy and Policy and how the LNW Energy & Carbon Reduction Implementation Strategy links to application, evaluation, and feeding back for continuous improvement and assurance that reduction in energy and carbon is being achieved towards corporate Network Rail targets of 11% by 2019, 25% by 2024 and beyond.

Figure 4 illustrates the steps for Network Rail to follow when developing an energy management system. The first step as set out above (7.1) is to review data via Energy Link. This system will provide the baseline against which future progress can be measured.

It is important to implement the RACI and gain support to the process from senior management such as the Route Managing Director, Director Route Safety & Asset Manager, Senior Route Asset Manager (DRSAM / SRAM) individual asset type RAMs and the maintenance and operational management structure. Without management support, an energy management system is likely to falter or have focus diverted from it by other priorities in respect of asset maintenance and operational issues.

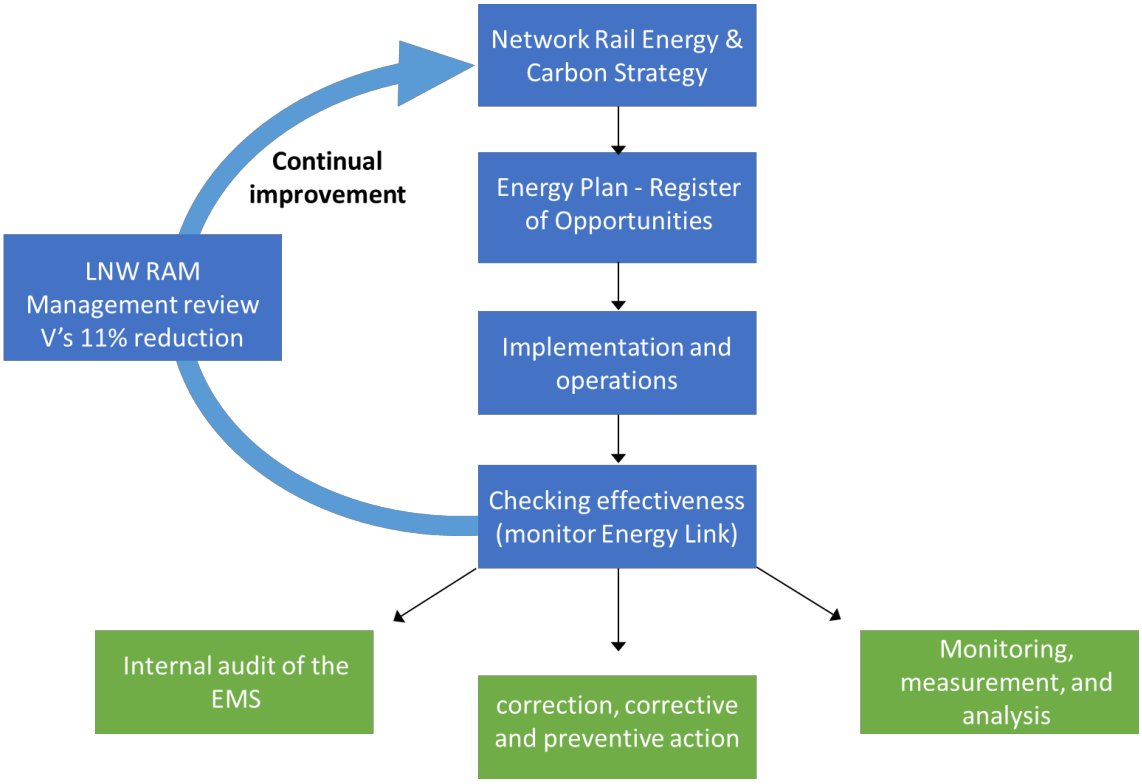


Figure 3. Energy Management Process diagram for LNW

7.3 Lean working

Lean principles and techniques should be applied for the implementation of energy and carbon saving solutions that include the following steps;

1. Specify and calculate the value in a proposal (recorded in the Register of Opportunities) from the viewpoint of the end user and Client, i.e. the tax paying public.
2. Identify all the steps in the value stream for each proposal, eliminating whenever possible those steps that do not create value. This may include product supplier visits if they are not essential and do not add value.
3. Make the value-creating steps occur in tight sequence when implementing any measures or activities to reduce carbon and energy.
4. As value is specified, value streams are identified, wasted steps are removed, and flow and pull are introduced, begin the process again and continue it until a state of perfection is reached in which perfect value is created with no waste.

