



Solar energy beyond power,
an industry in transition

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Opportunities in the urban landscape



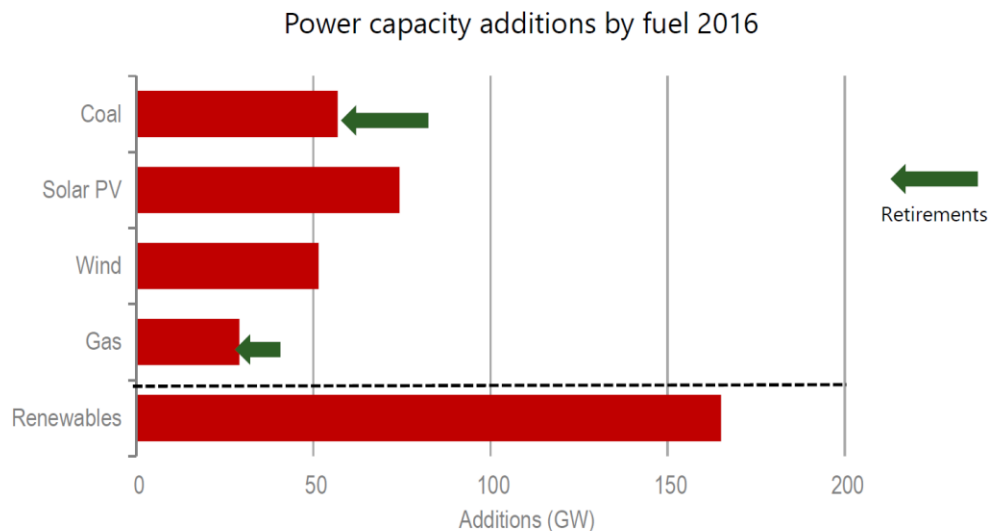
Overview

- The big picture – facts and scenarios
- Energy landscapes
- Solar PV applications and trends
- Opportunities and challenges
- Conclusions



What happened 2016

2016 – Renewables hitting new records driven by solar PV



For the first time a single renewable fuel became the largest source of net capacity growth, while all renewables provided an all-time record two thirds of global net capacity additions



World Energy Outlook 2017

Tipping the energy world off its axis



- Four **large-scale upheavals** in global energy are underway:
 - The **United States** is turning into the undisputed global leader for oil & gas
 - **Solar PV** is on track to be the cheapest source of new electricity in many countries
 - **China's** new drive to "make the skies blue again" is recasting its role in energy
 - The future is **electrifying**, spurred by cooling, electric vehicles & digitalisation
- There are many possible pathways ahead & many potential pitfalls if governments or industry misread the signs of change

