



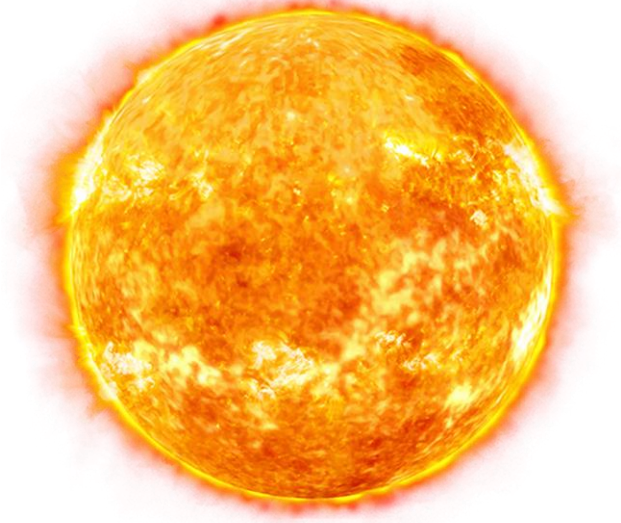
SwissLife
Asset Managers

The Road to Green Energy: Unlocking the Potential of Renewable Energy

Dr. Marc Schürch | 7th Sustainable Investor Summit, Zurich | 29.02.2024

There is no question on the availability of renewable energy – but on its utilization

380'000'000'000'000 TW



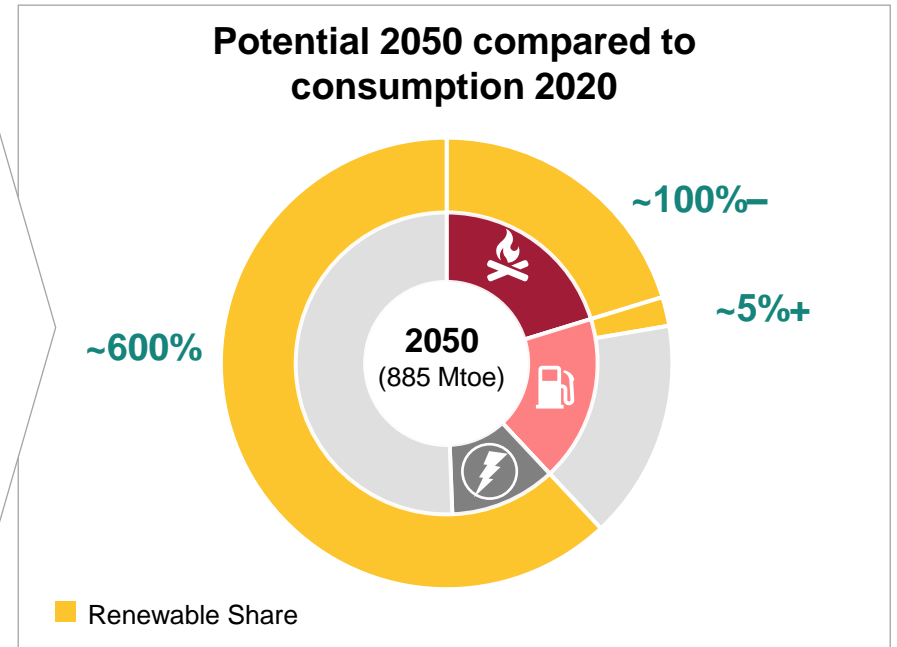
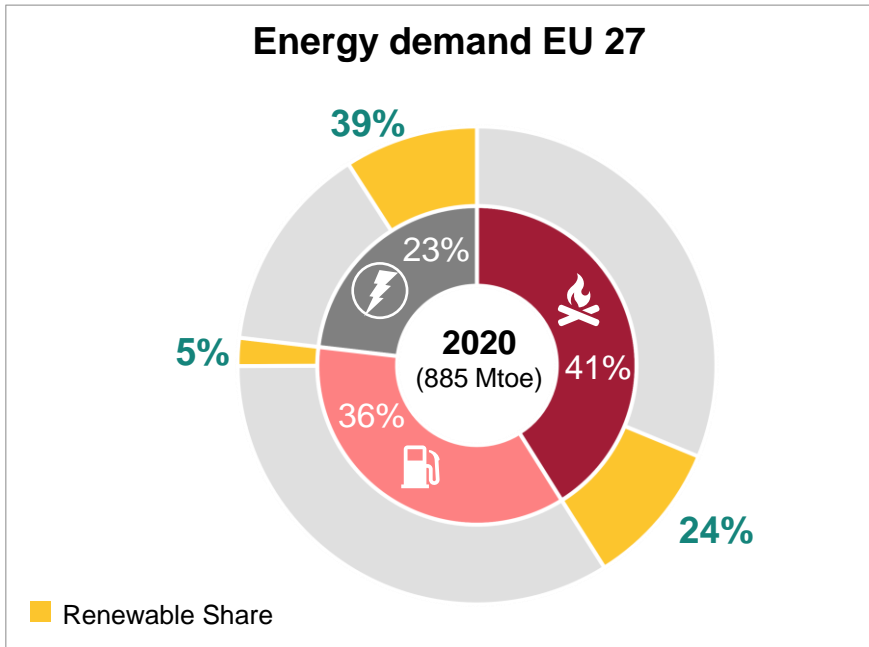
163'000 TW



