by KIT OUNG
Energy Savings Strategist – Energy Savings, Efficien:ology

Industrial Strategy Needs an Active Energy Management Culture – Part 1

In January 2017, the UK Government launched a green paper on "Industrial Strategy". This consultation looks at wide-ranging issues to attract, promote and grow the industry and manufacturing sector in the UK. One of the key and critical issues to achieve this ambition is energy supply. At the heart of this industrial strategy is the need to address the infamous term "energy trilemma" – the affordable, reliable and sustainable energy supply.

The background to the so-called trilemma is the deterioration of the UK's excess electricity capacity at peak to less than 2%[1] and the increase of energy cost of over 125% (for natural gas) and 150% (for electricity) over a 10-year period. The root cause of this is due to four contributing factors: (1) decades of "sweating the assets" with limited maintenance and investment in new power capacity; (2) accelerated decommissioning of old and uneconomic coal and oil generating assets; (3) the rise of decentralised and environmentally friendly sources of electricity; and (4) poor uptake of energy reduction by corporations and households.

Readers of my writings will be familiar with the high-level findings of energy efficiency opportunities and the gap between available technologies and its diffusion rates. The former Department of Energy and Climate Change even quantified the economic value of energy savings in its Energy Efficiency Strategy [2]: if energy reductions of between 21 – 47% savings could be achieved by 2020 (eight years from its publication), there would be a need to build 22 fewer power stations!

For those who are not familiar with the energy savings statistics, we have sufficient technology and know-how to reduce the current energy consumption by 73%[3] of which at least 25%[4] can be saved with little-to-no cost and operational changes. On the other hand, on average, we are achieving savings at a rate of 1% per year[5]. Why the disparity and reluctance when faced with such a compelling case for change?

We already have technologies and know-how to save 73% of energy consumption

Master Shifu [Dustin Hoffman], in Kung Fu Panda movies, tells the Dragon Warrior [Jack Black], "There are no accidents". There is a specific reason why energy efficient technologies became the saviour of all energy consumption and climate change problems.

Political and economic commentators accredit the explosion of a 'spend-to-save mentality' by using and retrofitting energy efficiency technologies, to a specific time where Ronald Reagan unseated and succeeded incumbent President Jimmy Carter as the next President of the United States. One of the key messages in President Reagan's election campaign centred on energy: Jimmy Carter's "use energy responsibly and conserve" manifesto lost out to President Reagan's "use as much as necessary, we'll roll out energy efficient equipment." The political implication, rightly or wrongly, lead to a global change away from using energy responsibly to let technology make us use less. The argument and energy efficiency narrative has taken that time since to countenance.

In the domestic scale, the 'spend-2-save' mentality led to countless energy efficient technologies such as LED light bulbs, TVs, star rating fridges and washing machines, dryers, vacuum cleaners and cars. For those who are refurbishing the home, there are an abundance of energy-efficient options including double-glazing (and triple- or quadruple), low conductivity walls and doors, high efficiency boilers and high efficiency ventilation technologies.

On the larger scale, due to the larger sizes and longer operating hours, a small improvement in energy efficiency, which is worth pennies to domestic users, becomes big and attractive for companies and government entities. These range from:

1. Kolokathis, C, Electricity Capacity Assessment Report 2014, OfGEM: London, 2014.
2. DECC, 2012, The Energy Efficiency Strategy: The Energy Efficiency Opportunity in the UK, November 2012, Department of Energy and Climate Change: London
3. Cullen, JM, Allwood, JM, and Borgstein, H, Reducing energy demand: What are the practical limits?, J Environ Sci & Technol, 2011, 45(4), pp1711-1718
4. Enkvist, P, Naucler, T and Riese J, What countries can do about cutting carbon emissions, McKinsey Quarterly, April 2008
5. Energy Technology Perspectives 2008, International Energy Agency: Paris, 2008
6. Siemens AG. Siemens sets new performance and efficiency world record at Düsseldorf power plant. Press release: PR2016010135PGEN. 28 Jan 2016.

