The world faces an unprecedented challenge: much of its infrastructure is reaching the end of its life. The combined effects of the move to decarbonisation and ageing investment mean that trillions of dollars of infrastructure decommissioning will need to take place. This Major Projects Association event sought to clarify the extent of the task ahead and to unpick some key lessons.

Decommissioning of infrastructure refers to the suite of processes involved in withdrawing a facility from service at the end of its life, deconstructing and dismantling it, and removing the components for reuse, recycling or disposal. Until very recently, decommissioning has been widely overlooked: focus has historically been on high-status new-build projects.

However, a plethora of technical, economic, social and environmental challenges of large magnitude and deep urgency have emerged as the decommissioning of infrastructure begins in earnest.

The scale of the global decommissioning task is gargantuan and defies accurate estimation. Not only is it impossible to know how much infrastructure is being decommissioned, but it is also impossible to know whether the decision taken to decommission in the first place was the correct one.

In addition, decommissioning costs can spiral out of control. (The UK has seen estimates of its cost of nuclear decommissioning costs rise from £40bn in 2005 to over £110bn in 2015).

**THE GLOBAL CHALLENGES**

The global size of the task in decommissioning infrastructure is huge and represents an unprecedented challenge to the energy sector alone. Decommissioning happens at the end of a project life cycle, but it should be considered as a project in its own right.

Decommissioning energy infrastructure faces several challenges, the most important of which is that legacy energy infrastructure was never designed for decommissioning. Decommissioning this infrastructure comes with huge image problems often related to the need to dispose of highly controversial waste substances.

Furthermore, decommissioning projects requires the development of new technologies, and legislation and governance have huge implications for cost drivers.

Added to these challenges are other complications:
- The decommissioning of megaprojects is – at least partially – commissioned by governments.
- Decommissioning megaprojects involves a large number of stakeholders.
- Decommissioning megaprojects presents little or no cash in-flow at the end, and no revenue-generating assets are created.
- Old facilities were built in great haste with no decommissioning plan and often with poor record-keeping.
- Working conditions are often highly constrained – creating a series of ‘first of a kind’ projects.

The result is a long, complex and costly decommissioning programme.

The benchmarking highlighted four key elements which were strongly linked to successful decommissioning. These were: the governance structure, the size of the nuclear facility, the availability of space on-site, and the presence of the Intermediate Level Waste storage/repository available on-site or in the country. All four project characteristics were correlated with lower project cost performance.

When to decommission?

In order to understand the best time to decommission structures it is helpful to gather data on the stresses of the structure in question. We do not know when to start to decommission certain infrastructure because we do not know its loading or its condition. Data-centric structural engineering provides a way forward to overcome these barriers.
Ideally, structures will be decommissioned before an accident happens. However, if you wait too long to decommission infrastructure it self-destructs. A relevant and very recent example is the Morandi Bridge in Genoa, Italy. It was an ageing bridge that collapsed on 14 August 2018, killing 43 people.

ARE WE JUST GUESSING?

Currently, organisations are guessing when to decommission, or even worse, they are waiting for something bad to happen. Even in the nuclear sector, some element of guesswork is involved (albeit mitigated by a large programme of experimentation). A key challenge to understanding when to decommission infrastructure is that the condition of the infrastructure is unknown. The owner alone does not make the decision when to decommission: many stakeholders are involved. The regulator is obviously a key stakeholder in this decision-making process.

Infrastructure decommissioning fundamentally starts because its use is no longer ‘economically justifiable’. Political reasons also influence the start of an infrastructure-decommissioning project – for example, the nuclear reactor shutdown in Denmark and Sweden due to safety concerns at the political level.

In the nuclear sector decommissioning is required for several reasons (e.g. moral question, terrorist attack, radioactive contamination etc.). The nuclear sector is characterised by a certain level of risk that reaches the maximum point when the decommissioning project starts (e.g. treatment of radioactive waste), and then decreases. The key challenge is getting agreement from internal and external stakeholders on the right time to start the decommissioning project and, therefore, overcoming the highest point of risk. Figure 1 summarises this concept.

![Figure 1](image)

**HOW DO WE DELIVER VALUE?**

Decommissioning has severe problems in demonstrating value to stakeholders. However, it is clear that there is value in an infrastructure decommissioning project, although it may not seem so. Value can be derived from ensuring a better environment for future generations. And value is produced through decreasing the risk of failure and related consequences. The cost in monetary terms of avoiding on-going maintenance costs could be a key driver to demonstrating the value of decommissioning. Finally, if the project is conducted effectively, value is derived from the land released by infrastructure decommissioning. The value of decommissioning needs to be reflected in NPV (net present value) investment decisions in new infrastructure.

**Click here to view a key paper focusing on value in nuclear decommissioning projects.**

**HOW CAN WE BUILD FOR A BETTER FUTURE?**

- Structural monitoring is essential to improve decisions on when to decommission.
- Communication is very important in order to use the data in the best way and to improve decommissioning project performance.
- Sharing lessons across infrastructure decommissioning projects is essential to ensure that the current generation of infrastructure will be easier to decommission.
- The transition from traditional stick-built infrastructure to modular infrastructure could facilitate and improve the performance of infrastructure decommissioning projects.
- ‘Design for decommissioning’ could also ensure an easier decommissioning.
- Creating a decommissioning platform to share lessons and improve collaboration could enhance infrastructure decommissioning project performance.

**POINTS FOR FURTHER DISCUSSION**

- When would you recommend decommissioning of your current project? Why?
- Should we create project ‘best before’ dates? How would they be determined?
- Other than avoiding accidents, what is the main value of decommissioning projects?

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With grateful thanks to Benito Mignacca, University of Leeds, for his help in producing this report.