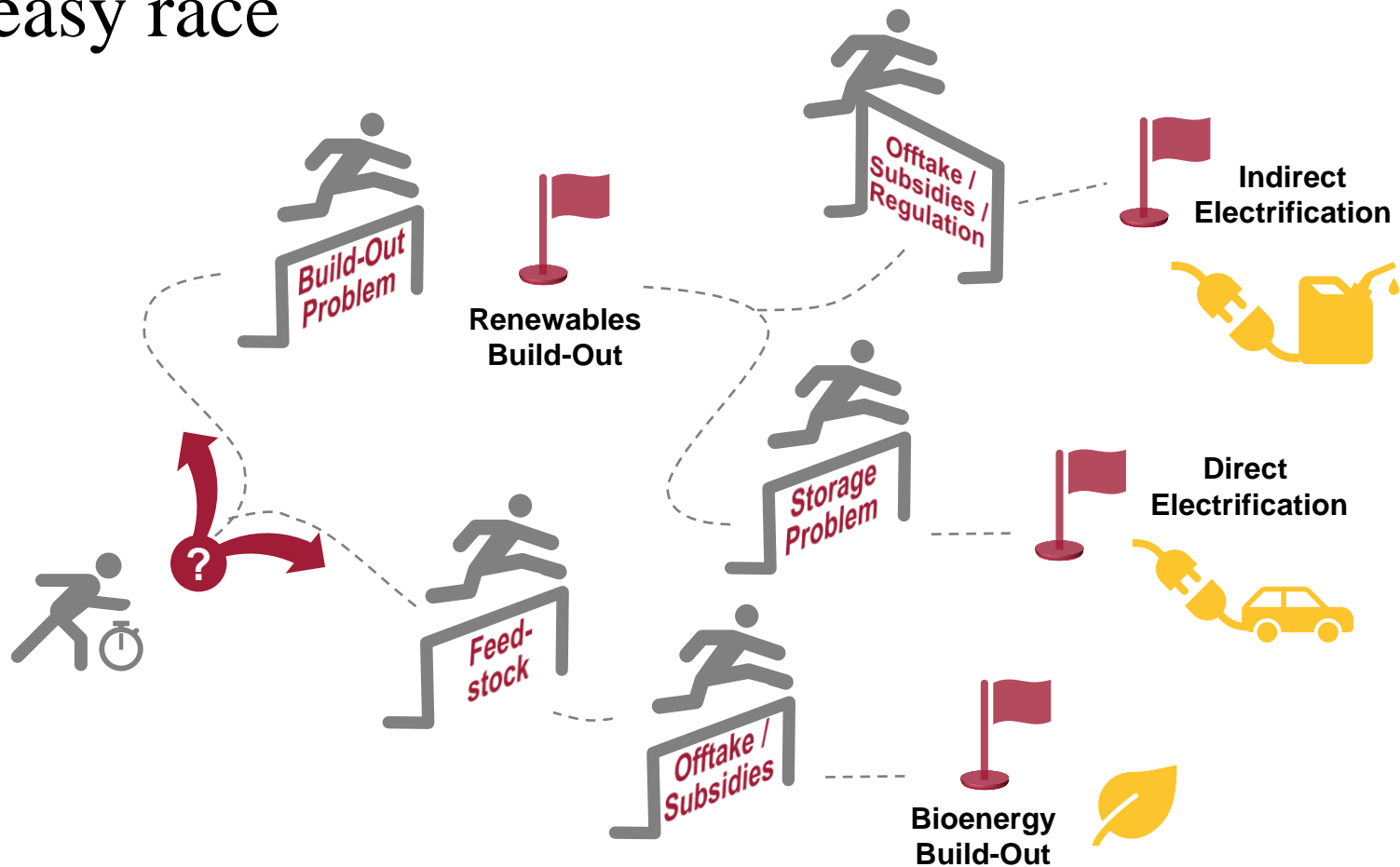
8,5 TW



The key to unlock the potential of renewables is largely electrification