1. Improved control systems, and ability to match energy demand vs. supply: capability to detect small variations via predictive and dynamic controls systems, use of variable speed drives to match water pumping or air ventilation requirements, etc.;

2. Better manufacturing techniques giving rise to energy efficiency gains: some examples include higher efficiency motors, high efficiency transformers and lower electricity consuming washing machines, etc.; and

3. Technologies that allow more energy to be utilised efficiently which would otherwise be wasted: some examples are using quad-generation to satisfy simultaneous power, heating, cooling, and CO2 demands; using regenerative braking on transport fleet; and turning waste into an energy source in waste-to-energy plants, gasification plants, anaerobic digestion plants, and fermentation into biofuel.

Advances in materials pave way for newer manufacturing processes using less material, improved energy efficiency and resource efficiency.

- In aviation, the use of composite materials for the airframe, improved aerodynamics, fully electronic flight controls, and other innovations allowed new aircrafts to have lower engine fuel burn compared to similar aircrafts in operation. Some airlines are also testing regenerative braking systems to recover energy of short-haul flights.

- In the power generations sector, advanced materials and innovative turbine blade designs have nearly doubled the efficiency of combined cycle power plant efficiency from 36% in 1970s to over 61% in 2015[6].

- The use of advanced materials and design techniques in buildings and the automotive industry have also allowed less steel to be utilised without compromising safety and structural integrity. It also means that buildings and storage tanks can be operated with less energy as there is less steel to be warmed up or cooled down.

Technological research and innovations is closing the gap between current technologies and the theoretical limits of energy efficiency. Some of the more notable R&D projects are:

1. Refrigeration units that do not require the use of a compressor, thus offering significantly lower energy consumption.

2. The use of Organic Rankine cycles to extract low temperate waste heat – the most common form of waste heat to generate power.

3. The use of Dearman cycles to provide simultaneous cooling and power whose by-product is air or nitrogen (both of which are inert and in abundance in the atmosphere).

4. Low-cost "plug-and-play" batteries in the shape of a table lamp or household radiator can be deployed in large scale by plugging in to any spare electricity socket. This allows the batteries to soak up excess intermittent renewably generated electricity at low-demand "off-peak" periods, to be discharged at peak periods.

5. Utilising CO2 to grow fast-growing algae as sources of biofuel, and converting CO2 into polypropylene oxide and/or graphene.

In short, there is no short supply of technologies and techniques available for harvesting energy savings. Many of these innovations and technologies not only save energy and delay the onset of climate change, but also save raw materials, water, reduce waste and other resources … all of which are ingredients to a successful Industrial Strategy.

The three keys … to save 73% of energy consumption

While there are great strides and achievements in technology, the uptake and implementation of energy efficiency remains limited. This is evident by the results of energy savings reported – 1% reduction per annum. In a one-thousand mile journey, the available technologies and techniques to use 73% less energy represents the 999-mile journey. The successful implementation of technology represents the last-mile of the journey.

Let me quote another great saying, "A journey of a thousand miles starts with one step". There is an equally important yet unsaid quote, "You have to take the last step to complete the thousand-mile journey."

The last-mile is not a technology issue but a people-based one.

This is where almost all efforts so far fall short. Nearly all technology-minded communities (research academies, institutes, associations, societies, consultants, service providers, etc.) ask governments to (or blame governments for not) mandate energy-efficient technology. Others jump on the behaviour change bandwagon – the need to change everyone's behaviour and nudge others towards implementing energy-efficient technologies.

Unfortunately, the solution to reducing the energy efficiency gap is not as straight forward as behavioural change. Fortunately, it also does not require one to become an energy efficiency technologist, or behavioural specialist to close the so-called "gap". It requires courage to ask the right question, "Why do companies not do more to save energy?"

