The energy crisis as an opportunity to accelerate the energy transition

Diana Ürge-Vorsatz
Professor, Department of Environmental Sciences and Policy, Central European University (Budapest / Vienna)
Vice Chair, WGIII, IPCC

REUTERS®

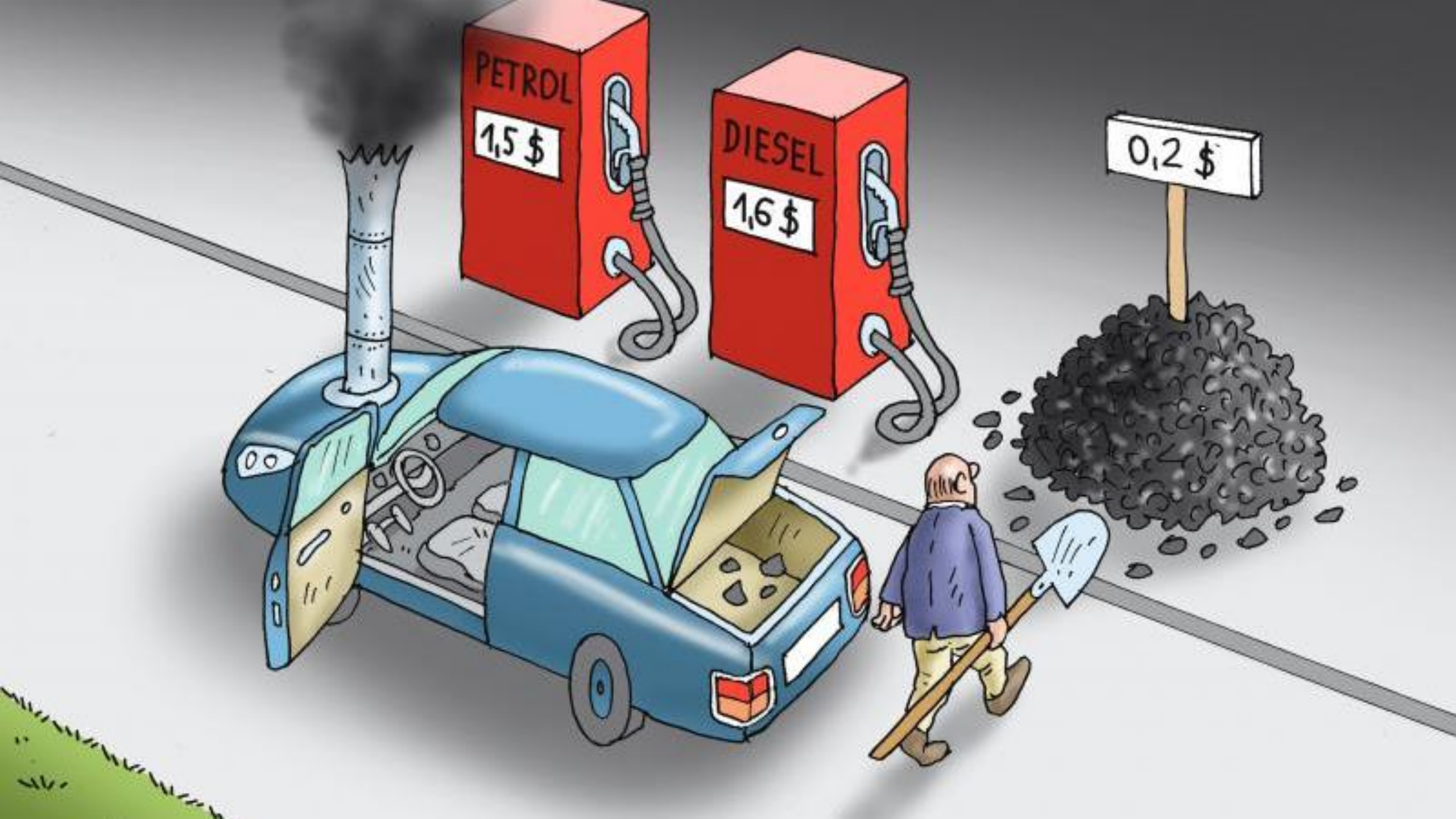
World Business Legal Markets More

United States

1 minute read · December 24, 2022 11:46 PM GMT+1 · Last Updated 2 days ago

