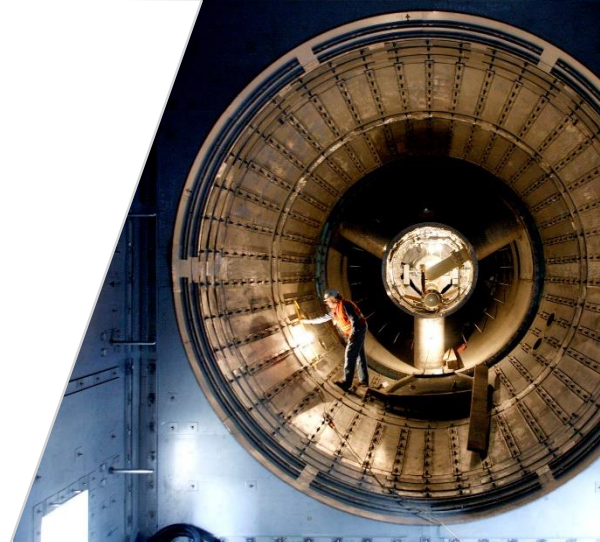


Sector Coupling in Europe

Powering decarbonization

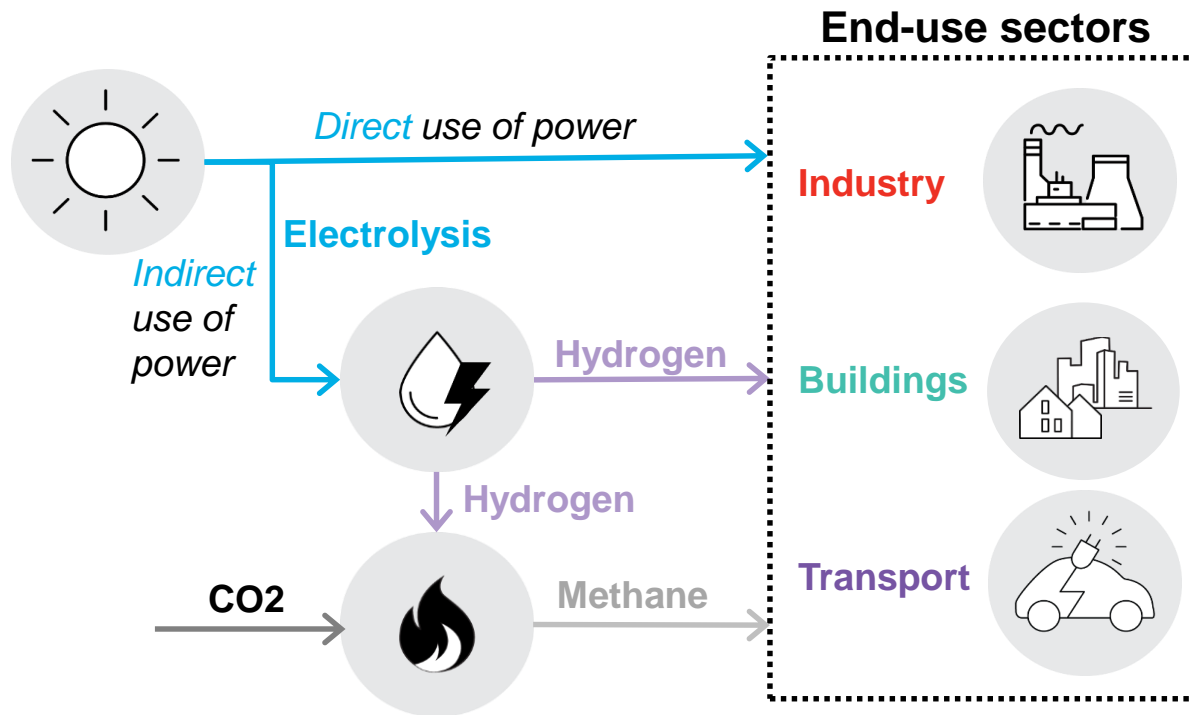
Antoine Vagneur-Jones

June 9, 2020



BloombergNEF

What is sector coupling?



Source: Robinius, M.; Otto, A.; Heuser, P.; Welder, L.; Syranidis, K.; Ryberg, D.S.; Grube, T.; Markewitz, P.; Peters, R.; Stolten, D. Linking the Power and Transport Sectors—Part 1: The Principle of Sector Coupling. *Energies* 2017, 10, 956.

Sector coupling pathway: key messages

Electricity could provide a substantial share of energy used in Europe by 2050, to the detriment of fossil fuels