To address the needs of an Industrial Strategy and balance the energy trilemma, we need to address the needs of industrial and manufacturing organisations. A company may simply either be: (1) having a cognitive bias leading to decisions for not implementing (or deprioritising) energy savings; (2) burnt out; (3) starting its operations in the UK from scratch.

The needs of these three groups of organisations are different and there is not one solution that fits all of them.

Key 1: Addressing organisation with cognitive bias in energy

For most organisations, the energy efficiency gap is most likely due to cognitive biases[7] - the way people think and make decisions about energy savings. It is where a choice architecture or nudge[8] comes into play – putting in place a series of decision processes or decision aids where people stop to think, reflect and make decisions about energy savings.

The following six steps, when used in a planned and concerted way, can help to reduce and remove the cognitive biases build in all human beings.

Step 1: Becoming aware that you can use less energy and wanting to act

This is the first step to realising awareness that every household or company can use less energy. Every household needs to consume energy in order to create a comfortable living environment. Similarly, every company needs to consume energy to manufacture and trade its products and services. While energy consumption is a necessity to support life and economic activity, there is a need to distinguish the minimum energy consumption to support a comfortable lifestyle and economic activity, and excess energy consumption.

For example, the typical fresh air supply into an office building is at the rate of 30 L/s per person. Yet, the recommended fresh air supply, depending on whether you subscribe to the UK or US recommendations, ranges between 7 - 8 L/s per person. This means that the quantity of fresh air supply to each building is in excess, giving an extra 22 - 23 L/s per person. This savings will translate into electricity savings from the ventilation fans, and reduced air conditioning (heating, cooling, and (de-)humidification).

If we look at the opportunities in buildings, transport and industry, the excess energy consumption from the minimum necessary is well over 83%, 68% and 62% respectively. Even within each sub-sectors, there are still improvement opportunities to use less in developed and developing nations.

A good benchmarking exercise with the best in class building or equipment can identify the improvement gap. The difference between the best-in-class and your energy consumption is the gap for improvement. It is up to you how much energy you want to save, and how fast you want to save it.

Step 2: Make energy consumption visible

The next key obstacle is that many people do not know how much energy they consume or how much is their energy cost. Most employees in a company do not pay the bill. A small number of employees may read the meters or receive the information on an invoice purely for reporting purposes.

Suffice to say, most people's day-to-day work or living activities do not involve interpreting the kWh or cost information on an invoice or bill. As the saying goes, "out of sight, out of mind". It is interesting to note that even the industrialist, Henry Ford, used only three indicators to measure his industrial productivity and they were not financial: time, material and energy."

In my book "Energy management in business", my friend, Professor Martin Fry, said, "we take energy for granted, like the air we breathe." A simple way to make energy consumption visible is the use of an 'energy profile'. It is a visual representation of all the energy using equipment in your company and the quantity of energy it consumes over the course of, say, one year. This representation is commonly presented as a pie chart.

When someone sees an energy profile, it leaves no doubt about what, where and how significant the energy users are. The information can help to put energy into the

7. Gillingham, K, and Palmer, K, 2014, Bridging the Energy Efficiency Gap: Policy Insights from Economic Theory and Empirical Evidence, Rev Environ Econ Policy, 8 (1): 18-38
8. Thaler, R, and Sunstein, C, 2008. Nudge: Improving decisions about health, wealth, and happiness.
9. Cullen, JM, Allwood, JM, and Borgstein, H, Reducing energy demand: What are the practical limits? J Environ Sci & Technol, 2011, 45(4), pp1711-1718
10. Levinson, W.A., Henry Ford's Lean Performance Indicators. In Quality Digest, 7th October 2011, available at http://www.qualitydigest.com/inside/quality-insider-column/henry-ford-s-lean-performance-indicators.html

foreground of people's minds and help generate and keep the conversation going leading to remedial actions and sustainable countermeasures. Companies may also use the energy profile to prioritise the big energy users for improvements over smaller users.

