

World Energy Scenarios

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World Energy Scenarios Global Perspective 2060

In collaboration with the Paul Scherrer Institute

Global scenarios framework recap

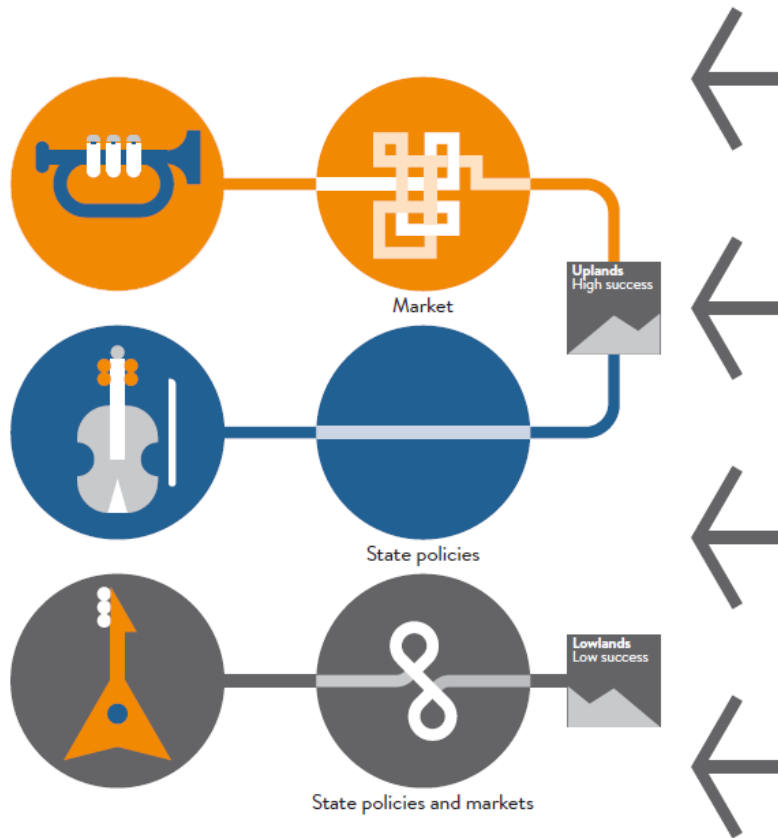


Scenarios

Modern Jazz
Highly digitally disruptive, innovative and agile world. Dominant market mechanisms. Energy plus services. Data dominance.

Unfinished Symphony
Strong policy, long-term planning, united action for climate and broadening agendas. Co-benefits and synergies.

Hard Rock
Fragmented world and low global cooperation. National and energy security focus. Globally connected challenges.



