



Preface and Guide for the Reader

With this book I hope to raise awareness about the technology revolution that can make both water and energy obtainable for all. Still more than a billion (=10⁹; note that billion in Europe means 10¹²) people lack access to both clean water and clean energy. Today renewable energy is becoming affordable for the underprivileged. Solar and wind energy are abundant in many regions outside the national power grids. Decentralised water treatment technology is available.

The book is aimed at different categories of readers:

- The **water professional** who wishes to learn about renewable energy: you can skip some of the water technology descriptions;
- The **power engineer** looking for applications of renewable off-grid energy: you can omit the basic information about solar PV and wind turbines;
- The **policy-maker**: no need to understand all the technical details. Still you can appreciate the enormous potential of off-grid renewable energy for water operations;
- The **investor**: this is one of the most meaningful investments that you can make;
- The **student**: the future energy source is renewable. This has huge consequences for water supply. You must be familiar with it.

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doi: 10.2166/9781780409443_xxi

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Energy has always fascinated me and may explain why I wanted to study nuclear engineering in the 1960s, a time when peaceful nuclear energy was supposed to save the world. I was engaged in the planning of the first Swedish nuclear reactor. Soon I became involved in automatic control and got a faculty position at the Department of Automatic Control at Lund Institute of Technology (now the Engineering Faculty of Lund University), Sweden in 1967. As a control engineer I was challenged in 1973 to discover whether control could be of any value for wastewater treatment operations. This triggered my interest in water and over the years I have been increasingly involved in water system operational challenges. In the Department of Industrial Automation at Lund University we did research applying control and automation in water, power and electric energy systems.

When I retired in 2006 and had more time for reflection, I started to see more clearly the many connections between water and energy and how closely they depend on each other. The buzzword water-energy nexus had been created. Dr Allan Hoffman, at that time Senior Analyst at the US Department of Energy, Washington D.C., was probably the first to use the term. He had opened my eyes to the water-energy challenges and we met in person for the first time in Washington D.C. in 2008. Since then we have had regular contact, and Allan has given me a lot of constructive feedback, new insights and encouragement.

At the time when the first edition of my book *Water and Energy* was published in 2012 the challenges of the water-energy nexus had been widely recognised. I was quite pessimistic about the development of the climate negotiations, water quantity and quality consequences of fossil fuel exploration and processing, oil accidents and oil spills, and the lack of political will to make any positive changes towards a more sustainable future. However, seeing progress in the climate negotiations invigorated my spirits and provided inspiration for the second edition of the book (Olsson, 2015). The commitments by both the US and China to sign the Paris Agreement were a truly positive sign.

In the last chapter of Olsson (2015) I tried to describe the new hope from renewable energy and the possibility that water and energy can be decoupled for energy production. So, in 2017 I was encouraged by Mark Hammond, IWA Publishing, to widen the scope of the chapter and examine how renewable energy can provide water, not only in areas where electricity is already available but also in

remote regions in developing parts of the world outside existing electric power grids.

Solar photovoltaic (PV) and wind energy have an enormous potential to bring electricity anywhere and to improve quality of life for millions of people. Solar PV has already exceeded all expectations. As a result, international agencies and organisations like the World Bank, IEA (International Energy Agency) and IRENA (The International Renewable Energy Agency) are continuously raising their predictions of future growth. China is leading the world in solar PV and wind turbine installations. The German *Energiewende* has triggered a remarkable development of renewable energy. Solar home systems have already been installed in millions of homes. All this progress has led to huge development in manufacturing skill and quality, which will increase the potential for use in other parts of the world.

There is an encouraging development in the efforts to increase the speed of off-grid electrification. In 2012 the Global Off-Grid Lighting Association (GOGLA, 2017) was established, an independent, not-for-profit industry association (www.gogla.org). GOGLA represents over 100 members as the voice of the off-grid solar energy industry. The organisation was born out of the IFC/World Bank's Lighting Global programme. Lighting Global (www.lightingglobal.org) is the World Bank Group's platform to support sustainable growth of the international off-grid solar market.

In the 1960s the activists chanted "power to the people". They never dreamed of the innovations that could spread light to the darkest corners of Earth. We now witness an energy revolution that has the potential to change quality of life for the world's most disadvantaged and poor. Distributed energy will change the relationship between the producer and consumer and will empower the powerless.

To supply renewable energy outside the existing electric power grids is the key not only to achieving universal access to electric energy, but also to bringing water to the millions of people who have no access to clean water today.

It is my ambition and hope that the book will raise the appreciation of the new possibilities that renewable energy gives in providing clean water for all. It is the combination of pressure from the grassroots movements and concerned citizens in combination with technology

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development, decreasing costs and interest from policy and decision makers that will make this dream a reality.

Gothenburg, Sweden

May 2018

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