Podnebna pot 2050: projekcije cen energije

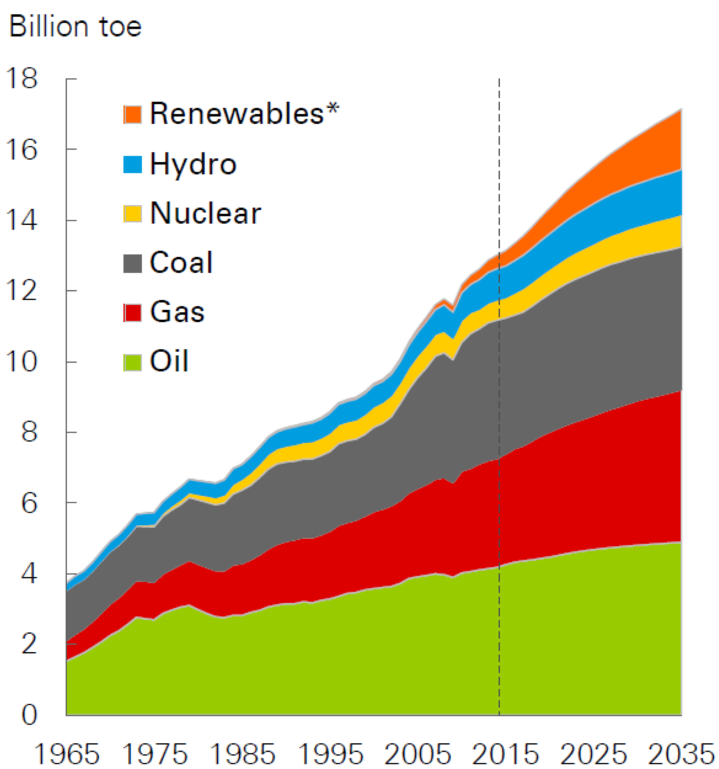
dr. Dejan Paravan

Ljubljana, 24.8.2014

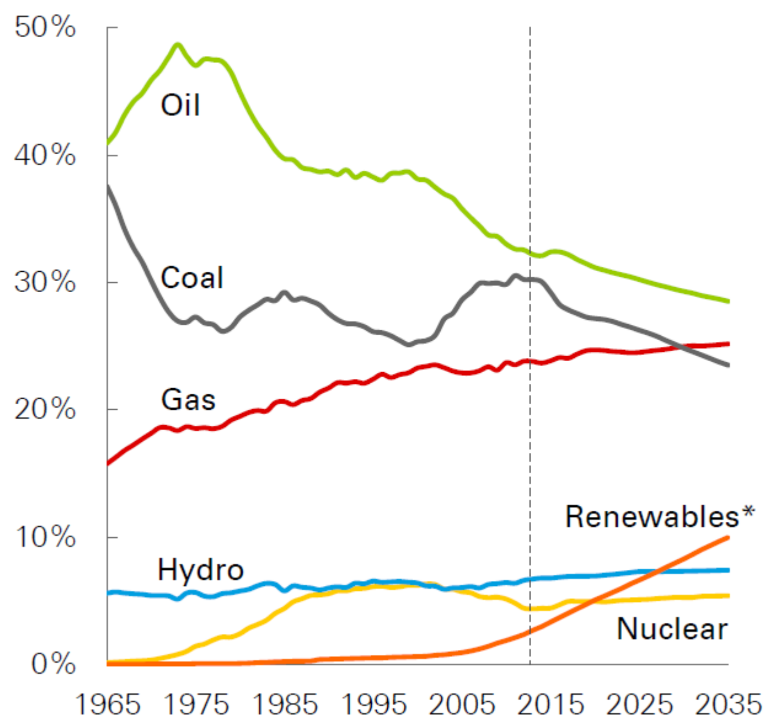
Napovedovanje cen energentov

Kaj pravijo veliki?