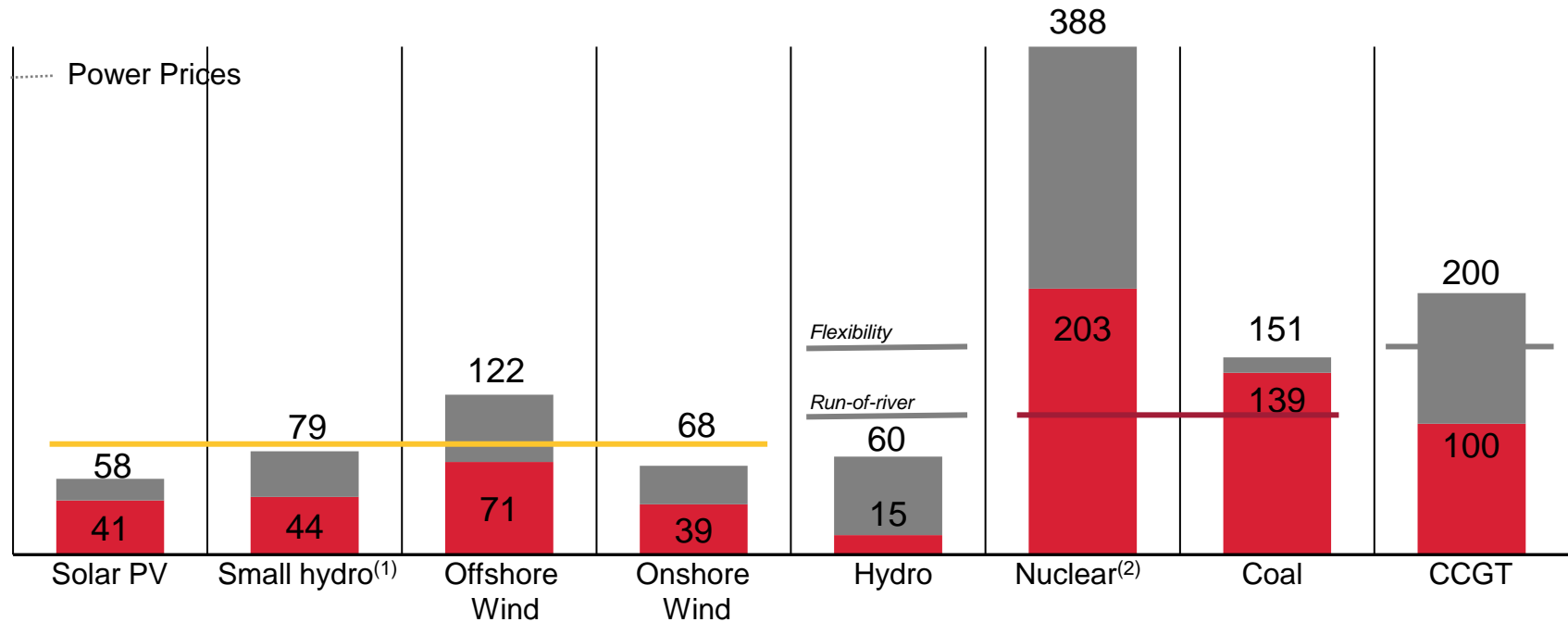
The hurdles of the energy transition are not an easy race



