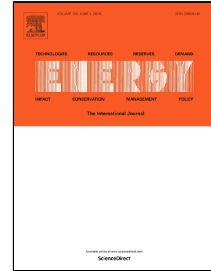


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A smart energy system approach vs a non-integrated renewable energy system approach to designing a future energy system in Zagreb

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Highlights

- EnergyPLAN simulations of the future energy system in the city of Zagreb
- Comparison between two different 100% renewable energy scenarios
- Both scenarios are modelled hourly as isolated systems
- A traditional non-integrated renewable system utilizes unsustainable amount of biomass
- Smart energy system has lower energy consumption and comparable annual costs

Abstract

There are various approaches to developing a 100% renewable energy system and choosing the optimal one depends on a series of factors. This article tackles that problem by comparing two possible ways of developing a 100% renewable energy system, using Zagreb, the capital of Croatia, as a case. The first one is a traditional non-integrated renewable energy system, where each energy sector is developed independently, while the second is based on the smart energy system concept, where different sectors are linked together in order to exploit synergies and increase the efficiency of the system. Scenarios for Zagreb according to these two approaches are developed and modelled in EnergyPLAN. The results show that a smart energy system can reach up to 49% of the total electricity production from intermittent sources on a yearly basis, while a traditional non-integrated system utilizes 50% more biomass than what is assessed to be sustainable. Therefore, a smart energy system is a beneficial option for Zagreb in terms of technical feasibility, while from an economic perspective, the total costs of the two scenarios are essentially at the same level.

Keywords

Energy planning; smart energy systems; cities; RES; sector integration; sustainable biomass

1. Introduction

The energy sector is facing major changes today and energy transition is one of the key points on the political agenda of countries all over the world [1]. One of the major players in the global energy transition will be cities. According to the United Nations, 54% of the world's population lives in cities today and that share is expected to grow continuously, resulting in a projected 66% of the total population to be urban in 2050. In Europe alone, 73% of the population is urban already today and it is expected that over 80% will be urban by 2050 [2]. Furthermore, urban areas account for 65% of the global energy demand and 70% of energy-related CO₂ emissions.

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