Primary energy consumption by fuel



Shares of primary energy



*Renewables includes wind, solar, geothermal, biomass, and biofuels

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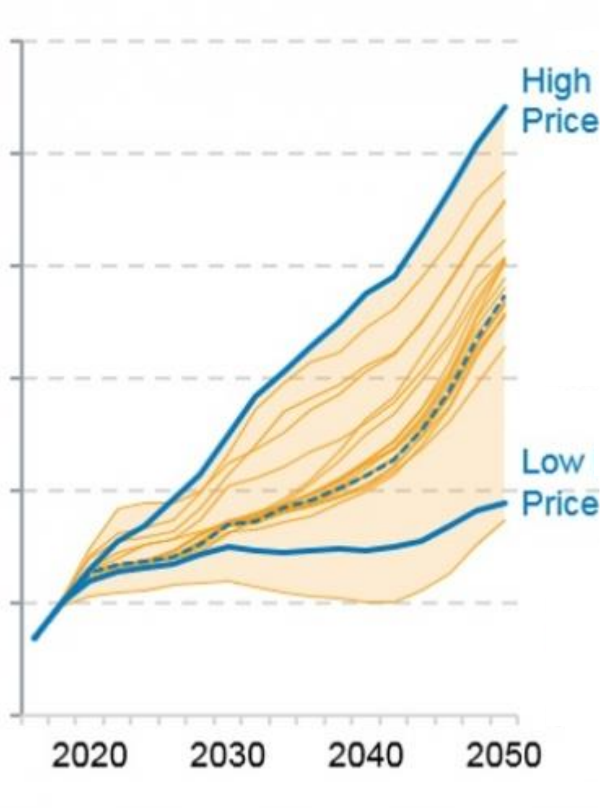
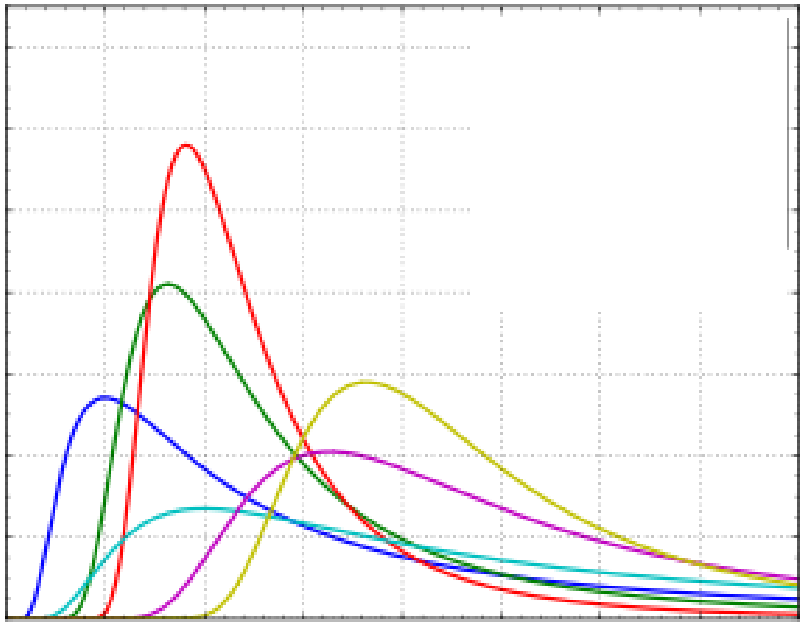
Negotovost => obvladovanje tveganj





Znanstveni dvoboj poletja 2017…

Article

100% Clean and Renewable Wind, Water, and Sunlight All-Sector Energy Roadmaps for 139 Countries of the World

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SUMMARY

We develop roadmaps to transform the all-purpose energy infrastructures (electricity, transportation, heating/cooling, industry, agriculture/forestry/fishing) of 139 countries to ones powered by wind, water, and sunlight (WWS). The roadmaps envision 80% conversion by 2030 and 100% by 2050. WWS not only replaces business-as-usual (BAU) power, but also reduces it ~42.5% because the work: energy ratio of WWS electricity exceeds that of combustion (23.0%), WWS requires no mining, transporting, or processing of fuels (12.6%), and WWS end-use efficiency is assumed to exceed that of BAU (6.9%). Converting may create ~24.3 million more permanent, full-time jobs than jobs lost. It may avoid ~4.6 million/year premature air-pollution deaths today and ~3.5 million/year in 2050; ~$22.8 trillion/year (12.7 ¢/kWh-BAU-all-energy) in 2050 air-pollution costs; and ~$28.5 trillion/year (15.8 ¢/kWh-BAU-all-energy) in 2050 climate costs. Transitioning should also stabilize energy prices because fuel costs are zero, reduce power disruption and increase access to energy by decentralizing power, and avoid 1.5°C global warming.