Another visually impactful representation of energy is the energy baseline – a graphic relationship between a companies' energy consumption and its primary business activity, e.g. production, sales, occupancy, services, etc. Normally drawn in a spreadsheet, it shows visual information on how a company's energy consumption varies with the business activity, i.e. it is a variable cost, not a fixed cost. As such, energy consumption is a controllable component of a company's operating cost.

Step 3: Find and implement opportunities in a way that maximises savings and minimises cost

The next step is to smoke out where is this, so called, extravagant energy consumption. It represents the first line of attack to reduce energy consumption, and to bring energy consumption back to the minimum necessary to support living condition and economic activities.

One of my pet peeves is the overuse of the term "energy efficiency", meaning energy savings or energy reduction. In reality, energy efficiency is only one way to reduce energy consumption. There are two other [and cheaper] ways: reducing energy users and reduction of energy consumption. Let me give you an example of saving energy from lighting in an office:

- **Reducing energy use:** You could decide that there is too much lighting in the room and remove the excess light fittings inside the room. Therefore, the number of energy users is reduced and energy is saved.

- **Reducing consumption:** You could find that the office is only used during daytime and the room has good access to natural day light. As such, you elect to turn off the light switch, thus achieving an energy saving. In this case, the number of light fittings (energy users) is the same, but the time it is left ON is reduced.

- **Improving energy efficiency:** You could replace all of the incandescent light fittings for a LED variant. In this case, the LED gives the same light output with significantly less electricity input, thus more efficient, and gives rise to energy savings.

In the above simplistic example, all three methods give energy savings. Improving energy efficiency involves investing capital to achieve energy savings. Reducing energy use and reducing consumption is nearly free or low cost in comparison to improving energy efficiency. There are also situations where equipment is the most efficient, but there is no need for that equipment. Using the office lighting as an example, it may have the most efficient LED lighting. However, if it is daytime and the office has great access to natural daylight, there is no need for the LED light to be ON!

Looking around any organisation, there are many opportunities to reduce energy use and energy consumption … and it does not have to be in energy units such as kWh. The opportunities can be found as excess consumption, leaks, waste, "over" processing, production speed losses, pressure drops, efficiency losses, ventilations grills chucking out hot air while others in the same area chucking out cold ones, etc.

A good quality, traceable and transparent energy audit identifies these cost effective opportunities for improvements. All of these improvement opportunities need to be prioritised appropriately in order to maximise energy savings and minimise capital costs simultaneously. In general, it starts with reducing demand through good housekeeping and controls, incorporating energy-efficient operational and maintenance requirements into procedures and ensuring these operational controls are implemented well.

The next portfolio of projects should be about recovering energy waste, typically in the form of waste heat. Let me quote another saying, "one man's waste is another man's food". Effecting energy recycling can be in the form of recovering the waste and transferring it to another part, or converting the waste into fuel sources. One thing to remember … if you are doing the earlier, both the heat source and heat sink must be in sync for the heat recovery to happen.

Then, material and resource efficiency projects come in. Many energy saving projects may also have other benefits. Some of these might be in water savings, raw materials savings, waste savings, packaging savings, maintenance savings, etc. You may also want to consider the efficient generation of energy such as combined heat and power plants.

Lastly, the advanced tools and techniques such as renewable energy sources, green chemistry and business model changes represent the emerging techniques and should be left as the last portfolio of projects.

In Part 2 we will look at the following aspects:
Step 4: Make energy saving messages specific and address stakeholders' pains
Step 5: Engaging and bringing people along the energy saving journey
Step 6: Celebrate successes and continually improve
Key 2: Addressing organisations with "burned-out" issues
Key 3: Addressing organisations planning to build new plants

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To address the needs of an Industrial Strategy and balance the energy trilemma, we need to address the needs of industrial and manufacturing organisations. A company may simply either be: (1) having a cognitive bias leading to decisions for not implementing (or deprioritising) energy savings; (2) burnt out; (3) starting its operations in the UK from scratch.