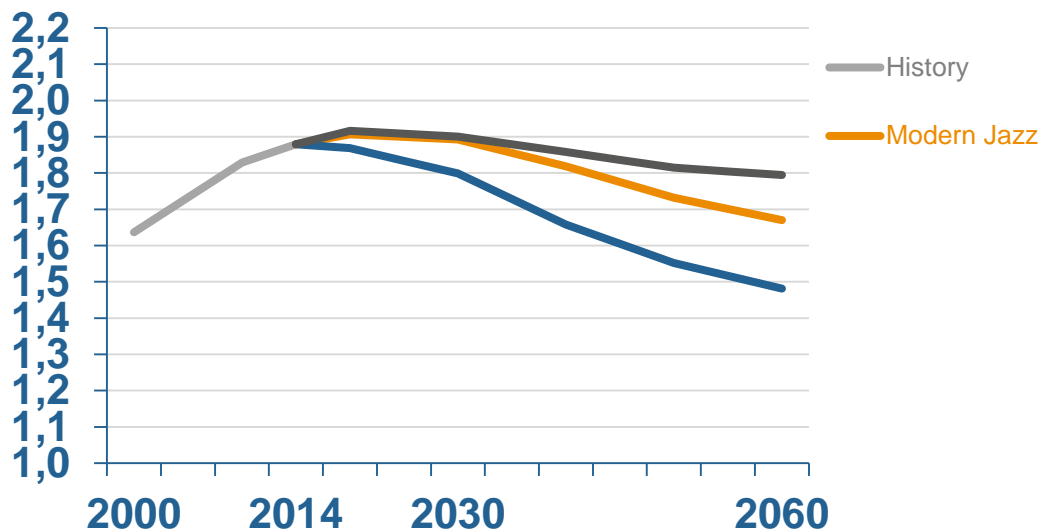
Critical Uncertainties



1 THE WORLD'S PRIMARY ENERGY DEMAND GROWTH...

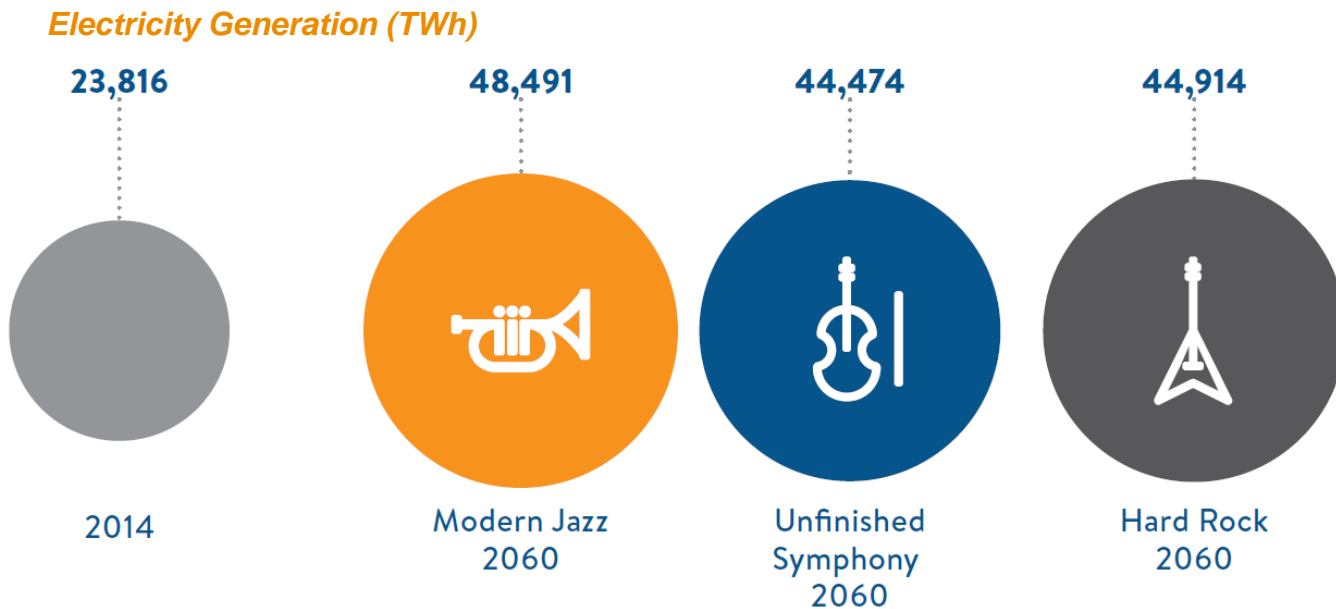
...will slow and per capita energy demand will peak before 2030 due to unprecedented efficiencies created by new technologies and more stringent energy policies.

Final Energy Growth Rate (p.a.)



2 DEMAND FOR ELECTRICITY...

...will double to 2060. Meeting this demand with cleaner energy sources will require substantial infrastructure investments and systems integration to deliver benefits to all consumers.

