Transition to Renewable Energies with Focus on Hydrogen in Germany

Samar Ensenbach¹, André Baeten², Somayeh Baeten²

¹GEOMAR Helmholtz Centre For Ocean Research, Kiel, Germany
²Faculty of Mechanical and Process Engineering, Augsburg University of Applied Sciences, Germany

ABSTRACT

In today’s world, the current growing population of mankind and hence the additional need for further energy resources have caused severe damages to our environment. Therefore, it is necessary for Germany to look for the green and renewable energy resources. With the growing number of villages and towns joining the transition town movement, and governments shifting their energy focus on renewables and investing more in the solar, hydrogen and wind power, this goal can be achieved. This study takes a scientific as well as statistical approach to identifying and discussing various possible renewable energies applied in Germany. Regarding this, the present study, based on a self-compiled parallel dataset, aims at describing the current ambitions of Germany as a pioneering country to reach higher rates of renewable energy resources with an emphasis on hydrogen. Thus, in focusing on local hydrogen production or large-scale central production and transport using pipelines or roads and railways, comprehensive insights into the usage as well as strategies in applying renewable energies in a larger context are offered. The possible rate of hydrogen production in Germany is discussed. Hence, a special attention is given to the geographical and infrastructure aspects with respect to the production and transportation of green hydrogen based on renewable energies.

KEY WORDS:

German energy reforms, renewable energies, hydrogen, transition towns

INTRODUCTION

As of today, most countries currently solely rely on fossil fuels. Currently at the start of the 3rd millennium, the world’s average annual energy consumption per person is about 100 times higher than it was 2000 years ago when there were only perhaps 200 million people in the world versus the current growing population of nearly 8 billion (U.S. Energy Information Administration, 2023, and Cocks, 2009). On the other hand, energy and living standards go hand in hand. How can continuously rising demand for energy be satisfied? Could energy use double in the next 40 years and keep increasing with no end in sight, see Cocks, (2009). Additionally, non-renewable sources of energy are running short and the countries, whose economy is based on such resources with no sustainable plans in sight, will have serious problems in the coming decades when the oil demand will overcome the production rate.

On the other hand, the current growing population of human beings and hence the additional need for further energy resources have caused severe damages to the environment and climate; Up to the point that the scientists warn that if the current strategies go on for a couple of decades, we will face inevitable global warming related issues and climate change crisis. Burning all fossil fuels produces carbon dioxide, and as it increases in the air, so does the air temperature. Therefore, the change in global weather will become greater as energy production from fossil fuels is raised.

Furthermore, the limited amount of fossil fuels will lead to a mismatch between the demand and the production rate, especially as coal will be phased out soon. Hence, the need for other sources of energy which are not only renewable but also environmentally friendly presents itself. Therefore, it is necessary for developing and developed countries to look for the green and renewable energy sources. Meanwhile, many countries have started looking for and using renewable sources of energy which are also safer for the environment, among them Germany which is one of the pioneers with its plans to alternate most of its energy supplies in the coming decades.

OBJECTIVES AND METHODOLOGY

This study aims at analyzing and explaining the German plans for a renewable energy-based future. The current situation of energy resources in Germany will be first looked at, and then available sources of renewable energies in Germany will be presented. A special focus is set on the production and use of hydrogen as energy storage capacity. After that, the plans of the energy reforms in Germany will be discussed and analyzed.

The study mainly emphasizes on the potential and suitable renewable sources of energy practically used in Germany, discusses why they are suitable and compares their potential outcome.

Finally, one case study of a German transition town will be introduced together with the regional network initiative of hydrogen supply and usage.