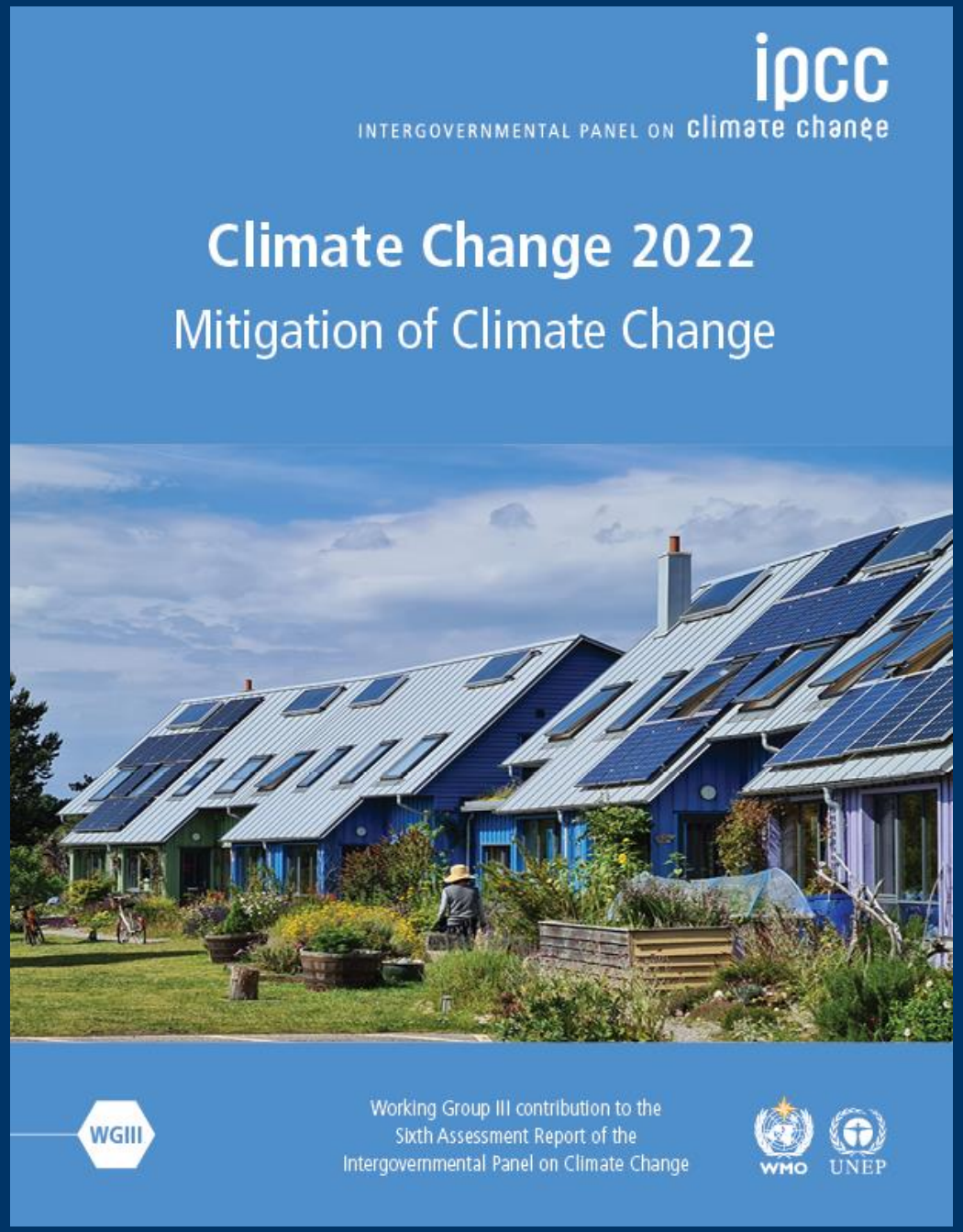
Factbox: Power outages hit more than 500,000 in the U.S. due to storms


GLOBAL TIMES
LIURUI
DECEMBER
EUROPE
ELECTRICITY
BILL


PETROL
1,5 $
DIESEL
1,6 $
0,2 $

Banana crop #70-74, house of Amory Lovins, Colorado, outdoors -44 C, no heating system*;*
„it was cheaper to build it that way”

Passivhaus (passive house)