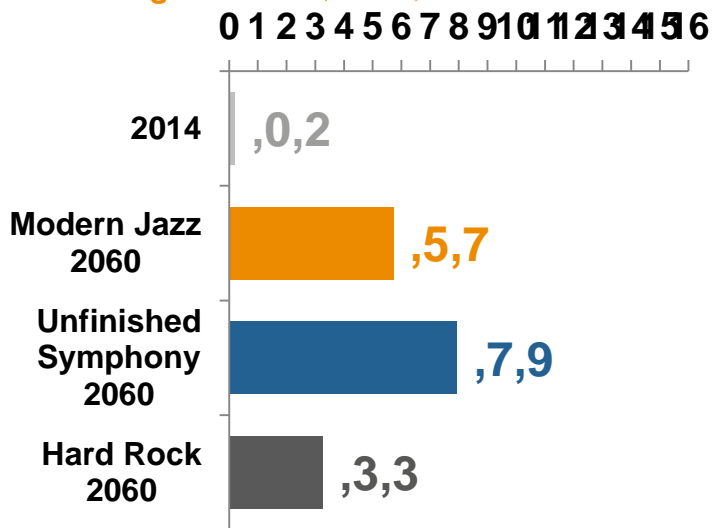


3 THE PHENOMENAL RISE OF SOLAR AND WIND ENERGY...

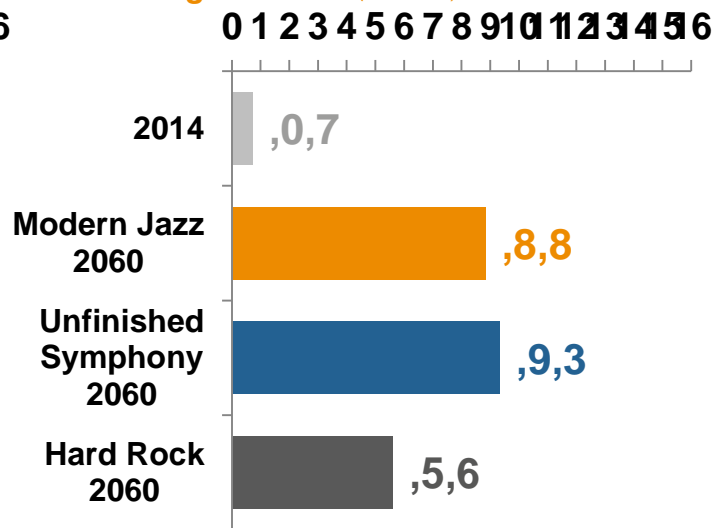
...will continue at an unprecedented rate and create both new opportunities and challenges for energy systems.

Electricity Generation by Source

Solar generation ('000 TWh)



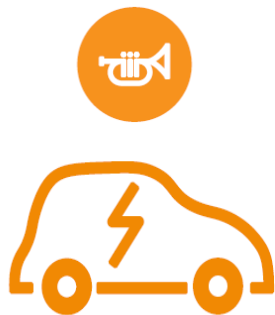
Wind generation ('000 TWh)



4 TRANSITIONING GLOBAL TRANSPORT...

...forms one of the hardest obstacles to overcome in an effort to decarbonise future energy systems.

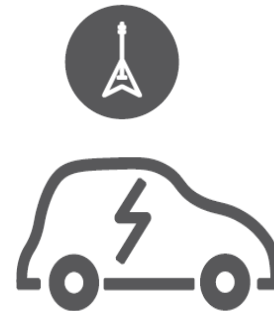
Electric Vehicles of Light-duty Vehicle Fleets



