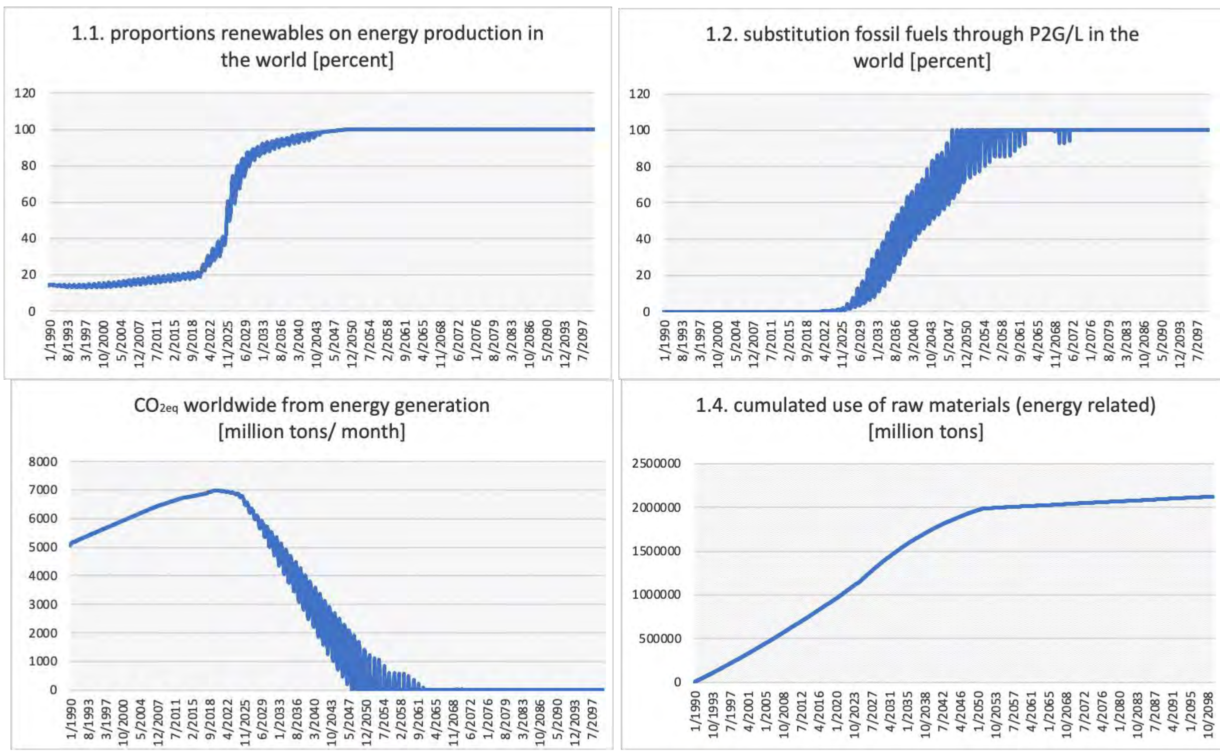
Fact sheet #3/6: Global resource availabilities towards reaching 100% renewables

This fact sheet shows that a global transition towards renewable energy is possible regarding the potential availability of the needed raw materials to achieve this transition.

Using larger system dynamics simulation models (see fact sheet #1/6), we quantitatively analysed different scenarios of the global transition towards renewable energies (wind onshore/offshore, photovoltaics (PV), power-to-liquid/gas (P2L/G), biomass/hydro) and its dependency on the availability of raw materials as well as on the need for energy from all sectors including that associated with the use of raw materials. We also considered the substitution (based on P2L/G) of material use of fossil energy carriers for the chemical industry.

Fig. 1: Results from a scenario reaching the targets by 2055



Source: Data from the quantitative ICARE model; own presentation (Consideo)

The scenarios are running until 2100 to capture continued raw material needs for repowering but assume no changes in energy demand between 2050 and 2100. The scenario 2 (see fact sheet #1/6) underlying this fact sheet assumed 15% less energy demand (sufficiency) by 2050 compared to the 2015 World Energy Outlook (WEO)[1] and GreenEe scenario's mix of renewables and level of electrification of the sectors (transportation, industry, housing) according to the German Environment Agency's RESCUE study[2]. It also assumes a globally constant, high rate of net installations of renewables with a slight delay of 5 years of this transforming in some developing regions (e.g., Africa, Latin America, Eurasia).