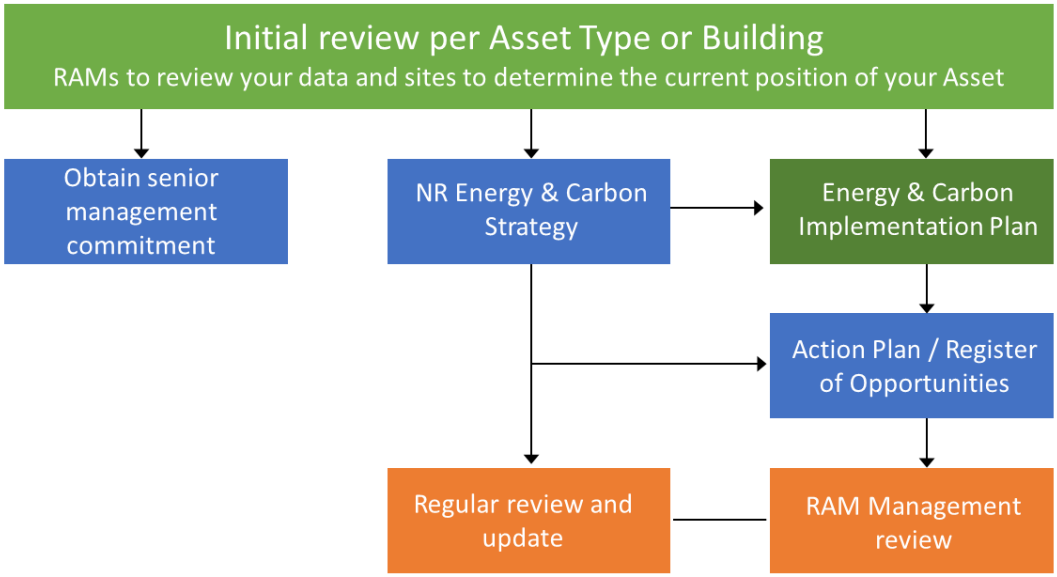


Figure 4. Energy Management System process for LNW RAM team adopted from RSSB Guidance

7.4 Targets for energy and carbon reduction

The route Financial Controller and the Senior Route Asset Manager (RAM) shall be responsible for creating individual targets per asset type for energy and carbon reduction and identify this in the Register of Opportunities by first reviewing the category of assets set out in the Scope above and then ensure the register of opportunities is regularly updated, having input from Works Delivery members. The total carbon reduction should equate to a minimum of 11% or more for 2019 or 25% for 2024. The Route Asset Management Plans shall also reference the energy targets set per asset type and the main areas of opportunities for energy reduction, both short term (CP6, CP6) and longer term where appropriate (view to 2050).

7.5 Register of Opportunities

The Energy Management Plan under ISO 50001 shall be the Register of Opportunities and controlled by the Energy & Carbon Strategy Manager but the route shall be responsible and accountable for ensuring the register is populated and updated every period. A workshop shall be set up every quarter and attendance from a route representative will be mandatory to assist and provide knowledge of opportunities across their respective assets.

Please see Appendix B for the Register of Opportunities template.

7.6 Managing Energy Usage & Information

Management of Energy consumption shall require active participation from works delivery, asset management and each of the delivery units. The asset management team should report any adverse meter readings to the Route Services Energy Bureau who will update Energy-Link and liaise with the energy suppliers to apply new information to the supplies. Changes and updates, as well as consumption can be monitored via Network Rail's Energy Link. Each RAM shall be responsible to ensure actual readings and not estimated are being provided to the Energy Bureau.

7.7 Energy Performance Monitoring

Where available, all building asset managers should review available EPC's and DEC's and review ratings to help identify where improvements can be made and how the asset compares against recommended scores.

Any implemented measures from the Register of Opportunities should have a continuous monitoring (Figure 3) and improvement check every period via Energy Link to ensure calculated savings are being realised and if this is not the case, an investigation as to the reasons should be instigated. All measures and interventions that are implemented should be specific, measurable, attainable, realistic, and time-based (SMART). Energy efficiency interventions can be logged within Energy-Link (events) to enable quick and simple benefits tracking. Owners of projects within the Register of Opportunities will be required to inform the Energy Bureau of implementation of measures so that the event can be logged.