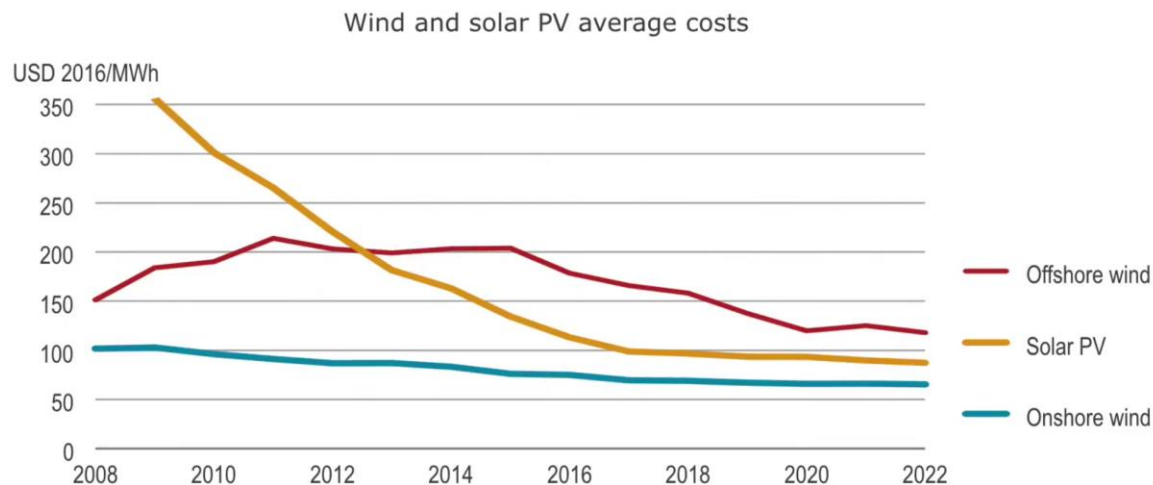


Fatih Birol, Executive Director IEA



Cost development

Wind and solar PV costs being driven down by competition



The cost of wind and solar PV have fallen sharply, with further reductions expected; cost-optimal integration requires interconnections, flexible generation, storage and demand response