26% of 3.0 billion



32% of 2.8 billion

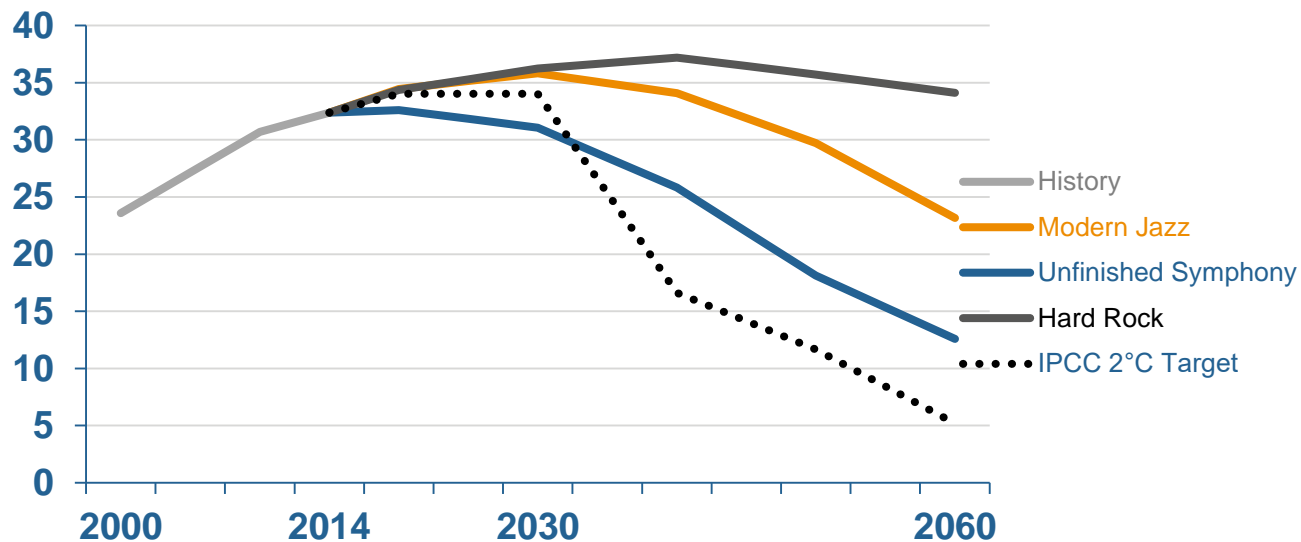


9% of 2.9 billion

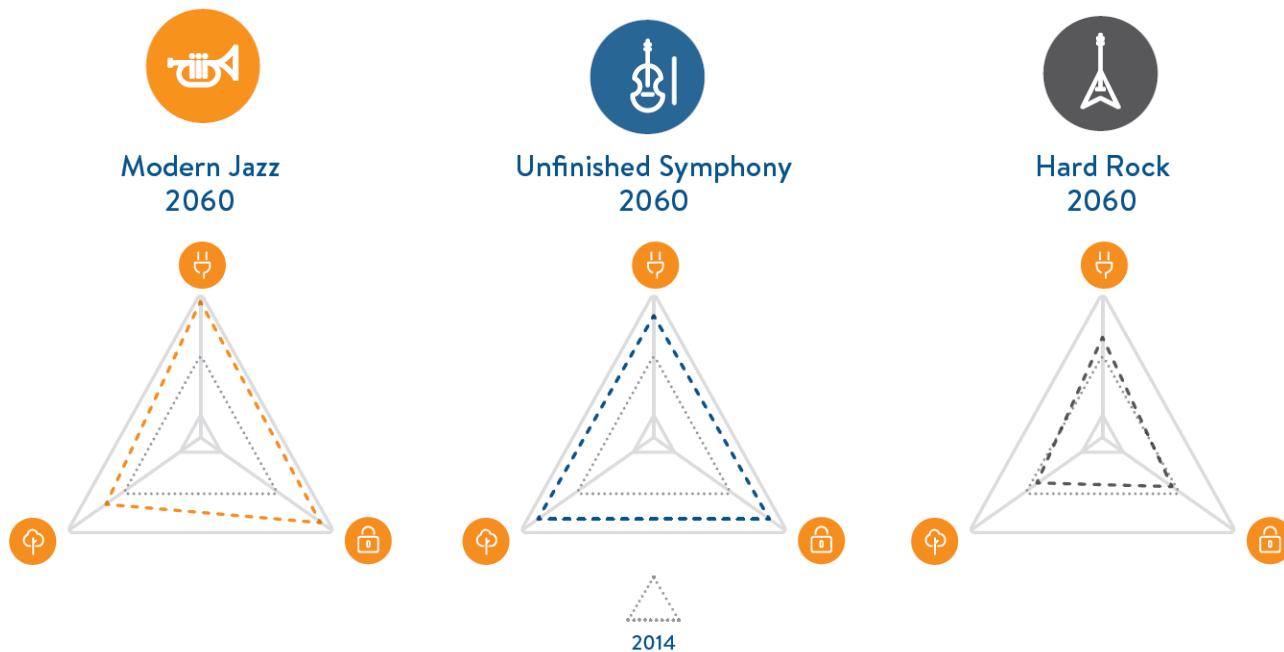
5 LIMITING GLOBAL WARMING...