7.8 Energy Budgets

The Route Financial Controller shall set Energy Budgets per asset type set out in section 2. The Energy budgets shall be reviewed every quarter and renewed targets set against these. The Route Asset Managers shall provide evidence that their asset of responsibility contains at least one opportunity in the Register of Opportunities and shall be responsible for ensuring energy use is being reduced unless the asset has expanded or undergone change of use or utilisation.

Guidelines for investment shall be dependent upon the Payback, NPV (Net Present Value) and IRR (Investment Rate of Return). Following the Energy and Carbon intervention hierarchy (Figure 5) if initiatives are identified that require capex intervention to rationalise, optimise or generate low carbon energy shall require a clear business case and calculation that demonstrates the Opex saving and carbon.

7.9 Investment Guidelines

Payback period, persistence factors and rate of returns vary depending upon the type of technology or intervention being deployed to reduce energy and carbon.

Area	Measure	Typical energy saving (%)[b c]	Typical payback (Years)	Persistence factor[a]
Combined heat and power	Gas turbine CHP	30 % – 55 %	2 – 7	11.40
Combined heat and power	Gas, diesel, gasoil engine CHP	30 % – 55 %	2 – 7	15.20
Combined heat and power	Electric to gas – heating using CHP	30 % – 55 %	2 – 7	15.20
Compressor	Air compressor upgrade			14.44
Computers and IT solutions	Cathode ray tubes (CRT) to flat screen LCD			7.20

Table 1. Examples of payback for different low carbon technologies such as CHP (source: RSSB)

Such interventions and budgets shall be allocated if the payback is less or equal to 7 years, or an IRR of >10%. These investment guidelines shall be regularly reviewed. A governance board shall be established to manage the implementation budget for low carbon solutions identified in the register of opportunities / energy management plan.

Projects which fall outside of these criteria will be considered on a case by case basis.

8 Energy Management Working Groups

8.1 Strategic Energy Management Group

The Strategic Energy Management Working Group sets out to achieve successful implementation of the Network Rail Energy & Carbon Policy and delivery of the Energy & Carbon Strategy. This group consists of the STE Energy & Carbon Strategy Team and the strategic energy leads from each route, nominated by the Route Managing Director. It will discuss and provide strategic direction on key energy management issues faced by the Routes and will strive to achieve Network Rail's regulated carbon reduction target. The main objective is to manage the delivery of the Energy & Carbon Strategy and shall also ensure actions set out in Route implementation Strategies are being successfully implemented and the Register of Opportunities are being updated.

Any actions within the Management Plan / Register of Opportunities that remain outstanding shall be escalated to the DRAM and SRAM.

8.2 LNW Route Energy Management Group

This group is led by the LNW Energy Lead and consists of key stakeholders and owners of projects within the Register of Opportunities. It's objective is to progress implementation of projects within the register, track outcomes and benefits and identify further opportunities. A two-way communication stream between both groups enables strategic direction and progress updates to be received.

9 CP5 & CP6 Target Outcomes

9.1 Route wide Opportunities for CP5

The LNW Route has a large portfolio of energy-consuming assets, sites and buildings. To maximise carbon and energy savings, it is important to assess whether any given opportunity may be suitable for roll-out across a wider portfolio. Initiatives that may achieve better economies of scale and assist towards achieving our CP5 target by 2019 include:

- Behaviour change
- Insulation (pipework and fabric)
- Building Air tightness / thermal bridging
- Replacing Tungsten / halogen lighting with LED
- Installing lighting controls across asset
- Install timers across large scale lighting assets
- Review of pump / fan efficiency – Variable Speed Drives
- Heating Controls
- BMS Optimisation and upgrade

- Controls systems (HVAC)

Low cost interventions such as occupancy sensors for lighting controls can have an important impact in respect of energy and associated operational carbon (Table 2).

Control strategy	Saving*(%)
Auto on/dimmed	5%
Auto on/auto off	10%
Manual on/dimmed	10%
Manual on/auto off	18%

Table 2. Savings made from occupancy sensors (*) According to BS EN 15193:2007

9.2 Route wide Opportunities for CP6

The targets for reducing energy and carbon in CP6 are more ambitious than in CP5 with a target of 25% reduction. Further energy efficiency interventions will be necessary in order to achieve this and future targets beyond CP6. Such targets shall also require the intervention and installation of Renewable Technology with a robust Business case combined with technical and commercial support from the Network Rail Energy & Carbon Strategy team in STE. Innovative procurement routes shall also be explored to invite third party investment with Energy Performance Contracts (EPC's) / Energy Performance Agreements (EPAs).