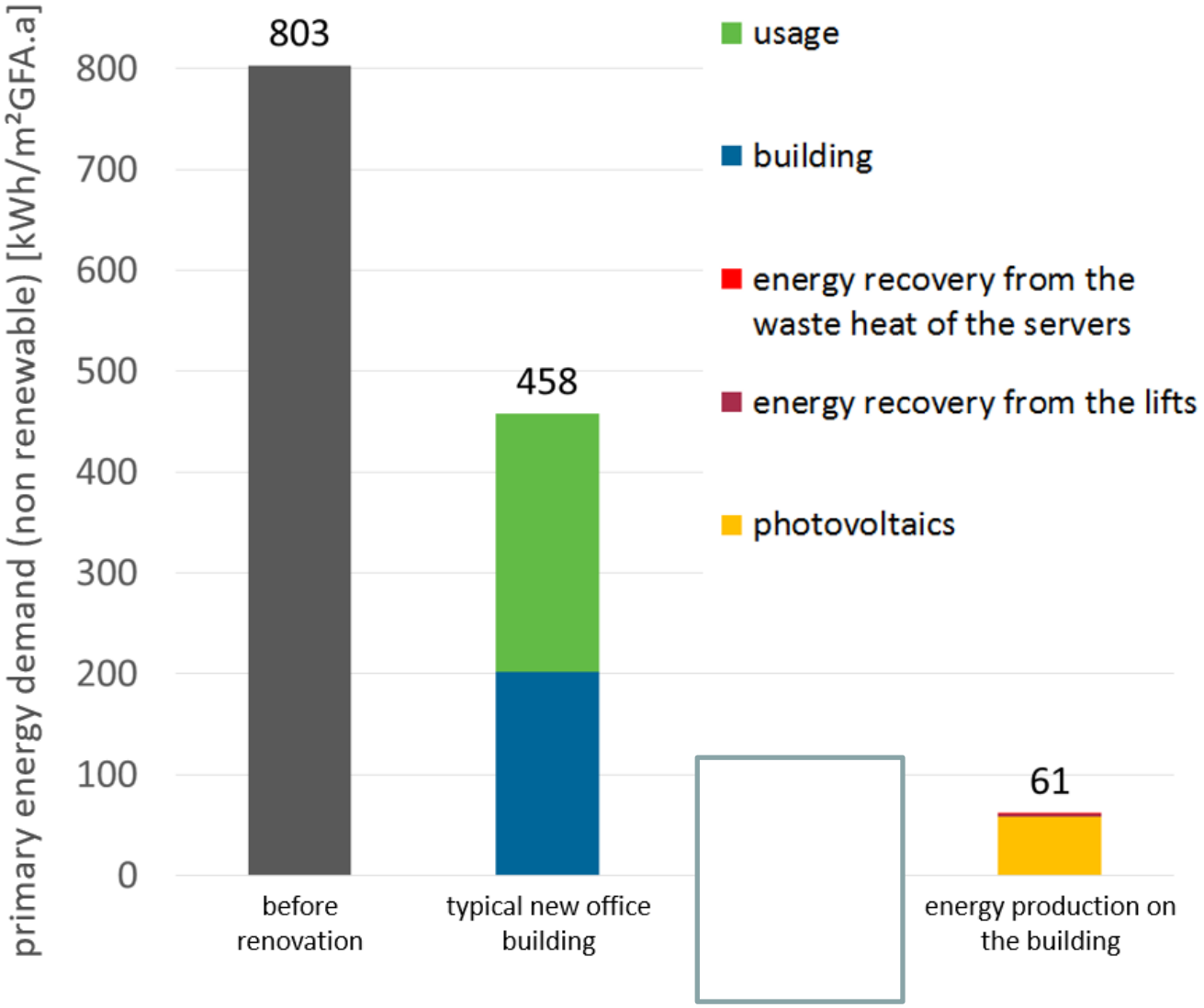


[Matt Bridgestock, Director and Architect at John Gilbert Architects]

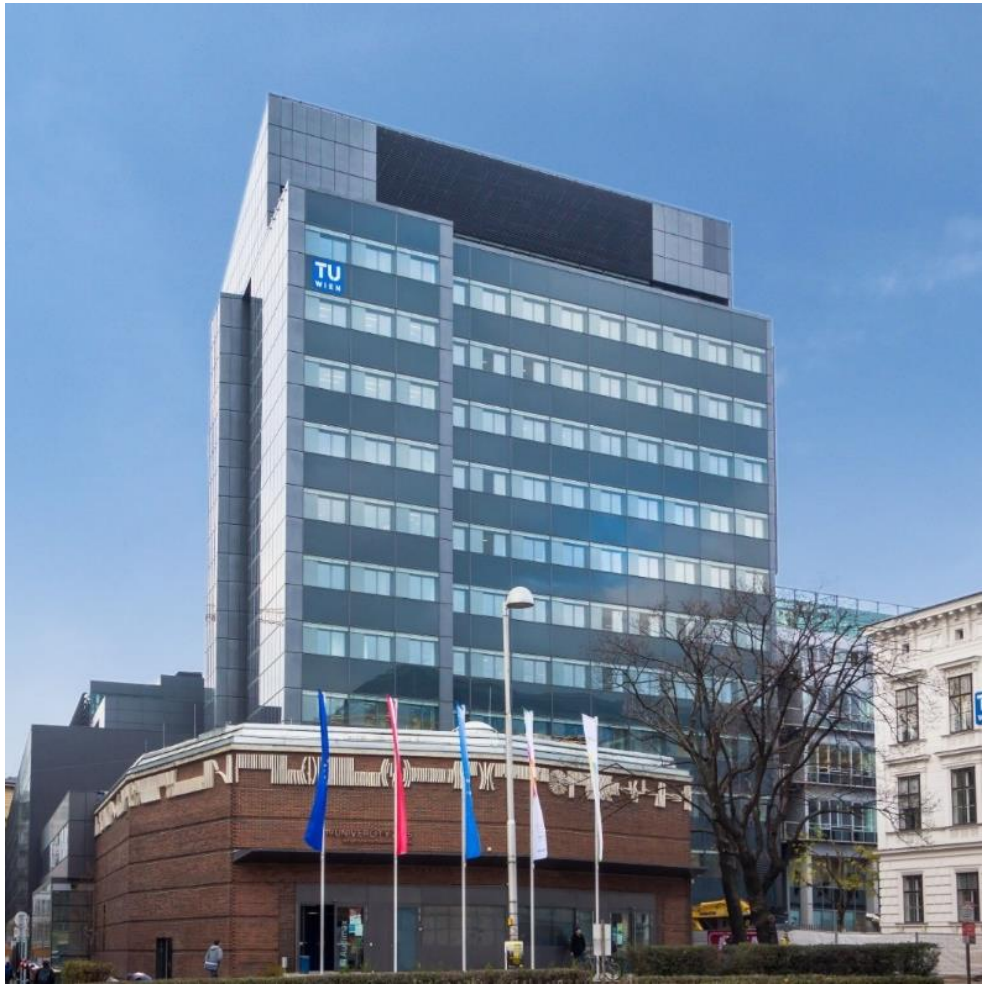
The built environment is crucial for a net zero future

forrás: Klemens Schlögl, Schöber & Pöll, Austrian World Summit 2018, Vienna, May 2018

Retrofit of the Vienna TU to Energy Plus Passivhaus level: The key was improved efficiency and reduced demand