Figure 1.1 shows how the proportions of renewable energy could sharply rise and with a slight delay also the substitution of fossil raw materials by P2L/G (figure 1.2). Greenhouse gas emissions from the energy

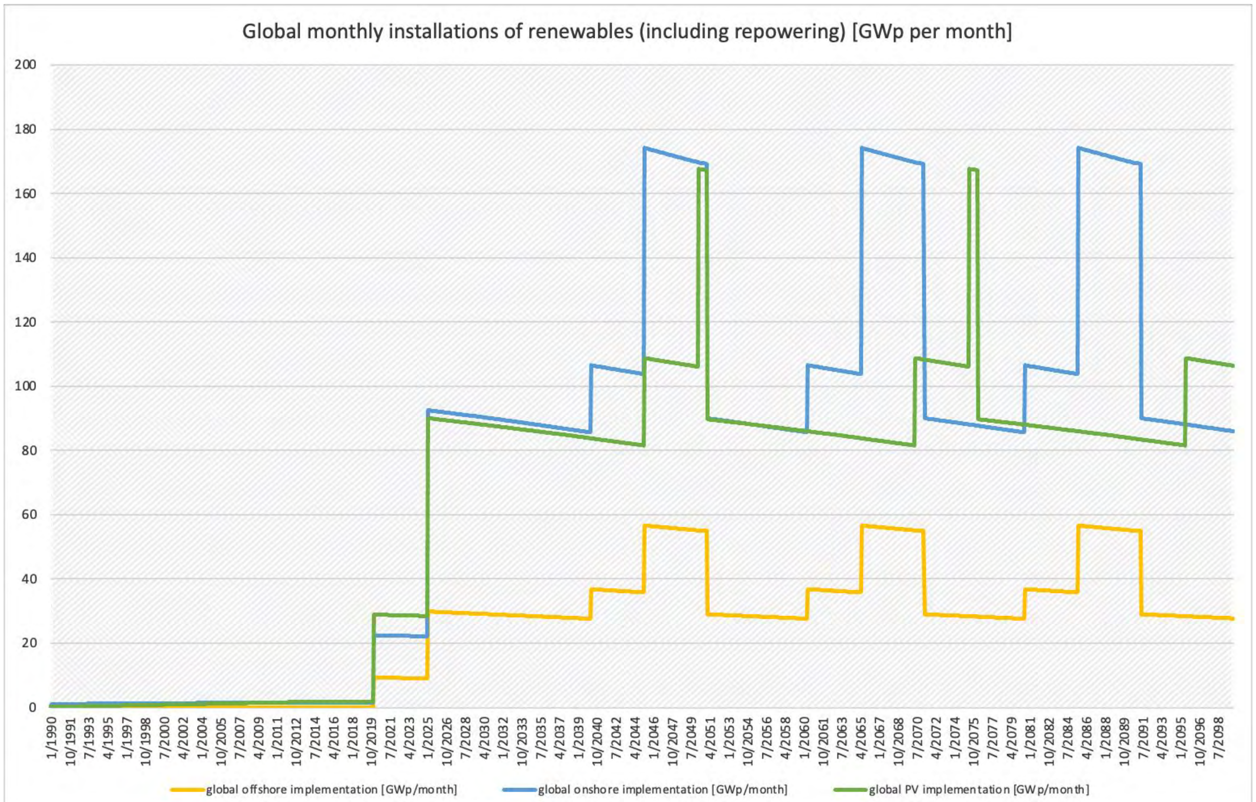
[1] https://www.iea.org/reports/world-energy-outlook-2015 by the International Energy Agency

[2] See https://www.umweltbundesamt.de/en/topics/climate-energy/climate-protection-energy-policy-in-germany/a-resource-efficient-greenhouse-gas-neutral-germany/rescue-scenarios-greenee1-greenee2.

sector (figure 1.3) would decrease to zero around 2050. Cumulative raw material uses from the energy sector (figure 1.4) from 2050 on would continue to increase only slightly due to the remaining need of virgin materials in a period of continued repowering assuming a rate of recycling of 90%.

Figure 2 shows the monthly global installations of renewables, which would require a 'moonshot project' compared to the installations of the past and the present. Not only would we need a significant increase of installations from now, but we also need a doubling of the capacities once net installations coincide with repowering of the existing installations after 20 (wind energy) to 25 (PV) years. These ups and downs of demand for installations probably can't be provided by the economy since the peaks last only a couple of years, which makes it unlikely to invest with such foreseeable decline of demand.

Fig. 2: Global monthly installations of renewables



Source: Data from the quantitative ICARE model

Hence, from a technical viewpoint the pathway needed is clear: constant global net installations per month plus repowering of existing installation. Global policies need to communicate and implement this pathway and adopt their policies accordingly. The ICARE project shows that different pathways of transition (Fact sheets #3 to #6) to 100% renewable energy will increase the price for energy and yet turn out to be economically beneficial for most regions because of a shift of value creation. This is another aspect that needs to be communicated and which could be used to finance social policies and market interventions, e.g., to compensate for necessarily underutilised electrolysers (see Fact sheet #2).

Disclaimer: This paper was developed within the project „Erkennen und Bewerten der Wechselwirkungen von internationaler Klima- und Ressourcenschonungspolitik", FKZ 3718 31 101 0, for the German Environment Agency, coordinated by Dr. Martin Hirschnitz-Garbers from Ecologic Institute and modelling done by Kai Neumann from Consideo GmbH. The responsibility for the content of this publication lies with the authors and does not necessarily reflect the opinion or the policies of the German Environment Agency.