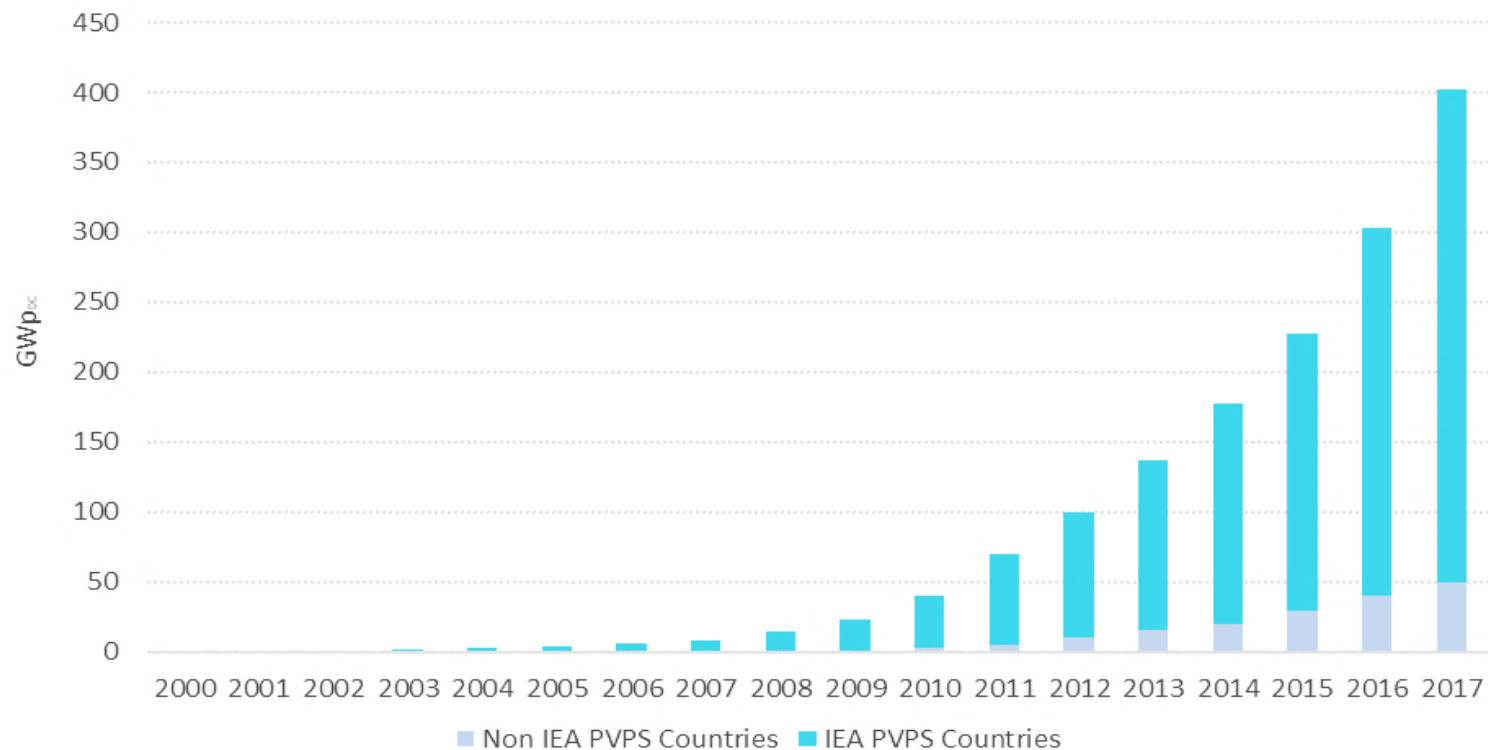


Costs: Enormous reduction

-75% over 10 years,
2017: \approx 20 USD/MWh in the best cases

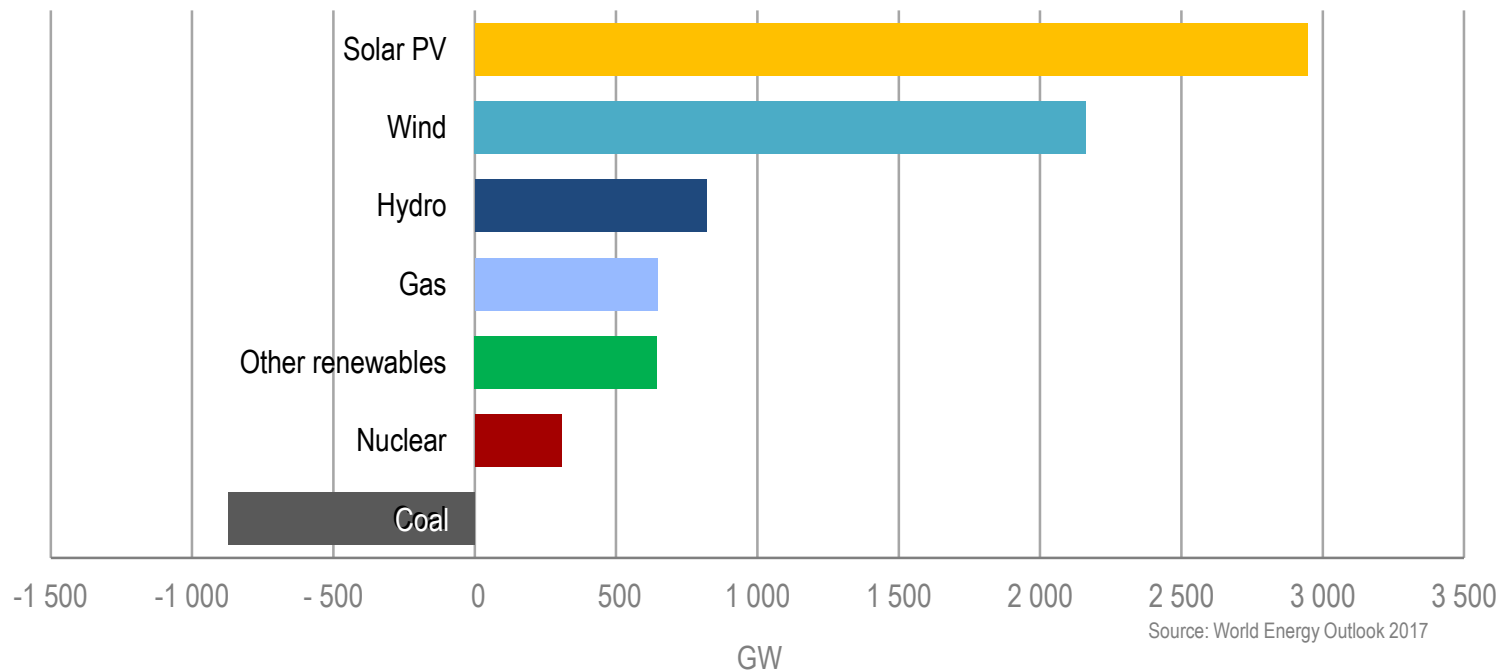


Photovoltaic market worldwide (cum.)