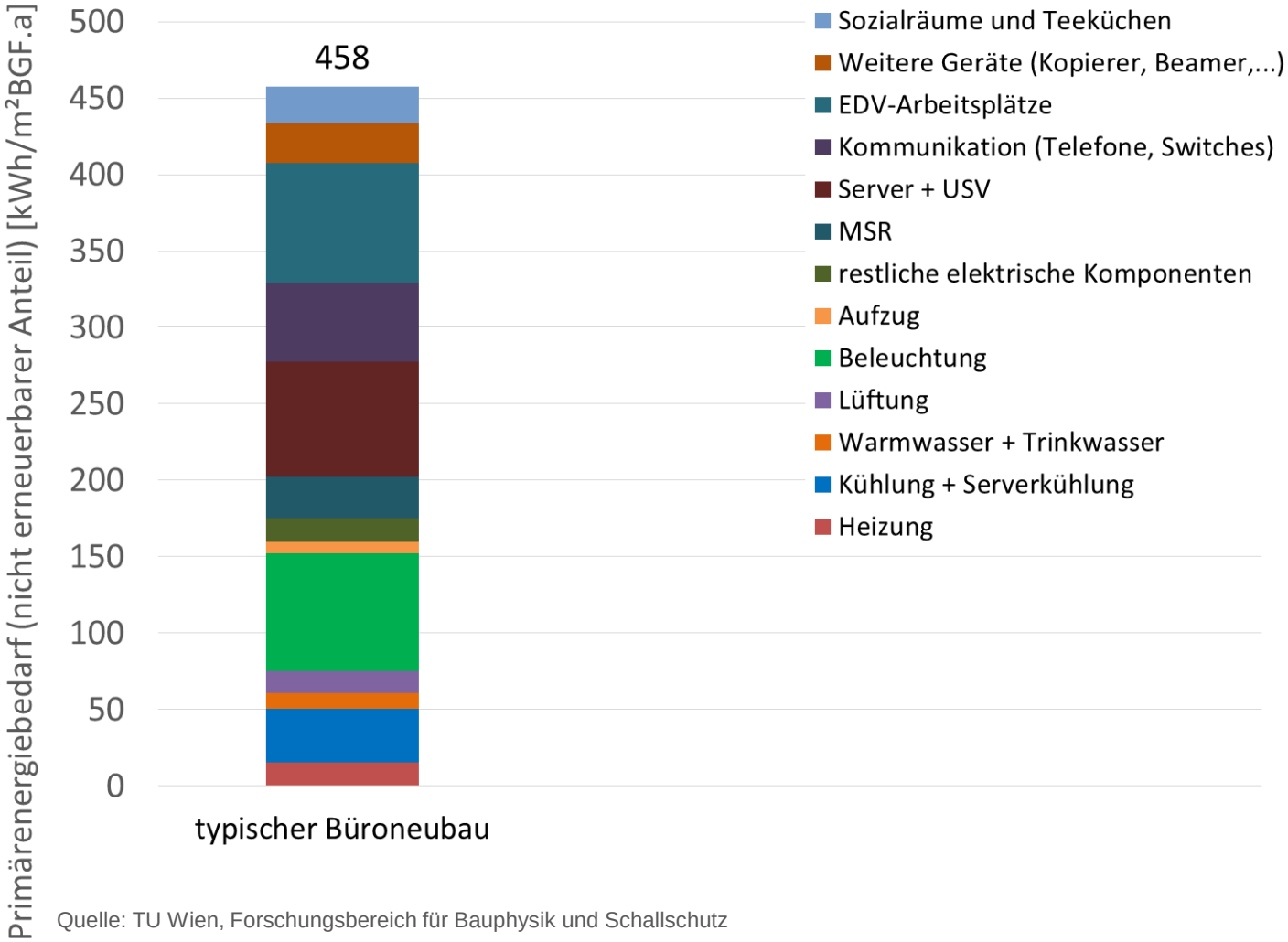


Source: Klemens Schlögl, Schöber & Pöll, Austrian World Summit 2018, Vienna, May 2018



Schöberl & Pöll GmbH
BAUPHYSIK und FORSCHUNG

Disruptive electricity demand reductions arrive from innovatively optimising opportunities in systems rather than replacing individual technologies



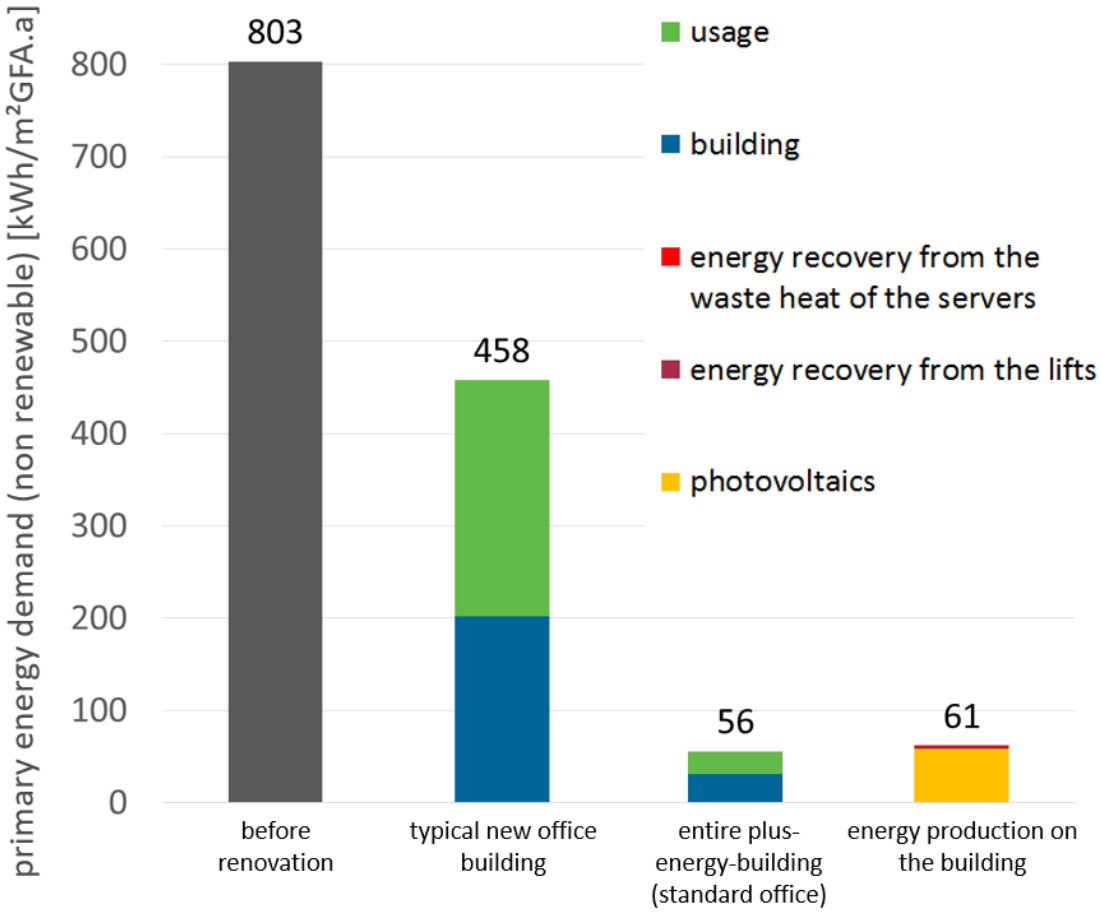
Quelle: TU Wien, Forschungsbereich für Bauphysik und Schallschutz