...to no more than a 2°C increase will require an exceptional and enduring effort, far beyond already pledged commitments, and with very high carbon prices.

Annual Carbon Emissions (GtCO₂)



6 TRILEMMA INDEX IN 2060



WORLD ENERGY SCENARIOS | 2019

European Regional Perspective 2040

In collaboration with the Paul Scherrer Institute

INCREASING,
BUT UNEVENLY
DISTRIBUTED
INNOVATION

DATA-
EMPOWERED
CUSTOMERS

TECHNOLOGY
COST
REDUCTIONS

CITIZENS RELY
ON
BUSINESSES,
EVEN ON
SOCIAL ISSUES

EUROPEAN MODERN JAZZ

ENERGY
SECURITY IS
OUTSOURCED
TO
CUSTOMERS

STRONG
INNOVATION IN
TRANSPORT
SECTOR

DIGITALISATION
STRONG, BUT
VERY UNEVEN

“ETHICAL
INTERNALITIES”
ARE PRICED
INTO SERVICES



EUROPEAN
UNION
SUBSIDIARITY
PRINCIPLES
ARE RE-
VISITED

CLIMATE
TARGETS AND
BUILDING
CODES ARE
INNOVATION
DRIVERS

ENERGY
POLICY IS
INTEGRATED
WITH OTHER
POLICIES

REFORM OF
ELECTRICITY
MARKET
DESIGN FOR
SECURITY

EUROPEAN UNFINISHED SYMPHONY



SECTOR
COUPLING IS
SEIZED

COOPERATION
VIA DEDICATED
NETWORKS

IMPACT OF
TRANSITION TO
POOR PEOPLE
IS CLEARLY
ADDRESSED

CC(U)S AND
LARGE SCALE
BATTERIES
LIKELY TO
PROGRESS

DECREASING
POWER OF
EUROPEAN
UNION

INEQUALITY
OF WEALTH
BETWEEN
COUNTRIES
INCREASES

BILATERAL
COOPERATION,
ALSO
BETWEEN US,
RUSSIA, CHINA

BARRIERS TO
DATA SHARING,
NO
EMPOWERED
CUSTOMERS

EUROPEAN HARD ROCK

LOCAL
SECURITY IS
PRIORITISED

TALENT MOVES
TO RICHER
AREAS