Renewables dominate capacity additions to meet sustainability goals

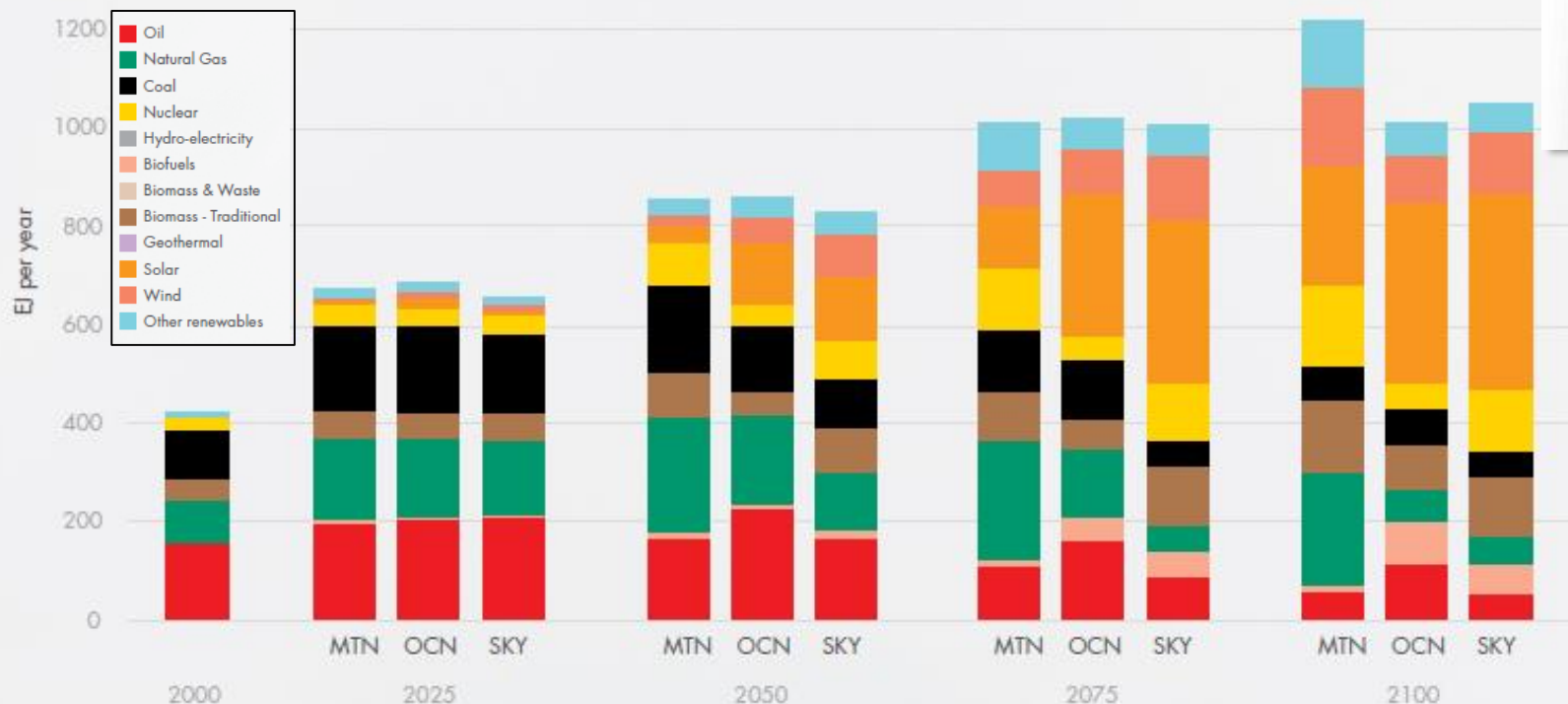
Global net capacity additions 2016 – 2040 in the WEO Sustainable Development Scenario



Renewables account for 63% of total world electricity generation by 2040 in the SDS, with wind and hydro becoming the largest sources of generation. China and India account for over 40% of net renewable additions.