10 Roles / Responsibilities

The RACI chart described above and shown in detail in Appendix A forms the backbone to the success of reducing energy and carbon. In addition to the RACI, the route shall also form Energy Champion roles to specific individuals who are keen to be involved in the important task of reducing energy and carbon emissions in the organisation.

10.1 Energy Champions

This role can be assigned to any member of the Route team by senior management and empowers team members to manage or get involved in schemes and initiatives that can positively impact LNW Route's carbon emissions. The Champion's work will involve monitoring energy use and liaising with the Energy& Carbon Strategy Team and LNW working group. They will also be invited to relevant training sessions and meetings where they can meet with the Energy & Carbon Strategy Manager. Here they can raise any issues or anomalies, share best practice and discuss

progress and new ideas. Energy Champions shall help implement initiatives set out in the Register of Opportunities.

10.2 Project and Action Owners

Projects and actions within the Register of Opportunities owned by individuals shall be included as part of performance reviews. This will encourage personal investment and ownership and will serve to encourage progress of actions and integration of energy efficiency behaviours into business as usual activity.

11 Training & Behaviour Change

11.1 General

Behaviour change is a low-cost method of reducing energy wastage, cost and carbon. In general, savings come from encouraging staff to identify where energy can be saved by switching off lights and equipment that is not in use or reduce demand where it is not needed. Savings can also come from engaging staff to identify more efficient energy practices such as optimising when in the day equipment is switched on and how it is used.

The LNW leadership team need to help create and support an effective behaviour change campaign with the support of the STE Energy & Carbon Strategy Team. A particular area to focus on is ownership of local decisions. For instance, energy consuming equipment and lighting is often left on when it is not needed because staff does not feel that they are empowered to switch it off. This is not a simple task as different activities can be carried out in different areas of the route, site and building functions may change, and site occupancy can frequently change.

Many behaviour change campaigns fail because they do not take into account behavioural psychology. Understanding people's barriers to change, values, and motivations is important in creating a campaign that has lasting impact. A simple way to start this process is with empowerment. Encouraging staff to seek out energy waste and giving them the tools to do this will do much to engender behaviour change.

Employees within the route now have a direct link between their actions and energy expenditure and accountability. Senior leadership is important because people generally like to follow the social norms of their surrounding environment. If the majority of people turn off the lights at the end of the day, it is likely the rest will follow suit.

The local Energy Champions support (Section 9.1 above) will also give a focus for behaviour change. This not only creates ownership for reducing energy demand at the asset level, but

provides the means to share best practice and to push ideas for energy savings up to senior management using the Register of Opportunity as the Management Plan.

11.2 Workshops / Toolbox talks

Regular meetings of the LNW Energy Management Group shall track progress and occasionally workshops will be held to identify and capture emerging opportunities. Awareness raising toolbox talks highlighting the importance of Energy and Carbon reduction shall be integrated into existing team meetings and Safety Hour sessions, and Energy & Carbon updates shall form part of the Agenda for the Strategic Meetings. The Energy & Carbon Strategy Manager shall support delivery of the workshops and toolbox talk materials to influence behaviour and assign either a specialist or external organisation if required.

11.1 Training

Raising awareness and energy efficiency and management competencies is an important aspect of the LNW Energy & Carbon Reduction Implementation Strategy. The current level of maturity in energy management must improve in order to achieve the aims set out in the Statement of Commitment and this Strategy.

Training in energy management is facilitated or delivered by the STE Energy & Carbon Strategy Team in a variety of formats, such as;

- e-learning module (currently under development – planned delivery by the end of Spring 2018);
- Energy-Link training sessions;
- Portfolio review deep dive sessions;
- toolbox talks;
- an energy & carbon management toolkit;
- one-to-one training and coaching; and
- the availability of more advanced technical training and apprenticeship courses delivered by external accredited bodies.

The STE Energy & Carbon Strategy Team has developed a competency matrix to provide guidance on the appropriate levels of competency of different roles within Network Rail. The Route Energy Lead will work with the LNW Energy Management Working Group and the Energy & Carbon Strategy Manager to establish training needs and plan appropriate interventions.

12 Investment Planning for Energy Efficiency

12.1 Invest-to-save

Many of the interventions for reducing Energy in this plan commence with behaviour and culture, followed by low costs interventions such as insulation, controls and those identified in section 8. However, there are many other options that will require investment to implement physical energy efficiency measures. A non-exhaustive list of potential technologies to be considered is shown in section 13. Network Rail HQ intend to procure delivery frameworks for these measures to enable Routes to select those measures most appropriate to them, and pick from a menu of funding options, from direct investment to energy performance contracting, so that the implementation methods most suitable to each Route are available. The framework contract is due to be in place by the end of October 2017, with delivery partners immediately ready to survey sites and deploy measures.

