



Chapter 2

Towards sustainability goals

“A little less conversation, a little more action”

Erna Solberg, Prime Minister of Norway.

“Can we afford Civilisation?”

Mark Twain 1835–1910.

The true impact of renewable energy is greater than the sum of the energy services it can provide. Renewable energy can solve many of the negative environmental, health, social and political impacts associated with conventional forms of energy. The United Nations has presented 17 Sustainable Development Goals (SDG) to transform our world. Two of these (SDG6 and SDG7) are directly related to our topic: clean water and sanitation for all, and affordable clean energy for all. The water and energy goals influence virtually all the Sustainable Development Goals that the global community has defined. Access to clean water and clean energy is closely coupled to the development of human health and well-being, environmental health and security.

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20 Clean Water Using Solar and Wind: Outside the Power Grid

2.1 THE UN SUSTAINABLE DEVELOPMENT GOALS

The 17 UN Sustainable Development Goals (SDG) were adopted by the international community in 2015 as part of the 2030 agenda for sustainable development (UN WWDR, 2014). It should be recognised that there are a lot of interlinkages between the various SDGs. Therefore, it is important to adopt an integrated approach towards their implementation.

Sufficient energy and water will be needed to meet nearly all the development goals. SDG6 – clean water and sanitation – depends a lot on the availability of renewable energy, recognising that much of conventional energy generation today depends on the availability of water. SDG7 – access to affordable and reliable, sustainable and modern energy for all – depends strongly on the development of modern renewables like solar PV and wind. The strong links between SDG6 and SDG7 are increasingly recognised (Olsson, 2015; IRENA, 2017a). The energy-water-food nexus is a growing concern for decision makers globally (WEC, 2016). Pumping and water treatment by biological processes or desalination will increase the supply of clean water. Conventional electric power technologies, such as thermal power plants, consume large volumes of water for cooling, while solar PV and wind generation have negligible water consumption.

As already noted, solar PV and wind power consume up to 200 times less water than thermal power plants. Furthermore, renewable energy can provide clean water using pumping energy and various treatments including desalination. It should be recognised that the role of renewable energy and water solutions will directly and indirectly contribute to all the other 15 SDGs. This is further elaborated in Table 2.1.

<p>Making renewable energy and water solutions available will directly and indirectly contribute to all the other 15 UN Sustainable Development Goals.</p>
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Water supply using renewable energy is a key technology to meet the UN SDGs. A workshop was conducted in 2016 at the Massachusetts

Table 2.1 Important links between the UN Sustainable Development Goals SDG6 (clean water and sanitation) and SDG7 (affordable and clean energy) and the other 15 SDGs (partly adopted from IRENA, 2017a).

SDG	Links
1 – No poverty	To eliminate poverty requires both basic energy and clean water. Both can stimulate economic activity. Decentralised energy can save expenditure on fossil fuels, which has a huge impact on the daily life of poor people in many parts of the world. Clean water will naturally influence health conditions, which in turn will affect general living conditions.
2 – Zero hunger	Renewable energy has been used for pumping. Irrigation that is not wasteful will improve food production and reduce vulnerability to droughts. Renewable energy can also provide the necessary energy for food preservation and refrigeration, thus reducing food waste.
3 – Good health and well-being	Clean energy for cooking can reduce risks for respiratory diseases caused by indoor air pollution. Decentralised electric energy can support the operation of health clinics and hospitals in remote areas. Renewables for power – replacing fossil fuels and the transportation of them – will reduce health problems related to outdoor pollution.
4 – Quality education	Today many children cannot study after school because their home lacks electricity. Renewable energy for lighting will allow studies and reading after dark, which is a significant change of life conditions in areas formerly without electric power. Renewable power will also make time available that was used previously for fuel collection.
5 – Gender equality	Usually women and children have the burden of fuel and water collection. The use of traditional biomass for cooking has significant health effects on primarily women and children. Electric lights can increase safety and allow girls and women to attend meetings after dark.
8 – Decent work and economic growth	An increasing share of renewables will give new job opportunities. Better water provision for agriculture will support jobs in food production. Electric energy supply can give several new job opportunities at the village level.