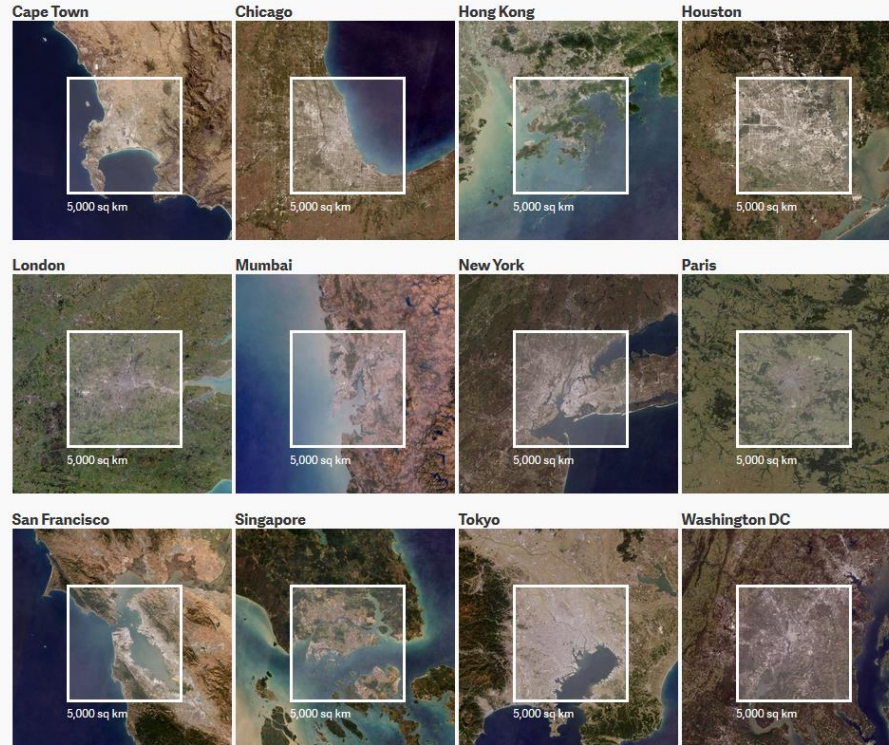


Scenarios





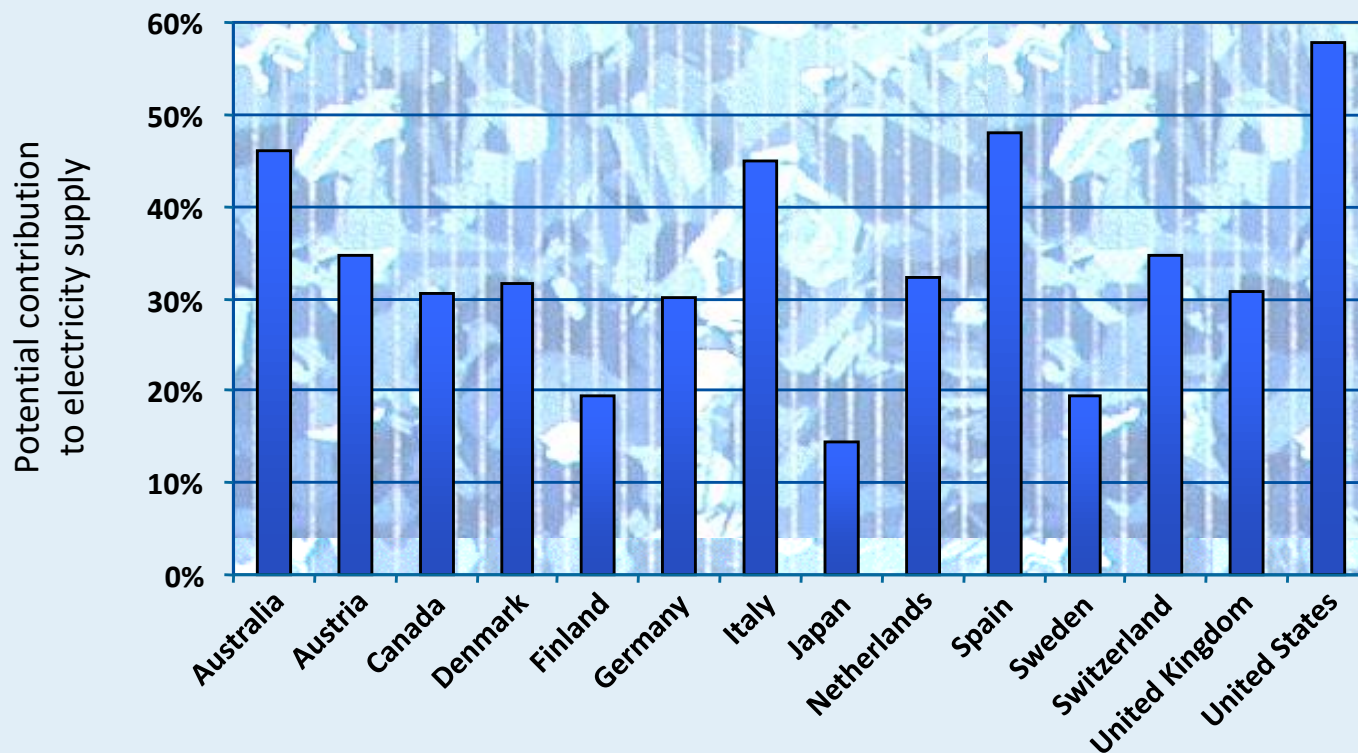
Saudi Arabia's plan for a 200 GW PV system