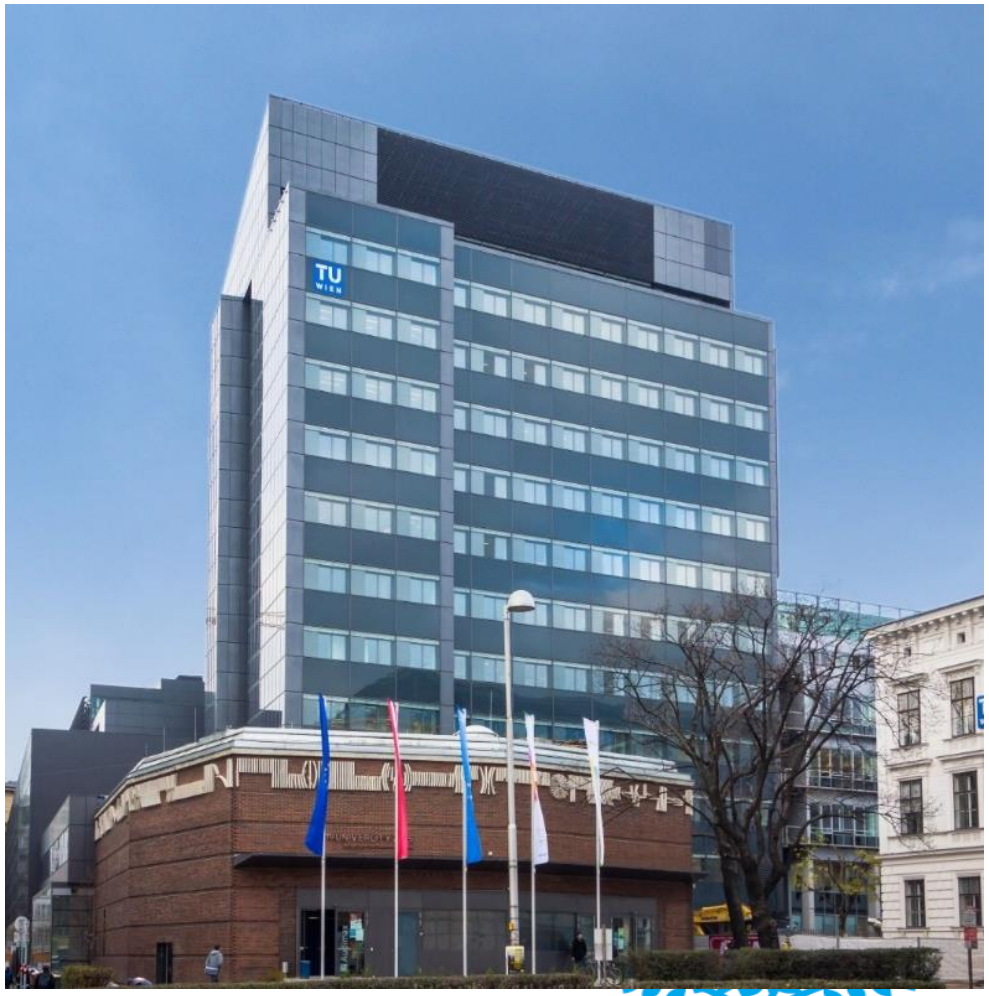
Source: Klemens Schlögl, Schöber & Pöll

Energy plus (Enerphit) retrofit of the Vienna Technical University tower

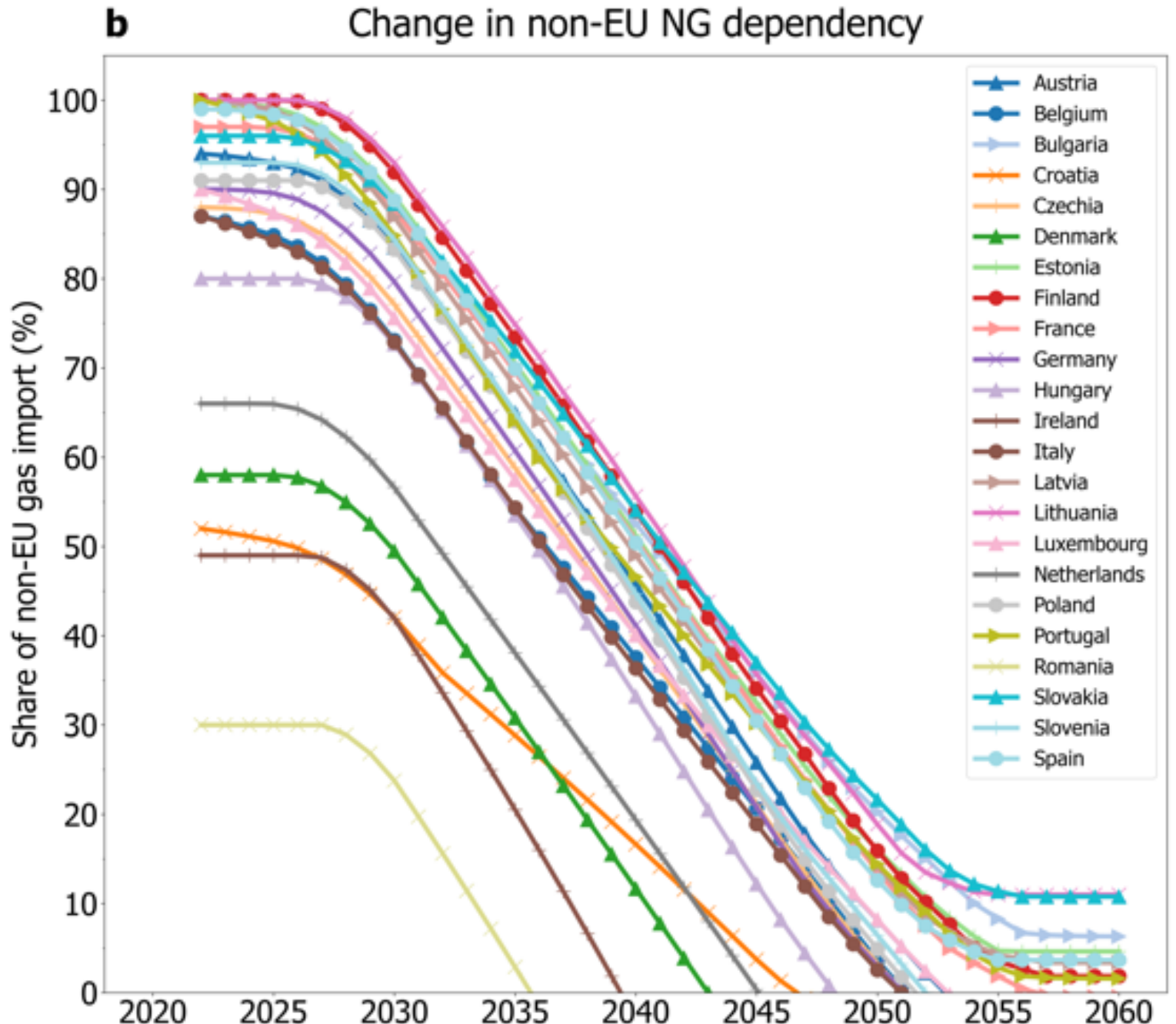
AUSTRIAN WORLD SUMMIT

Schöberl & Pöll GmbH
BAUPHYSIK und FORSCHUNG

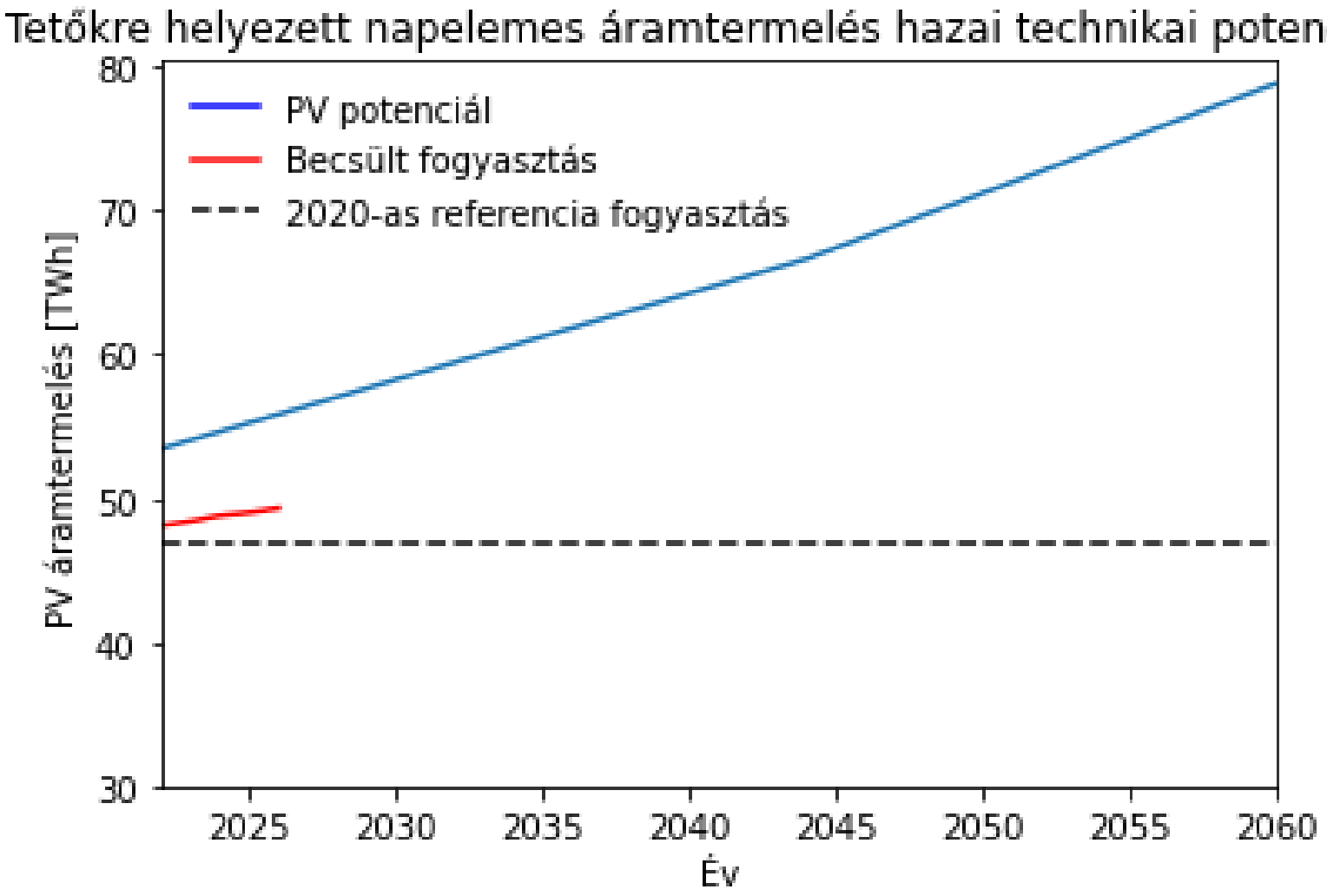


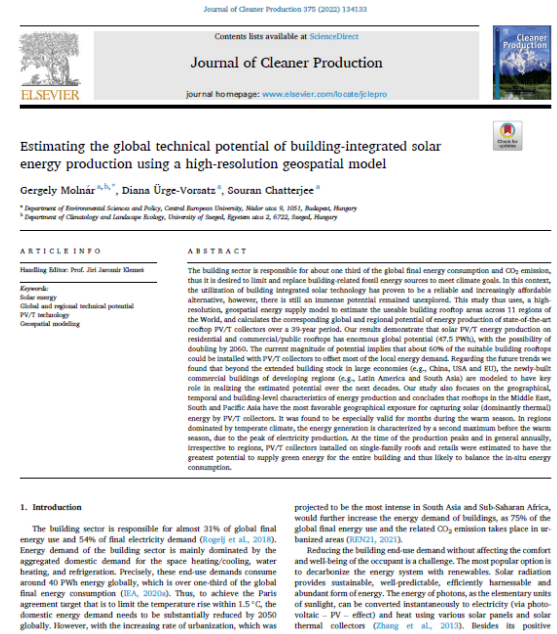


Source: Klemens Schlögl, Schöber & Pöll, Austrian World Summit 2018, Vienna, May 2018


b
Change in non-EU NG dependency
Share of non-EU gas import (%)
0
10
20
30
40
50
60
70
80
90
100
2020
2025
2030
2035
2040
2045
2050
2055
2060
Austria
Belgium
Bulgaria
Croatia
Czechia
Denmark
Estonia
Finland
France
Germany
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Netherlands
Poland
Portugal
Romania
Slovakia
Slovenia
Spain

Technical potential of building-integrated PV generation, Hungary





Journal of Cleaner Production 375 (2022) 134133

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Estimating the global technical potential of building-integrated solar energy production using a high-resolution geospatial model

Gergely Molnár[a,b,*], Diana Ürge-Vorsatz[b], Souran Chatterjee[a]

[a] Department of Environmental Sciences and Policy, Central European University, Nádor utca 9, 1051, Budapest, Hungary
[b] Department of Climatology and Landscape Ecology, University of Szeged, Egyetem utca 2, 6722, Szeged, Hungary

ARTICLE INFO

Handling Editor: Prof. Jiří Jaromír Klemeš

Keywords:
Solar energy
Global and regional technical potential
PV/T technology
Geospatial modelling

ABSTRACT