(Continued)

22 Clean Water Using Solar and Wind: Outside the Power Grid

Table 2.1 Important links between the UN Sustainable Development Goals SDG6 (clean water and sanitation) and SDG7 (affordable and clean energy) and the other 15 SDGs (partly adopted from IRENA, 2017a) (*Continued*).

SDG	Links
9 – Industry, innovation and infra-structure	Available local energy from renewables can create new business opportunities, both directly and indirectly.
10 – Reduced inequalities	Available local energy can reduce the costs of buying external energy via fossil fuels. The installation and maintenance of renewable energy sources will create new jobs. Easier access to water will reduce inequalities between consumers previously connected to piped water and those consumers forced to buy water from vendors.
11 – Sustainable cities and communities	Cities and particularly peri-urban areas can reduce the carbon footprint of energy supply. A decentralised water supply and treatment can increase not only availability of affordable water but also resilience.
12 – Responsible consumption and production	Renewable energy has the potential to make global energy supply cleaner and safer. Decentralised water systems can increase availability of clean water in remote and rural areas. All these systems could be produced, installed and operated in an environmentally and socially sustainable way.
13 – Climate action	Increasing energy efficiency in combination with a massive upscaling of renewable energy can make it realistic to limit global warming to 2°C. Climate change will cause water scarcity in many regions. Renewable energy generation will require less water than conventional systems. Solar pumping and water treatment can provide water and help to adapt to changing conditions.
14 – Life below water	Production and transportation of fossil fuels has had a catastrophic impact on groundwater sources, rivers and oceans. The impact on marine life has been significant, changing the marine ecology and causing great suffering for all those who depend on seafood. Furthermore, CO ₂ emissions from fossil fuel burning have caused both warming and acidification of the oceans. Renewable technologies that will replace or reduce the consumption of fossil fuels can reduce the spills of coal, oil or gas extraction, refining and transportation via pipelines or tanker traffic.

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SDG	Links
15 – Life on land	Conventional energy systems have a significant and negative impact on the environment. This can be avoided using well-designed renewable energy. It can replace fuel wood and charcoal in off-grid locations, thus avoiding too much forest degradation. With water more readily available both agriculture and wildlife can be supported much more.
16 – Peace, justice and strong institutions	Renewable energy not only can provide access to clean energy to those lacking energy but also make clean water available. This will decrease social and economic inequalities both within societies and between regions and countries. Unlike hydrocarbon fuels, electricity is not easily tradable between different world regions. It is therefore very important to assess renewable energy resource availability on a regional basis. Furthermore, it gives the final user much more control of the power generation.
17 – Partnerships for the goals	Both renewable energy and clean water will contribute to the broader goals of sustainable development. To succeed it will require local, inter-regional and global cooperation and partnerships.

Institute of Technology (MIT) in association with the Global Clean Water Desalination Alliance (Lienhard *et al.*, 2016). On top of presenting the current status of large- and small-scale desalination the participants were asked to value the most interesting options for desalination. Two metrics were used: (1) technology readiness level (TRL) and (2) impact. This is a methodology introduced by NASA in the 1970s. The TRL levels define up to ten levels of technology maturity, ranging from idea through basic and applied research to pilot and full commercial-scale implementation. The impact is graded at five levels. The 17 participants viewed the highest TRL and impact on two technologies with almost the same evaluation: reverse osmosis (RO) powered by either wind (mostly for large-scale) and solar PV. The workshop also concluded that “integration of desalination and renewable energy at a small scale can provide clean water in areas of

24 Clean Water Using Solar and Wind: Outside the Power Grid

transient or sustained water scarcity with limited or non-existent grids”. Desalination is reviewed in Chapter 5 and solar PV and wind are further described in Chapters 8–10.

A word of caution may be expressed here. There is no mechanism to force governments or organisations to implement the SDGs. A key condition is how financing is going to be realised. Here it is crucial how international organisations like the World Bank, the International Monetary Fund and various development funds act. This is well described by the term Washington Consensus, first used in 1989 by English economist John Williamson (https://en.wikipedia.org/wiki/Washington_Consensus).