Renewable electricity is competitive to electricity produced from fossil fuels



Levelized Cost of Electricity by technology in EUR/MWh (2022 real)



Source: Bloomberg, Fraunhofer Gesellschaft; (1) LCOE range has been calculated using the forecasted values by BloombergNEF and applying an FX rate of 0.92 USD/EUR. (1) Values in US, comparable to values in European countries like Switzerland (2) Nuclear costs in France

Renewable electricity is competitive to electricity produced from fossil fuels



Administrative Burden

Appeals



Site Availabilities

Grid Expansion



Innovation



All storage options have advantages, but come with significant shortcomings



Pumped Storage



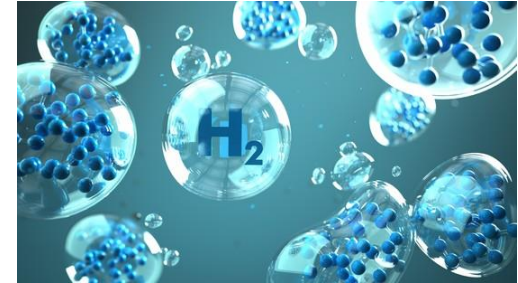
- + • Efficiency 70-80%
- Spread of **EUR 40-60/MWh** needed¹
- Scalable
- Seasonable Storage
- • Geographic inflexibility
- Limited **potential**

Battery Storage



- + • Efficiency 80-90%
- Spread of **EUR ~80/MWh** needed¹
- Example EV: **~2.5-10 times cheaper** than fuel
- • Short duration storage (ca. 1-4h)
- Energy density is low and storage **15 times heavier**

Hydrogen Storage



- + • Compressible to 350-700bar or piping option
- Usage in steam turbine (ST) or in fuel cells (FC) for re-electrification
- • Efficiency of 25-50% (FC)
- Spread of **EUR ~160-200/MWh** needed¹ (FC)
- Voluminous: 31 kg/m³

Source: Swiss Life Asset Managers. Pictures from Shutterstock; 1 Power price of EUR 60/MWh underlying, based on experience of SL AM investments.

