

Invited Writer

**ENERGY POLICY FOR A SUSTAINABLE AND SECURE
STATIONARY ENERGY SECTOR**

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Human societies now face interlinked challenges in meeting their stationary energy requirements:

- Tightening flow constraints for crude oil and later natural gas[1] with associated upward pressure on prices of fossil fuels and the many goods and services that depend on them.
- Worsening environmental impacts, at the global level due to climate change emissions from the use of fossil fuels, as well as a wide variety of local and regional impacts [2]
- Water quantity and quality concerns due to environmental and human pressures [2,3]

These challenges together threaten the economic, social and environmental sustainability of the stationary energy sector. They imply a need to rapidly reduce our dependence on fossil fuels and, in particular, to reduce the use of coal for electricity generation. Inland steam-cycle power stations also face the possibility of cooling water constraints.

Unfortunately, coal is an important and cheap primary energy resource for electricity generation in many countries, for example Indonesia and Australia have massive coal reserves. Moreover, electricity supply has become an essential service in modern human societies. Therefore, carefully crafted policies are required to deliver improved environmental outcomes at the lowest possible cost and with low social and security of supply impacts.

The stationary energy sector can be described as a particular manifestation of technology and in turn, technology may be defined as the application of scientific knowledge for practical purposes. A broader definition of technology is “the art of knowing and doing”, which can be subdivided into “hardware, software and orgware”, where hardware is an appropriate set of manufactured objects that is capable of producing a desired purpose, software is the knowledge required to design, manufacture and use the hardware to produce the desired purpose, and orgware is the societal or institutional context in which the hardware and software are developed, implemented and used [4]. This broader definition of technology is appropriate for the stationary energy sector because it involves so many items of equipment and so many actors – governments, companies operating on the supply side

of electricity and gas industries and very large numbers of end-users on the demand side of electricity and gas industries.

Apart from nuclear fission or fusion, energy cannot be either created or destroyed, and thus the stationary energy sector can be regarded as implementing one or more energy conversion chains that commence with primary energy forms of various types and finish with end-use energy forms of other types, in the process delivering desired end-use services. The task of achieving a secure and sustainable energy sector should consider both the contribution and the unintended consequences of each conversion process in each energy conversion chain to delivering the desired end-use services. This paper will focus primarily on the electrical energy conversion chain implemented by an electricity industry.

An electricity industry performs a number of functions that, if closely coordinated as though the industry was a single machine, together implement an energy conversion chain that can deliver desired end-use services:

- Generation services provided by power stations: conversion of primary energy forms to electrical energy
- Network services provided by transmission and distribution networks: Connectivity between generation and end-use equipment
- End-use energy services provided by end-use equipment: Delivering end-use energy services by the conversion of electrical energy to end-use energy forms.

Electricity industries are complex and require sophisticated hardware, software and orgware to meet sustainability and security expectations. Key low-emission alternatives to the use of coal for electricity generation, such as improved end-use efficiency and frugality on the demand side of the electricity industry and low emission generation, may require changes to industry hardware, software and/or orgware before they can reach their full potential or even function effectively at all. For example, this applies to renewable energy forms such as solar or wind energy that are non-storable and may be connected to the electricity supply system via electronic interfaces.

Policies that reduce climate change emissions may also improve security of supply by reducing dependence on imported fossil fuels. However, this will only be the case if the electricity industry hardware, software and orgware can accommodate the characteristics of low-emission hardware.

This paper will review the policies that are used globally to promote improved sustainability and security of the stationary energy sector, the challenges that have arisen in practice and how they are being met, including practical cost implications. Examples will focus on the Australian experience [5].

REFERENCES

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