The building sector is responsible for about one third of the global final energy consumption and CO_2 emission, thus it is desired to limit and replace building-related fossil energy sources to meet climate goals. In this context, the utilization of building integrated solar technology has proven to be a reliable and increasingly affordable alternative, however, there is still an immense potential remained unexplored. This study thus uses, a high-resolution, geospatial energy supply model to estimate the useable building rooftop areas across 11 regions of the World, and calculates the corresponding global and regional potential of energy production of state-of-the-art rooftop PV/T collectors over a 39-year period. Our results demonstrate that solar PV/T energy production on residential and commercial/public rooftops has enormous global potential (47.5 PWh), with the possibility of doubling by 2060. The current magnitude of potential implies that about 60% of the suitable building rooftops could be installed with PV/T collectors to offset most of the local energy demand. Regarding the future trends we found that beyond the extended building stock in large economies (e.g., China, USA and EU), the newly-built commercial buildings of developing regions (e.g., Latin America and South Asia) are modeled to have key role in realizing the estimated potential over the next decades. Our study also focuses on the geographical, temporal and building-level characteristics of energy production and concludes that rooftops in the Middle East, South and Pacific Asia have the most favorable geographical exposure for capturing solar (dominantly thermal) energy by PV/T collectors. It was found to be especially valid for months during the warm season. In regions dominated by temperate climate, the energy generation is characterized by a second maximum before the warm season, due to the peak of electricity production. At the time of the production peaks and in general annually, irrespective to regions, PV/T collectors installed on single-family roofs and retails were estimated to have the greatest potential to supply green energy for the entire building and thus likely to balance the in-situ energy consumption.

1. Introduction

The building sector is responsible for almost 31% of global final energy use and 54% of final electricity demand (Rogelj et al., 2018). Energy demand of the building sector is mainly dominated by the aggregated domestic demand for the space heating/cooling, water heating, and refrigeration. Precisely, these end-use demands consume around 40 PWh energy globally, which is over one-third of the global final energy consumption (IEA, 2020a). Thus, to achieve the Paris agreement target that is to limit the temperature rise within 1.5 °C, the domestic energy demand needs to be substantially reduced by 2050 globally. However, with the increasing rate of urbanization, which was projected to be the most intense in South Asia and Sub-Saharan Africa, would further increase the energy demand of buildings, as 75% of the global final energy use and the related CO_2 emission takes place in urbanized areas (REN21, 2021).