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In Part 1, published in the March-April issue, we explored:
Introduction and background
Key 1: Addressing organisation with cognitive bias in energy
Step 1: Become aware that you can use less energy and wanting to act
Step 2: Make energy consumption visible
Step 3: Find and implement opportunities in a way that maximises savings and minimises cost

In Part 2, I will continue with….
Step 4: Make energy saving messages specific and address stakeholders' pains
Step 5: Engaging and bringing people along the energy saving journey
Step 6: Celebrate successes and continually improve
Key 2: Addressing organisations with "burnt-out" issues
Key 3: Addressing organisations planning to build new plants
Conclusion

Step 4: Make energy saving messages specific and address stakeholders' pains

The quirks of scientific and engineering language may sometimes be difficult to understand. Engineers, like me, tend to write ten paragraphs of long sentences, in a passive and third person language when a simple, concise, and short paragraph does the trick.

If identified energy-efficient technologies are to have a fighting chance of getting attention from senior management and being eventually implemented, we need to make the energy messages simple and address the needs of various stakeholders in the company. This involves three things: (1) we need to understand that different people, in their various job roles, relate to energy differently; (2) we need to understand the cognitive biases of the various stakeholders; and (3) we need to craft a message that meets the needs of the various stakeholders.

One of the very first tasks is to identify the various stakeholders, not just those with the pen power, but everyone who would benefit from the energy-saving technologies. This includes the operators, technicians, engineers, process owners, managers and senior managers. Next, we need to identify how the energy-saving technologies can help solve their pains or make their work easier … from their perspective, not yours.

And lastly, is to design a targeted and crafted plan for communicating the messages to the identified stakeholders. This is where a nudge or choice architecture kicks in. It is important to communicate with the stakeholders in their language and in their terms. It makes it easy for them to understand and support the proposition. Otherwise, the communication is difficult, can cause a lot of friction, or worst, flares of temper. This is what I call the "chicken and duck talk syndrome".

Step 5: Engaging and bringing people along the energy saving journey

As engineers, apart from the long sentences, in third party and passive forms, we seem to think that communicating once is sufficient. Various studies have shown that successful companies communicate the same messages at least 10 times more than others and use a range of mediums to do so.

While communication is key to get people on board, that itself is not the end. We also need them to be engaged, motivated to use less energy, and to do something about it. According to the former CEO of Nucor Steel[1] , 70% of a company's success is due to its people actively wanting and driving the change. There is a need to ensure that everyone has a key role to play in delivering energy savings opportunities. This includes:

1. Articulating a broad vision for energy savings, why it is important to the company, how everyone can contribute, and how the company will achieve that vision.

1. Heskett, J.L., Manage the culture cycle, The World Financial Review, Sept – Oct 2011.

2. Defining and embedding energy efficient behaviours and procedures into day-to-day operations.

3. Ensuring everyone is sufficiently competent in carrying out the energy efficient behaviours and procedures.

4. Managing a planned and appropriately resourced energy savings programme, including the delivery of energy savings technologies.

5. Making sure everyone has a role and many chances to implement these behaviours.

6. Giving coaching sessions and touch points for everyone to ask questions, seek clarifications and improvements in their involvements.

7. Providing energy performance information on how key areas are doing as a feedback. Seeking commitments and suggestions for further improvements in the various key areas.

8. Establishing high-level policy to cement senior management commitments in making energy savings.

The above steps help to create and embed energy efficient behaviours and practices into the culture of the organisation. A strong culture that desires energy savings will find ways to disarm organisational barriers to energy savings and have a better chance of succeeding.

Step 6: Celebrate successes and continually improve

Finally, as part of people engagement continuum, in particular sustaining and encouraging future successes, there is a need to celebrate all success and progress, no matter how small it is. Everyone, regardless of what he or she says, likes to be acknowledged, appreciated and receive a "pat on the back" for job well done.