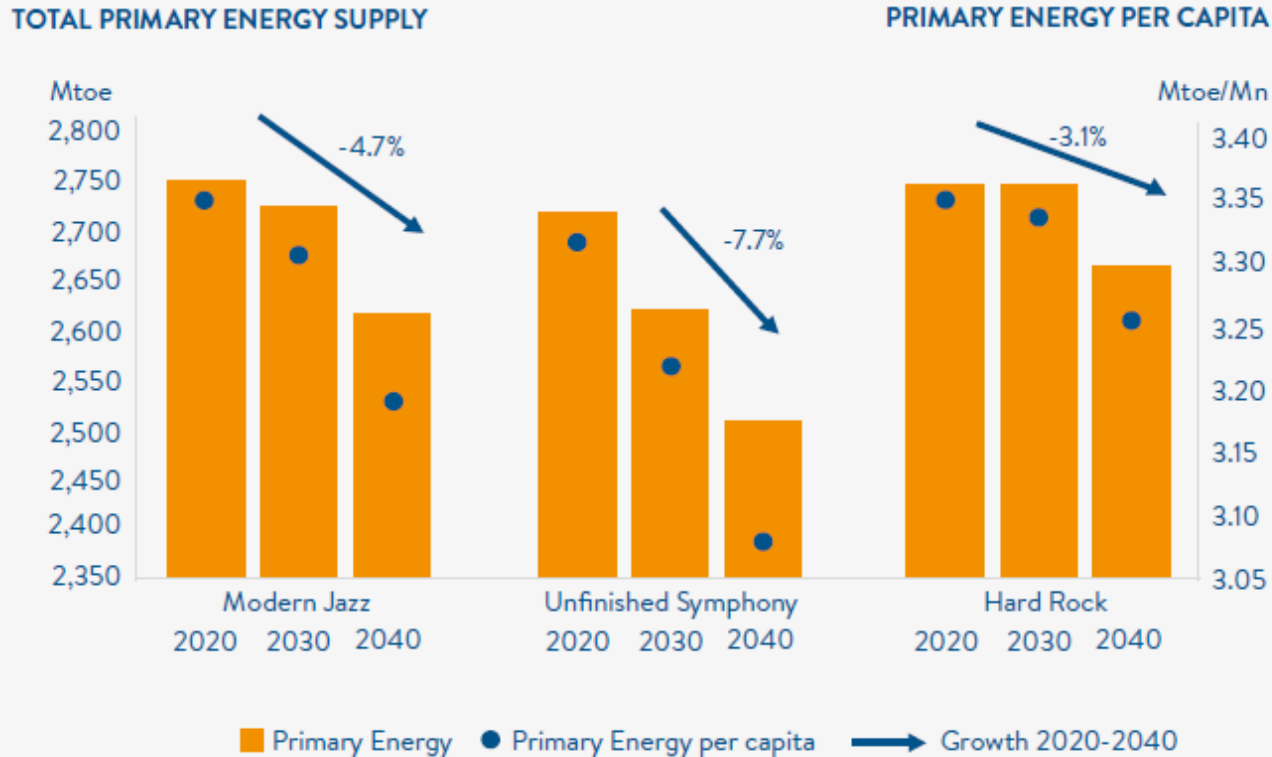
POLICIES
TOWARDS
CLIMATE
CHANGE
MITIGATION

TRANSPORT
INNOVATION IS
UN-EVEN

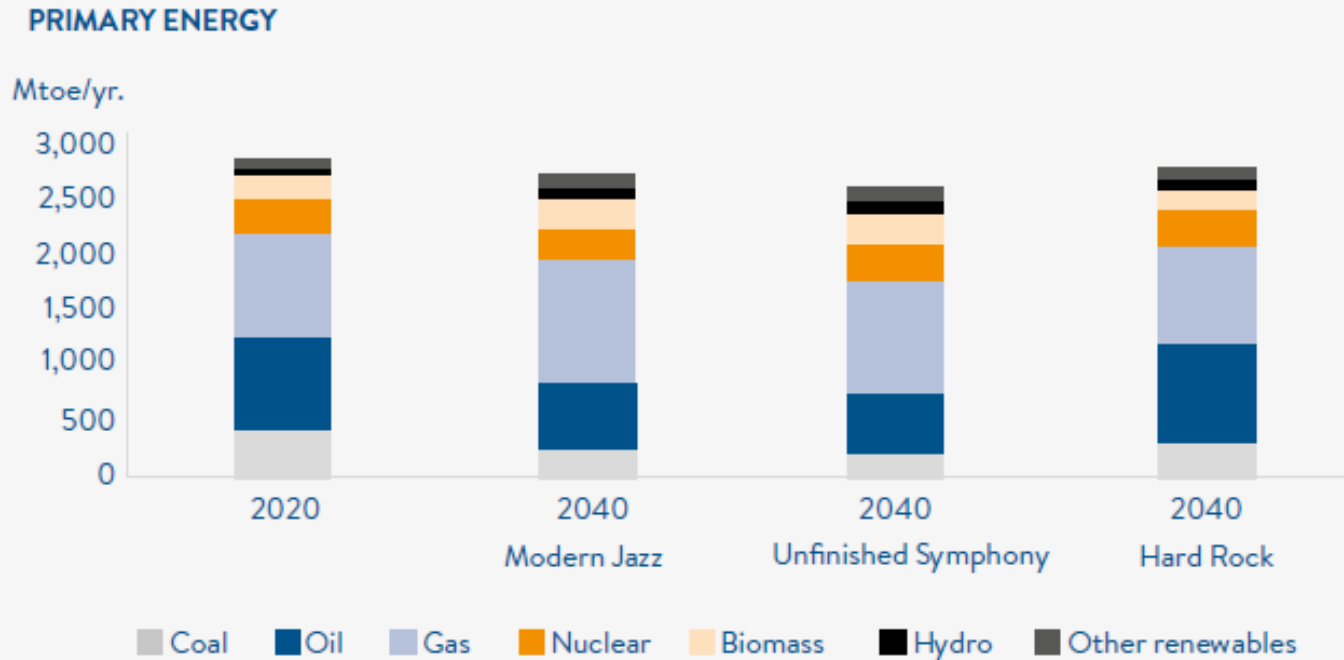


ENERGY IMPLICATIONS

Total annual primary energy supply and primary energy per capita

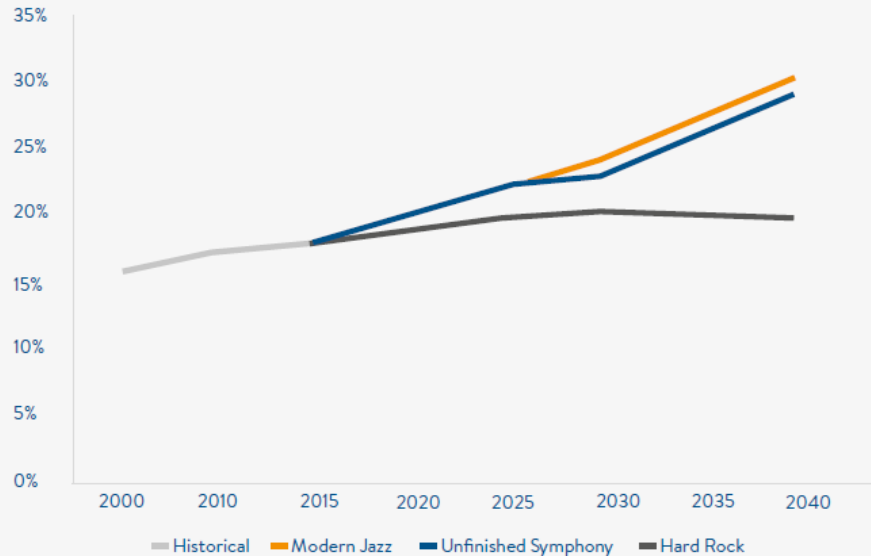


Annual primary energy by sources

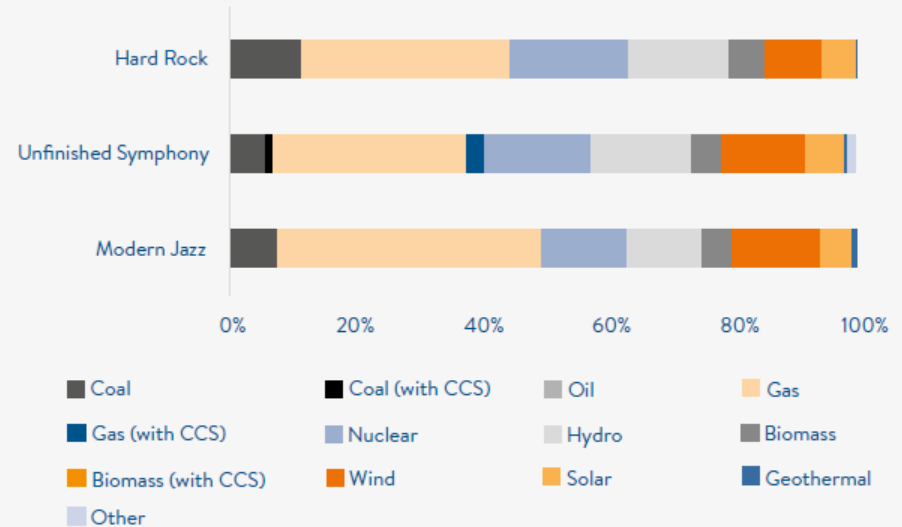


Electrification

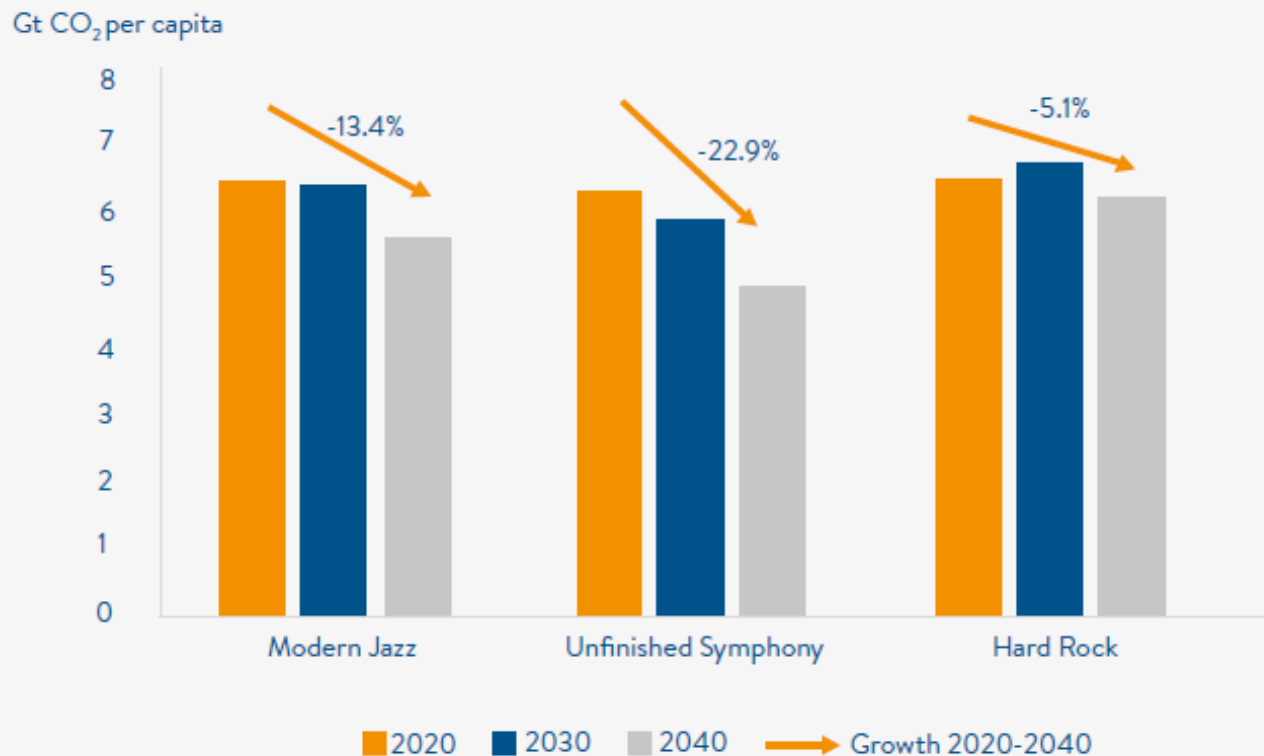
Electrification rate (% of total final energy)



Sources of electricity generation (%)



Europe carbon emission per capita



Recommendations for European leaders

POLICY MAKERS

- Engage citizens in honest discussions of whole energy transition costs and re-localisation of new market designs
- Promote sector-coupling strategies to achieve socially affordable and deeper decarbonisation
- Promote integrated policy pathfinding in relation to energy-industrial development
- Develop proactive energy infrastructure action planning, including repurposing of pipelines to progress hydrogen

ENERGY BUSINESS LEADER

- Leverage digitalisation to help identify and secure new co-benefits and synergies, e.g., smart systems integration, switching supply and storage

INVESTMENT COMMUNITY

- Promote technology neutrality in financing net-zero carbon pathways

MACRO MANAGEMENT

- Seek/encourage investment
- Focus on regional integration of pipelines and grid to enhance dynamic resilience

Thank you!