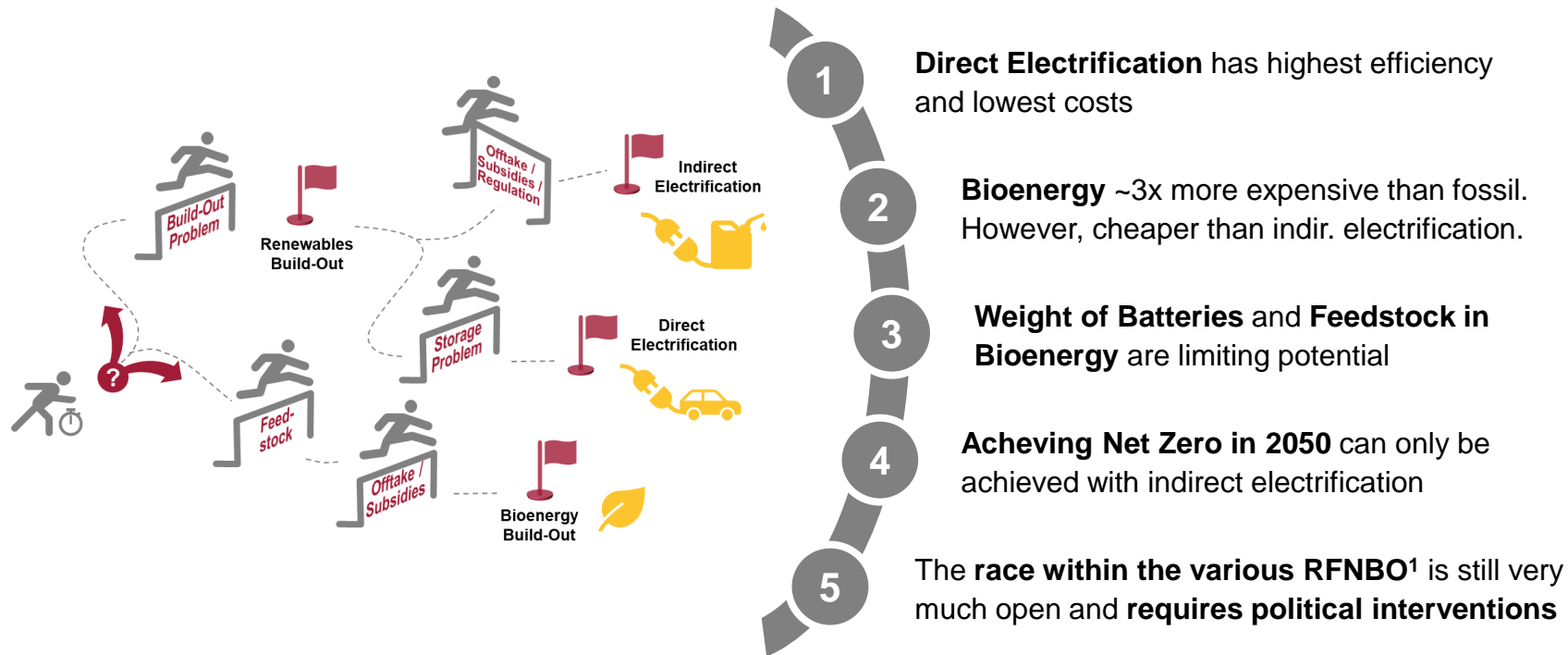
Alternative fuels are still expensive, but depend on electricity price



	Hydrogen (30 bar)	Petroleum-like Fuels	Green Ammonia
	$H_2O + \text{⚡} = H_2$	$H_2 + CO_2 = CH_3OH$	$H_2 + N = NH_3$
Process	<i>Electrolysis</i>	<i>Fischer Tropsch</i>	<i>Haber Bosch</i>
Usage	<ul style="list-style-type: none"> • Admixture to natural gas • Process to other RFNBO 	<ul style="list-style-type: none"> • E-Diesel • E-Methanol • Sustainable Aviation Fuel 	<ul style="list-style-type: none"> • Direct fuel • Dual fuel with LNG • Fertilizer
Volume [MJ/m ³ Comparison]	4x more volume than Natural Gas	1.7x more voluminous than MGO	1.7x more voluminous than MGO
Price [EUR/MJ Comparison]	2-7x more expensive than Natural Gas	2.5-3.5x more expensive than MGO	1.5-2.5x more expensive than MGO ¹

Source: 1 Prices: EUR 600/mt for Marine Gas Oil, EUR 800/mt for ammonia and EUR 1200/mt for e-methanol. Energy density: 36.6 GJ/m³ for MGO, 21.3 GJ/m³ for ammonia and e-methanol, Weight: 820 kg/m³ for MGO, 683 kg/m³ for ammonia and 792 kg/m³ for e-methanol, Hydrogen in 350 bar: 2.5 GJ/m³ and 31.25 kg/m³, Hydrogen in 30 bar pipeline: 324 MJ/m³ and 2.7 kg/m³, 120 MJ/kg, EUR 6/kg, Natural Gas in 30 bar pipeline: 1'200 MJ/m³ and 24.0 kg/m³, EUR 7.2/MMBTU or EUR 25/MWh

We can unlock the potential of renewables only via CO₂ price increase or regulation



Source: 1 Renewable Fuels from Non-Biological Origin

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a self-determined life.*