Support will be available to the route from the STE Energy & Carbon Strategy Team with the following:

- Technical advice to understand the appropriate application of energy efficiency measures.
- Promote maximum benefit in the shortest timeframe by applying the principles of the Energy Hierarchy (Figure 5).
- Provision of cost benefit analysis and project development templates.
- Helping project owners to develop and bolster business cases and investment plans.
- Advising on additional benefits to consider such as maintenance savings or additional future costs.
- Providing case studies and post implementation benefit analyses to enable swift replication.

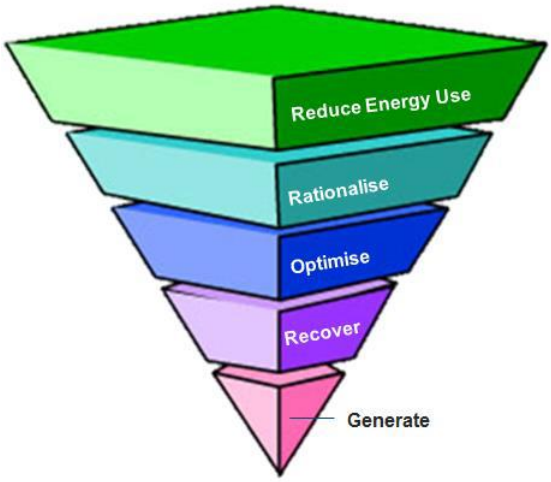


Figure 5. Energy and carbon reduction intervention hierarchy

Although generation is placed at the bottom of the energy hierarchy, renewable generation has an important role to play in our efforts to reduce emissions. Network Rail has installed renewable technologies across a range of assets and their contribution is recognised. We will continue to use renewable generation as one of the potential solutions in a holistic view of energy and carbon reduction across the Network Rail portfolio but will guide the business on their appropriate deployment to ensure there is a robust business case for investing in renewable technology.

13 The Energy Technology List

When considering buying new energy using equipment, this should be selected from the Energy Technology List (ETL). The ETL is managed by the government and is a list of energy efficient products that must meet specific energy saving or energy efficient criteria.

It is part of the Enhanced Capital Allowance (ECA) tax scheme for businesses:
https://www.gov.uk/guidance/energy-technology-list#enhanced-capital-allowance-eca-scheme

Therefore, products included on the ETL are what are considered by independent experts to be among the most energy efficient on the market.

Categories include:

- Air-to-air energy recovery
- Automatic monitoring and targeting (AMT) equipment
- Boiler equipment
- Compressed air equipment
- Heat pumps
- HVAC equipment
- High-speed hand air dryers
- Lighting
- Motors and drives
- Pipework insulation
- Refrigeration equipment
- Solar thermal systems
- Uninterruptible power supplies
- Warm air and radiant heaters
- Waste heat to electricity conversion equipment

For more details about eligible product types, see the technology factsheets
https://www.gov.uk/government/collections/energy-technology-listtechnology-information-leaflets

Advice should be sought from the Network Rail Energy & Carbon Strategy Team when any of the above technologies and interventions are being assessed across any assets along the LNW route.

14 Whole Life cycle Assessment

Life Cycle Assessment (LCA) is a way to identify and calculate the environmental impact of a given product or proposed energy efficient equipment across its whole lifetime, from material extraction to manufacture to use to disposal known as ‘Cradle to Grave’ assessment. This shall play an important assessment when considering low carbon and renewable technology for any assets along the LNW route.

The ISO (International Standards Organisation) standards ISO 14040:2006 and ISO 14044:2006 sets out the phases the LCA shall include such as scope, design life of equipment, components (inventory) and impact assessment.

Impact assessment: the purpose of the life cycle impact assessment, LCIA, is to provide additional information to help assess a product or equipment's (Lifecycle Inventory) LCI results so as to better understand their environmental impact that includes components that make up the plant or equipment and scheme.

Results from any LCA carried out should be discussed as a basis for conclusions, recommendations and decision-making in accordance with the goal and scope of the Network Rail Sustainable Development Policy and Environmental Policy.