Images: Quartz composites of Landsat 8 data

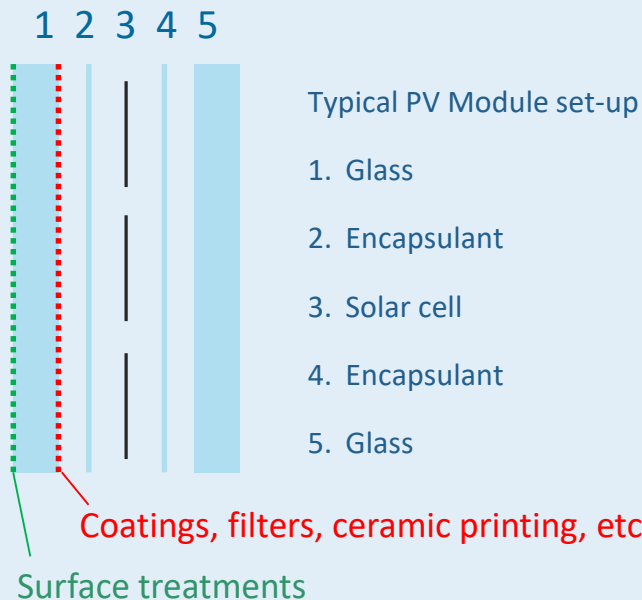


Potential of building integrated PV





New possibilities emerge



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Opportunities and challenges of BIPV

- Solar cell & glass treatment technologies
- Building material, building skin & building products
- Multifunctionality
- Aesthetics, design & architecture
- Standards
- Process integration
- Industrial manufacturing & (customized) mass production
- Cost & energy performance
- Building energy systems & energy system integration
- Business models, social acceptance & cultural change

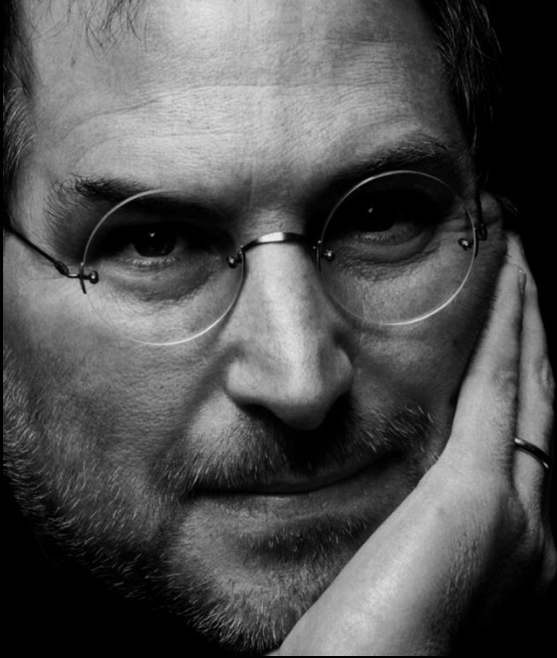


Some final thoughts

PV starting to form our energy landscape

- The unique selling proposition of PV
Very high potential, very low cost, big diversity
- Need for a much broader view
Beyond technology, beyond PV, beyond power, energy system integration
- New opportunities arise
Competitiveness, new applications, system view
- PV as a backbone of the energy system
*Entering many areas of the energy system,
possibly becoming the most important source of electricity / energy*
- Sense of responsibility
Trust and confidence
- Sustainability in all dimensions
Environment, economy, society, decarbonisation of the energy system