In a study by Teresa Amabile[2], by tracking personal journals over many years, she found that when progress and successes are acknowledged and celebrated, it lifts the psychology and attitude of people, and that in turn speeds up the next progress or success. In journal entries where acknowledgement and celebrations are not practiced, it saps the mental attitude and energy, and they report of demotivation and disengagement. Celebrating successes and progress may be more challenging in some cultures with an attitude of "I paid you" or "it's your job". None the less, celebrating is highly motivating and can bring about further success. In Teresa's research, many of the celebrations did not even incur cost, many were just a heart-felt appreciation or a small gesture.

Steps 1 to 5 line up a list of technical and non-technical energy savings opportunities, and a culture that supports energy efficient practices. There is one thing that could crumble the house of cards though and that is a failure to establish and maintain a good psychological contract with everyone in the company. A psychological contract is an unsaid and mutual contract of what the employer and employee expect of each other – the pre-cursor to creating a psychologically safe and supportive working environment.

Many things can build a psychological contract: being authentic, being accountable, being honest and truthful, your word counts, being compassionate, taking an interest in employee issues, etc. They take a long time to build and can be broken with simple and careless actions. Every organisation needs to pay attention to the deal breakers and make sure psychological contracts are not broken.

UNIDO's record of accomplishment of this holistic energy management framework shows organisations can achieve between 10% - 20% in the first year of energy reduction. It also shows intensity of energy reduction is 100% to 200% faster than in usual business scenarios.

Key 2: Addressing organisations with "burnt-out" issues

The six steps above will not be suitable for an organisation that is "burnt-out". There are many reasons why an organisation is "burnt-out", these may be organisations on the verge of bankruptcy or on the way to becoming one. These organisations focus on carrying out tasks that are on a "moment-to-moment" basis, trying to stay afloat or to survive. Any strategic and/or tactical planning is of a very short-term nature, normally reacting to an impending or emerging crisis.

Organisations in this category are constantly chasing from target to target: this month's production to the next, this quarter's financial targets to the next, this year's compliance audits to the next, etc.

Organisations falling into this category may also be "burnt-out" from the perspective of employees, i.e. employees performing too many tasks to the extent that they are no longer capable of taking on additional tasks and executing them well. Many things can lead to resource constraints and could range

2. Amabile, T and Kramer, S. 2011. The Progress Principle: Using Small Wins to Ignite Joy, Engagement, and Creativity at Work. Harvard Business Review Press

from having an overly ambitious strategy, constantly changing operation plans, unrealistic resource planning, setting goals that are unachievable, being over lean / under-staffed to carry out all essential tasks and/or poor competency leading to an inability to supply its product or services on time and in full.

Based on a normal statistical distribution, the number of companies falling into this category could be measured in double-digit percentages – several folds larger than what most people think! Yet, these organisations have not been recognised by any technical and behavioural change communities.

For these companies, energy-saving technologies, government mandates and behavioural change techniques are noise and an irritant. This has nothing to do with the rationality of "energy-saving" messages and the ability to improve profitability of the company. It has everything to do with the organisation needing to address activities in order to survive; everything else is a luxury or a cost.

These "burnt-out" organisations need support to "get out of the rot". It includes, among other things, supporting them to set good strategies, planning achievable goals, allocating appropriate resources and ensuring staff competency in key areas.
Only after the organisation is out of the critical areas are they in a position to look at longer-term issues, such as energy savings. For those people helping companies resolve burnt-out issues, there is a need to ensure all revised or new business processes are inherently energy efficient – to avoid having a need to undo them later.

Key 3: Addressing organisations planning to build new plants

For organisations wanting to invest in new plants and facilities or doing major and/or deep modifications, the challenge is, yet again, completely different from the organisations covered thus far. For these organisations, it is about chasing after energy efficiency. Here is where the normal engineering principles and Best Available Techniques (BAT) apply.

Design: The design of the new plant and machinery needs to be correct and use the lowest possible energy consumption. For example, dairy plants need 80°C hot water, yet most dairy plants install 10 barg steam boilers of which nearly 50% of the energy is lost. Having the knowledge of BAT and energy performance of similar facilities is important for designing and predicting its future energy performance. Such benchmarks exist and should be enforced by all organisations at the design stage.