In regards to any funding or schemes linked to Renewals Asset Policy delivered interventions, the schemes will not always align directly with whole LCA as a result in national approaches on affordability. Wherever possible, renewals schemes will utilise LCA approaches but it may be necessary to adopt minimum interventions which still align with the spirit of Network Rail Sustainable Development and Environment Policies.

Summary

We all have a legal, corporate and social duty and obligation to ensure we are efficient in the way we use our energy, and actively look for opportunities in reducing energy and carbon, particularly for non-traction assets. Now that responsibility for energy use and budgetary control lies within the Routes and with clear targets for energy and carbon reduction set out in the Energy & Carbon Strategy, this implementation Strategy aims to assist in providing a robust process in helping LNW in achieving these targets.

This plan follows the principles of ISO 50001 (Energy Management) and sets out how LNW route aims to help achieve the target for corporate CO_2e emission reduction of 11% by the end of CP5 and continue to prepare for further reductions in CP6 of a more ambitious 25%.

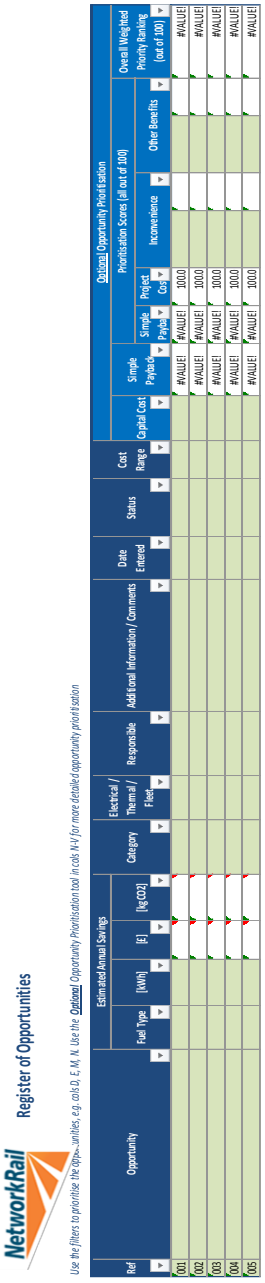
APPENDIX A - RACI

London North Western Route Energy Management RACI Matrix

Version: Draft 03 **Last update:** 11/04/2017

ISO 50001 deliverable	Quality Stage	Activity	RMD	Chief Operating Officer	Head of Maintenance Delivery	Head of Operations Delivery	IMDM	IME	Area Services Manager	DRAM	SRAM	Director Change	Route Commercial Manager	Route Financial Director	Route Financial Controller	Works Delivery Director	Stakeholder Manager	HQHSHE	HRBP	RAM (Buildings)	RAM (E&P)	RAM (Signalling)	Business Development Director	Station Manager	Environmental Specialist	Utilities Specialist	Workplace/Property Manager	Internal Comms Manager
Energy Policy	Policy	Create Route Energy Strategy	I	C	C	C	C	I	I	A	R	I	C	C	I	C	I	R	C	R	R	R	R	R	R	R	C	I
Energy Standards		Co-ordinate and oversee Route Energy Policy development	I	C	C	C	C	I	I	A	R	I	C	C	C	C	I	R	C	R	R	R	R	R	R	R	I	I
Energy Management System Framework		Define Route Energy Policy - Asset	I	C	C	C	C	I	I	A	R	I	C	C	C	C	I	R	I	R	R	R	R	C	R	R	I	I
		Define Route Energy Policy - Non-Asset	I	C	C	C	C	I	I	A	C	C	I	C	C	C	C	R	C	I	I	I	I	C	R	R	R	C
		Update Energy Policy to reflect legal, standards and external change	I	I	I	I	I	I	I	A	R	I	I	I	I	I	C	R	I	C	C	C	C	I	R	R	R	I

APPENDIX B – Register of Opportunities



Register of Opportunities

Use the filters to prioritise the opportunities, e.g. cat=D, E, M, N. Use the Optional Opportunity Prioritisation tool in cols N-V for more detailed opportunity prioritisation

Ref	Opportunity	Estimated Annual Savings				Category	Electrical / Thermal / Fleet	Responsible	Additional Information / Comments	Date Entered	Status	Cost Range	Optional Opportunity Prioritisation							Overall Weighted Priority Ranking (out of 100)
		Fuel Type	[kWh]	[£]	[tgCO2]								Capital Cost	Simple Payback	Simple Payback	Project Cost	Prioritisation Scores (all out of 100) Inconvenience	Other Benefits		
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