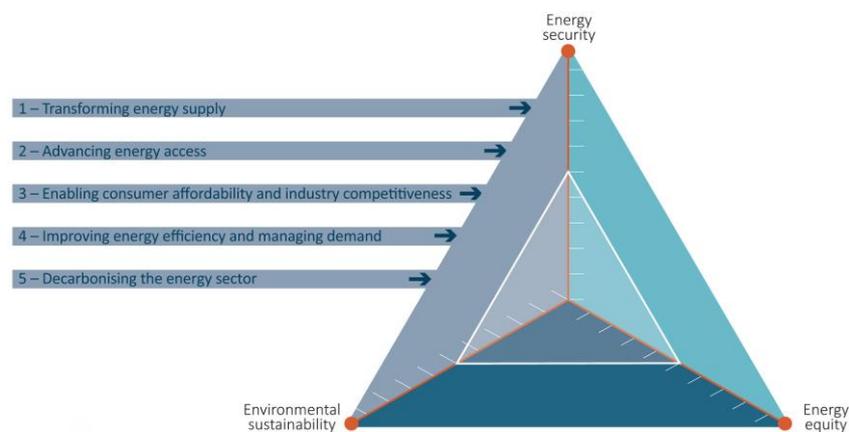




# UNDERSTANDING THE ROLE OF COAL IN THE ENERGY TRILEMMA

The energy trilemma comprises the three main aspects of energy production: security of energy supply; environmental sustainability; and energy affordability. Balancing this trilemma is a challenge, and each country has its own priorities.



**The energy trilemma and relevant policy issues (WEC, 2017)**

## THE TRILEMMA CHALLENGE

The energy trilemma diagram (above) is a means to evaluate and represent the current status of a country with respect to the balance of energy sustainability, affordability and security. Aspects of the trilemma change over time for each country with changes in fuel mix, environmental and energy policies, and economic development. Some countries are beginning to prioritise decarbonisation, while others continue to focus on providing access to electricity to populations not yet on the grid.

### Energy security

Energy security is the dominant corner of the energy trilemma. Governments must ensure that there is enough electricity to meet the demands of existing and future populations – and they will do so even if it is costly and has environmental consequences. Flexibility is key to security. Secure energy systems have a variety of power sources as well as the ability to switch between them at short notice. Currently, fossil fuels, especially gas and coal, offer the most in terms of affordable, flexible power. Those countries with modern grid infrastructure and numerous energy choices available, including power provided via interconnectors from neighbouring countries, already have energy security and flexibility and therefore can be more selective about the environmental sustainability of their energy mix. For those for whom electricity availability for all is still a goal, there is no flexibility and so energy security is more obviously dominant. Even advanced regions with surplus energy capacity will encounter crisis situations due to severe weather or unexpected plant outages. These events can be incredibly expensive for industries and households and so governments try to avoid them at all costs. Thus, in developed economies as well, energy security comes first.

## Energy affordability

The cost of electricity includes the cost of obtaining fuel and turning it into power as well as the cost of delivering the power via the grid. It is difficult to accurately compare costs from different energy sources as there are many variables to be considered. However, in many places coal combustion, even advanced coal combustion with carbon capture, utilisation and storage (CCUS), can be considered competitive in terms of price whilst offering the security of high capacity values and dispatchability. Variable renewable energy (VRE), especially wind power, may often appear to be the best option in terms of costs of power production, but there can be significant additional cost involved with expanding and upgrading networks to bring new wind turbines onto the grid. Further, the addition of VRE to the energy mix increases overall generation costs in many regions since excess capacity is required as backup to compensate for the intermittency of the renewables. Decarbonisation may entail the replacement of many baseload systems and the subsequent reduction in baseload will require significant changes to grid systems to ensure that demand can always be met. These system changes are expensive and the final decision on how the energy transition will be facilitated and financed will always have energy security at its core.

## Environmental sustainability

Coal has the capacity to help with the attainment of several targets of the United Nations Sustainable Development Goals. Affordable coal power can lift communities from poverty, help with the provision of clean water and sanitation, provide employment, and promote economic growth. It can also enable industrial development and innovation, leading to more sustainable cities and communities.

The decarbonisation of the energy sector under the Paris Agreement does not necessarily mean a complete move away from coal. High efficiency, low emissions (HELE) coal power plants emit much less CO<sub>2</sub> than subcritical power plants. New HELE technologies are being developed, such as gasification fuel cells, chemical looping, oxycombustion systems and supercritical CO<sub>2</sub> cycles, which can facilitate the transition from low emission technologies to almost zero emission systems. Combined with CCUS, clean coal HELE systems have the potential to find a place in a carbon-constrained world and to act as a secure bridge, providing vital baseload to growing economies whilst potentially evolving with CCUS into near-zero emission technologies within the timeframe of the Paris Agreement.

## Take home messages

Ideally the trilemma should be perfectly balanced, providing clean, affordable and reliable energy to all but the reality is more of a challenge and local issues such as fuel availability, politics, and economic priorities have to be taken into account.

Coal remains in the energy mix in many regions for a few simple reasons:

- it is affordable;
- it can be operated with low emissions;
- it is readily available; and
- it provides the access to electricity which is vital for poverty alleviation and economic growth.

The following strategies can be applied to minimise the environmental impact of continued coal use:

- use the cleanest and most efficient coal technologies available (HELE plants);
- ensure new plants are carbon capture ready; and
- consider HELE coal technologies as a bridge towards decarbonisation, with zero-emission coal technologies considered within the future potential diverse energy mix.

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Each executive summary is based on a detailed study which is available separately from [www.iea-coal.org](http://www.iea-coal.org). This is a summary of the report: Understanding the role of coal in the energy trilemma by Dr Lesley Sloss, CCC/301, ISBN 978-92-9029-249-9, 95 pp, February 2020.