Reducing the building end-use demand without affecting the comfort and well-being of the occupant is a challenge. The most popular option is to decarbonize the energy system with renewables. Solar radiation provides sustainable, well-predictable, efficiently harnessable and abundant form of energy. The energy of photons, as the elementary units of sunlight, can be converted instantaneously to electricity (via photovoltaic – PV – effect) and heat using various solar panels and solar thermal collectors (Zhang et al., 2013). Besides its positive

2022: 53.4 TWh
2035: 62.3 TWh
2050: 71.5 TWh
2060: 78.9 TWh (+48%)

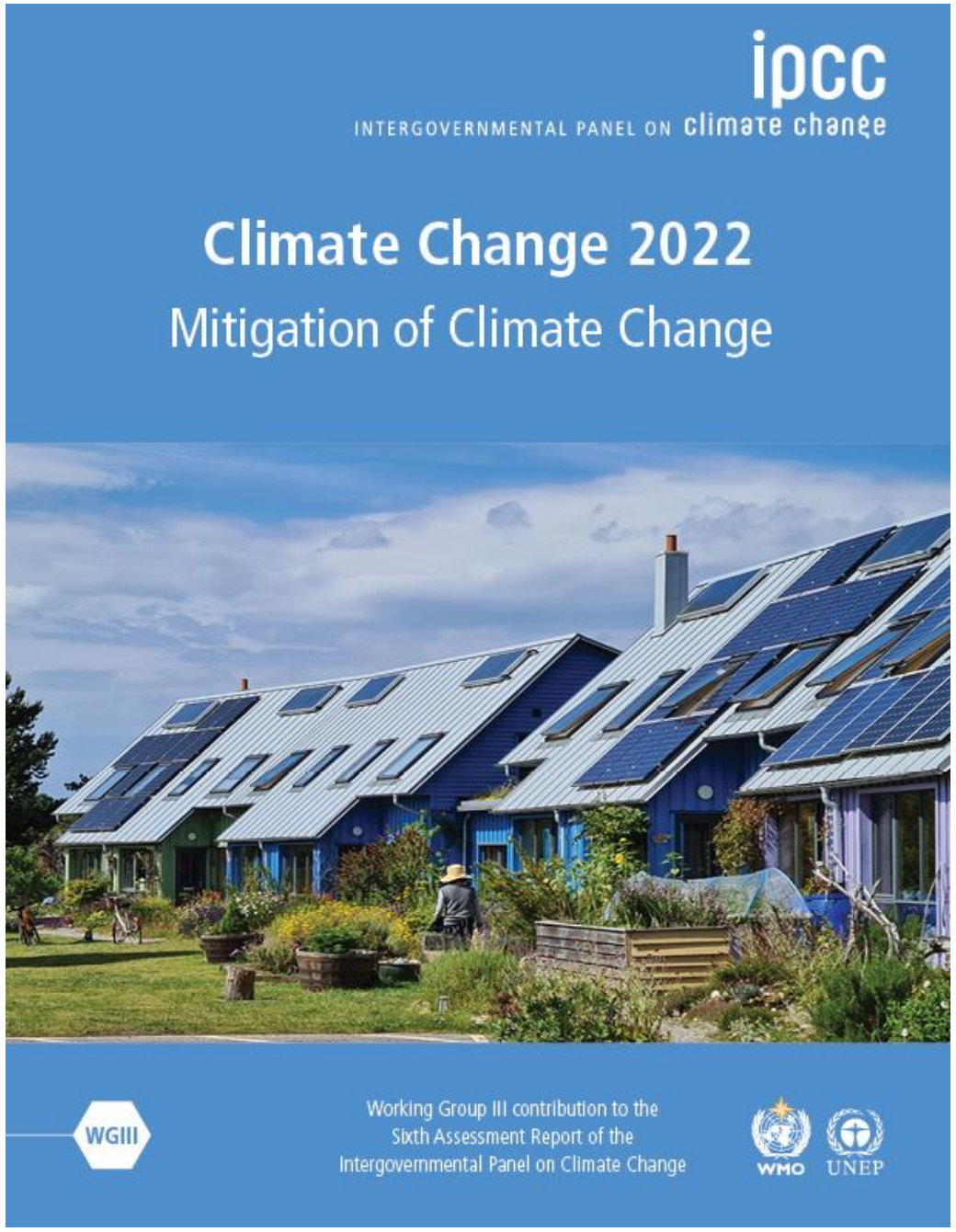
Éves változás (+0.52 TWh/év)

How can net zero ENERGY buildings and BiPV bring us to very high levels of energy security?

1. Half of all European final energy is for heat, we can almost eliminate that energy demand
2. Elimination of all non-EU natural gas import dependence
3. Very low energy bills and self-production isolate residents&businesses (and countries) from energy market disruptions, price volatilities
4. Buildings become much more resilient to power outages, extreme weather events, other crises –> security
5. Locally produced power is more resilient to power system disruptions, political conflicts
6. Whereas all energy generation in large scale results in geopolitical dependencies, only the energy never used can relieve us from these (energy efficiency)
7. With very low demand on the grid from buildings (formerly 70% of power demand), existing production capacities are freed up for electrification of other sectors

Stranded assets

- Limiting global warming to 2°C or below will leave a substantial amount of fossil fuels unburned and could strand considerable fossil fuel infrastructure.
- **USD11.8 trillion in current assets will need to be stranded** by 2050 for 2°C world; further delaying action for another 10 years would result in an additional USD7.7 trillion in stranded assets by 2050
- The loss of wealth from stranded assets would **create risks for financial market stability**, reduce fiscal revenue for hydrocarbon dependent economies, in turn **affecting macroeconomic stability** and the prospects for a just transition.
- About **30% of oil, 50% of gas, and 80% of coal reserves will remain unburnable** if warming is limited to 2°C, and substantially more to 1.5C
- the worldwide fleet of coal and gas **power plants** would need to **retire about 23 and 17 years earlier than expected lifetimes**, respectively, in order to limit global warming to 1.5°C and 2°C
- Blast furnaces and cement factories without CCS, new fleets of **airplanes** and internal combustion engine vehicles and new urban infrastructures adapted to sprawl and motorisation may also be stranded



"the most secure energy is the energy we never need to produce"

Ürge-Vorsatz Diana

vorsatzd@ceu.edu

www.ipcc.ch

Twitter:

@DianaUrge

dr_Diana_UrgeVorsatz

diana.urgevorsatz