INTRODUCTION

The seriousness of air-pollution, climate, and energy-security problems worldwide requires a massive, virtually immediate transformation of the world's energy infrastructure to 100% clean, renewable energy producing zero emissions. For example, each year, 4–7 million people die prematurely and hundreds of millions more become ill from air pollution,[1,2] causing a massive amount of pain and suffering that can nearly be eliminated by a zero-emission energy system. Similarly, avoiding 1.5°C warming since preindustrial times requires no less than an 80% conversion of the energy infrastructure to zero-emitting energy by 2030 and 100% by 2050 (Timeline and Section S10.2). Lastly, as fossil-fuel supplies

Context & Scale

For the world to reverse global warming, eliminate millions of annual air-pollution deaths, and provide secure energy, every country must have an energy roadmap based on widely available, reliable, zero-emission energy technologies. This study presents such roadmaps for 139 countries of the world. These roadmaps are far more aggressive than what the Paris agreement calls for, but are still technically and economically feasible. The solution is to electrify all energy sectors (transportation, heating/cooling, industry, agriculture/forestry/fishing) and provide all electricity with 100% wind, water, and solar (WWS) power. If fully implemented by 2050, the roadmaps will enable the world to avoid 1.5°C global warming and millions of annual air-pollution deaths, create 24.3 million net new long-term, full-time jobs,

Evaluation of a proposal for reliable low-cost grid power with 100% wind, water, and solar

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A number of analyses, meta-analyses, and assessments, including those performed by the Intergovernmental Panel on Climate Change, the National Oceanic and Atmospheric Administration, the National Renewable Energy Laboratory, and the International Energy Agency, have concluded that deployment of a diverse portfolio of clean energy technologies makes a transition to a low-carbon-emission energy system both more feasible and less costly than other pathways. In contrast, Jacobson et al. [Jacobson MZ, Delucchi MA, Cameron MA, Frew BA (2015) Proc Natl Acad Sci USA 112(49):15060–15065] argue that it is feasible to provide "low-cost solutions to the grid reliability problem with 100% penetration of WWS [wind, water and solar power] across all energy sectors in the continental United States between 2050 and 2055", with only electricity and hydrogen as energy carriers. In this paper, we evaluate that study and find significant shortcomings in the analysis. In particular, we point out that this work used invalid modeling tools, contained modeling errors, and made implausible and inadequately supported assumptions. Policy makers should treat with caution any visions of a rapid, reliable, and low-cost transition to entire energy systems that relies almost exclusively on wind, solar, and hydroelectric power.

energy systems modeling | climate change | renewable energy | energy costs | grid stability

A number of studies, including a study by one of us, have concluded that an 80% decarbonization of the US electric grid could be achieved at reasonable cost (1, 2). The high level of decarbonization is facilitated by an optimally configured continental high-voltage transmission network. There seems to be some consensus that substantial amounts of greenhouse gas (GHG) emissions could be avoided with widespread deployment of solar and wind electric generation technologies along with

Wind and solar are variable energy sources, and some way must be found to address the issue of how to provide energy if their immediate output cannot continuously meet instantaneous demand. The main options are to (*i*) curtail load (i.e., modify or fail to satisfy demand) at times when energy is not available, (*ii*) deploy very large amounts of energy storage, or (*iii*) provide supplemental energy sources that can be dispatched when needed. It is not yet clear how much it is possible to curtail loads, especially over long durations, without incurring large economic costs. There are no electric storage systems available today that can

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Smer dekarbonizacije