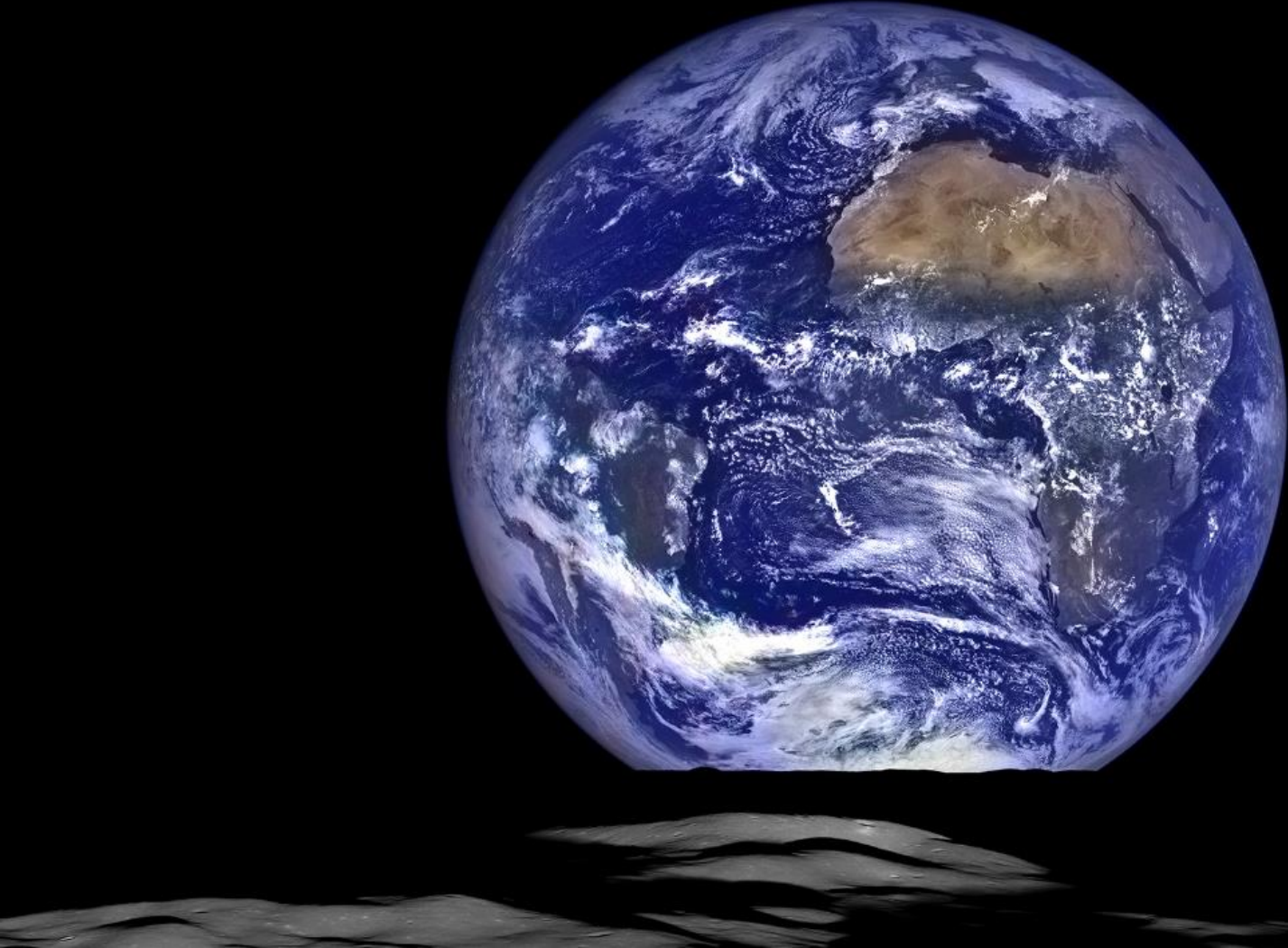
Imagination



Steve Jobs, Apple
"It's not a faith in technology. It's faith in people."



Chris Luebke, Arup
"The future, always oversold and under-imagined."



Thank you



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