Together with BAT information, carrying out energy efficiency design reviews, also known as design qualification, helps companies to use as little energy as possible. All this needs to be done before approving the design for construction. This is because energy consumption and energy cost of the new plant is over the lifetime of the plant. Very frequently, retrofitting the facility at a later date is virtually more cost prohibitive and/or impossible. Therefore, assessing the merits of energy efficiency improvement should be over its planned lifetime.

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After finalising and sanctioning the new investment, most organisations move their focus and attention away to other issues and then come back for the handover. However, there are other aspects that can go wrong and have an impact on energy consumption. Some of these aspects are:

Procurement: Having a good and energy efficient design is just the start; the next step is to procure the most energy efficient equipment that supports the design. Two things could, and frequently do, go wrong at this stage. The first reason is that the design requires equipment with a specific feature to be available but this has not been purchased. For example, the design may require a chiller with a minimum turn down of 10-to-1 but the one purchased has a turndown of 4-to-1, thus consumes more energy. The second reason is that purchasing decisions often replace the specified equipment with a lower cost variant without considering its future operating costs. It is important to check that all equipment conforms to its design intent prior to installation. All deviations from the specifications should be challenged and replaced to its original specification.

Installation: The installation may also progress in a manner that contributes to a higher than predicted future energy consumption. For example, overrunning construction cost may result in a purchase of lower and/or off-specification equipment to complete the project. Or overrunning time may lead to skipping the installation of key components that affect future energy consumption. Again, in this instance, it is important that the installation is checked against design prior to testing and commissioning. Deviations from the design should be challenged and reinstated to design.

Testing and commissioning: Once the design, procurement and installation is correct, the next stage in a new build and/or retrofit is the testing and commissioning stage. As with the procurement and installation stages, similar issues can arise during the testing and commissioning stage. As testing and commissioning are normally the last phases of work before handover, it is mostly commonly done in haste. This can be resolved by having a commissioning plan and checklist pre-prepared before construction starts (usually before procurement starts) and checking that all commissioning activities are complete and performed as expected by the design.

Handover: The period between a successful commissioning and handover is not a clear-cut stage.

Many contracts allow for a period of overlap between construction and commissioning to fix unforeseen issues, and operations and maintenance teams proofing the new equipment and training its employees on the new ways of working. Some call this an operational qualification, others call it a soft landing. Frequently, commercial pressures to operate the new equipment mean that there is a long list of items to be fixed but never enough time to do so. All issues have to be fixed and the actual energy performance compared to its designed energy performance. The root cause to any deviations from its designed energy performance needs to be identified, challenged and reinstated.

Operational and maintenance: Once the handover is done, the task to operate and maintain the new equipment lies with the organisation. Care should be taken to identify and embed the operating and maintenance requirements. If organisations do not operate and/ or maintain the new equipment in accordance with its procedures and as designed, its energy performance will also suffer.

Conclusion

Three types of organisations exist that can re-industrialise the UK. They have differing needs and all play a role to ensure an abundant, reliable and sustainable energy supply.

Organisations that are "burnt-out" require support to improve their operating positions before improving energy performance. Organisations with cognitive bias towards energy need a nudging support to bring attention and focus to the subject. Organisations who are building new installations require guidance to raise their engineering practices.

As can be seen, there is no single approach that fits the needs of these organisations. Addressing the energy trilemma challenge whilst re-industrialising the nation requires different strategies and approaches which address the needs of the three distinct types of organisations. A strong energy management practice needs to feature prominently and fit into the operating culture of organisations.

Raising the bar on energy management can take the form of a large scale and well-rounded energy management awareness, training, and guidance plan. Well-rounded energy management training does not have to be a gold-plated specialist training but requires a delicate balancing act between technical and managerial skills. It also needs to be appropriate to their job role and impact on their decisions on energy performance.

Author's Profile

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