2.2 PUBLIC HEALTH, GENDER ISSUES AND EDUCATION

Renewable energy can provide the basic energy needs in homes. The World Health Organization (WHO) estimates that more than four million people die prematurely each year because of indoor air pollution, caused by cooking with traditional biomass and inefficient stoves. In addition, the use of kerosene lamps for lighting further contributes to health hazards and accident risks, such as burns.

Every year more than four million people die prematurely because of indoor air pollution.

The positive health effects of using renewable energy should be recognised. Satisfying energy needs has also a gender perspective as the health hazards in traditional households mostly affect women. Furthermore, if available, electric power can bring water close to the home and will also improve quality of life for women and girls, who are mostly responsible for bringing home water. Modern renewable energy can also reduce or eliminate the time required to gather firewood. This reduces unsustainable biomass harvesting but it also gives time for, primarily, women and girls to pursue education or generate some income for the family. With renewables available, electric lighting can be provided at home and in schools, so education is profoundly influenced.

About 1,000 million people in the world depend on health facilities without any reliable electric power and readily available clean water. Many more people rely on facilities with unreliable access to both energy and clean water. Off-grid renewable energy can deliver affordable and clean energy to remote healthcare centres.

Access to electricity and clean water has a profound influence on education. There are strong links between education, energy, clean water and economic development. Jones *et al.* (2018) point out:

- In sub-Saharan Africa 90% of children attending primary schools have no access to electricity;
- Half of schools in Peru and a quarter of village classrooms in India have no electric power;
- One child in three – an estimated 188 million children – attend schools that have no lights, no running water, no refrigerators, no fans and no computers or printers.

As the authors point out, the dominating question is whether these children will be equipped with sufficient skill to help their country to grow economically. Electricity provides improved access to water. Results from Kenya clearly demonstrate the consequences: access to water means better sanitation. This in turn dramatically decreased absenteeism of both pupils and teachers due to waterborne diseases such as skin infections, typhoid and cholera (Jones *et al.*, 2018).

Jones *et al.* (2018) also note that 40–60% of the world's unfarmed arable land is in sub-Saharan Africa. A key issue is to train farmers in the use of more effective irrigation and cultivation.

Oil exploration, refining and distribution have a significant water footprint under normal operating conditions, in terms of both quantity and quality (Olsson, 2015, Chapter 11). This is further exacerbated as a result of the unprecedented impact on water resources from leakages, dredging, refining or accidents in exploration or transport. Therefore, the consequences for water resources from oil operations or oil accidents will be increasingly grave (Zabbey & Olsson, 2017). Population growth, increasing water use for agriculture and industrial activities and climate change all increase water scarcity. This will have huge social and economic consequences for large populations. Researchers have examined data collected by NASA's Gravity Recovery and Climate Experiment (GRACE) satellite mission during the period 2002 to 2016

26 Clean Water Using Solar and Wind: Outside the Power Grid

to track freshwater trends worldwide. In the report, published in May 2018 (https://climate.nasa.gov/climate_resources/167/), the researchers claim that data shows access to fresh water will be the biggest challenge to humanity in the twenty-first century. The GRACE data made it possible for the researchers to track changes in freshwater resources around the world even in areas where local data has been scarce or unavailable.

2.3 FURTHER READING

The UN Sustainable Development Goals, presented by UNDP, are published in detail on the web page http://www.undp.org/content/dam/undp/library/corporate/brochure/SDGs_Booklet_Web_En.pdf.

The World Health Organization (WHO) is an important source of information for topics related to water, health and sanitation. The web page <http://www.who.int/topics/water/en/> is an entry point to fact sheets, statistics, guidelines and other information.

The gender issue is observed by the UN programme Gender and Water (<http://www.un.org/waterforlifedecade/gender.shtml>), where “gender” refers to the different roles, rights and responsibilities of men and women and the relations between them.