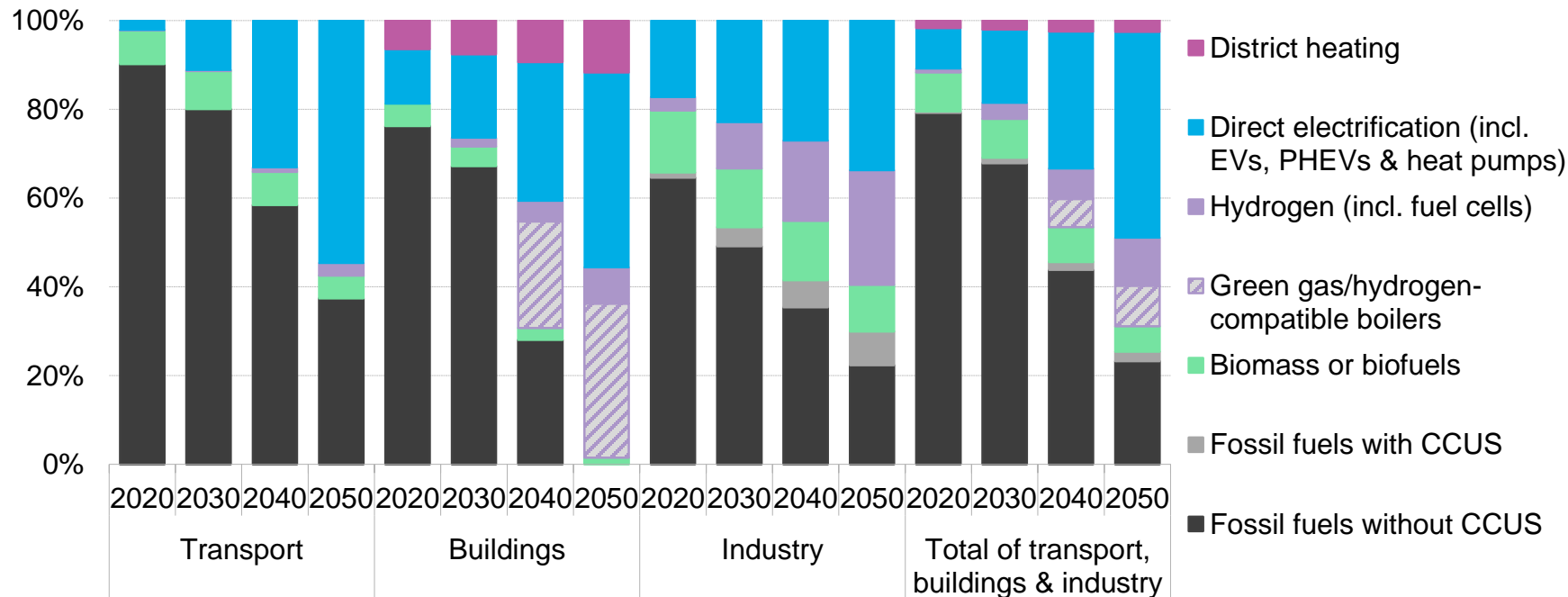
Sector coupling would make a significant contribution to climate goals

Sector coupling is a massive undertaking that will not happen without policy action

Sector coupling makes a major contribution toward net zero, but will not deliver this goal on its own

Breakdown of energy consumption

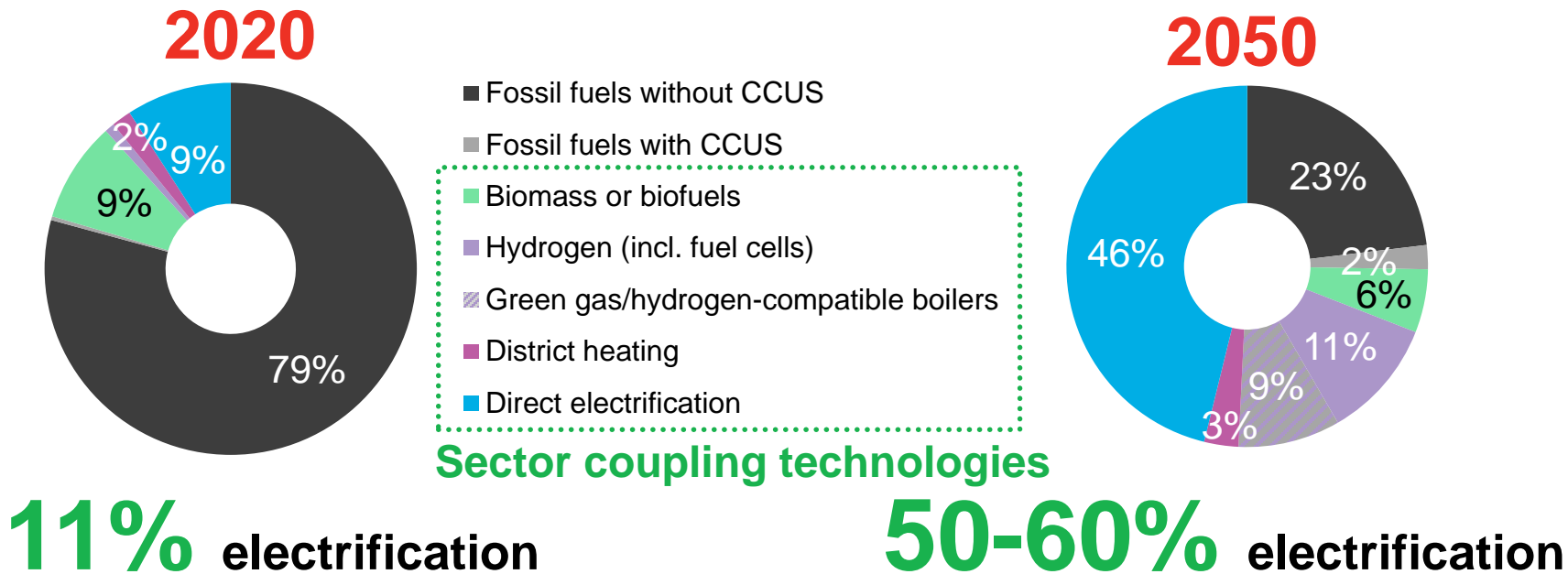
Across transport, buildings and industry in the Northern European archetype



Source: BloombergNEF. Note: Shares are weighted by each sector's and subsector's energy consumption in the Northern European archetype (Eurostat).

Impact on fuel mix

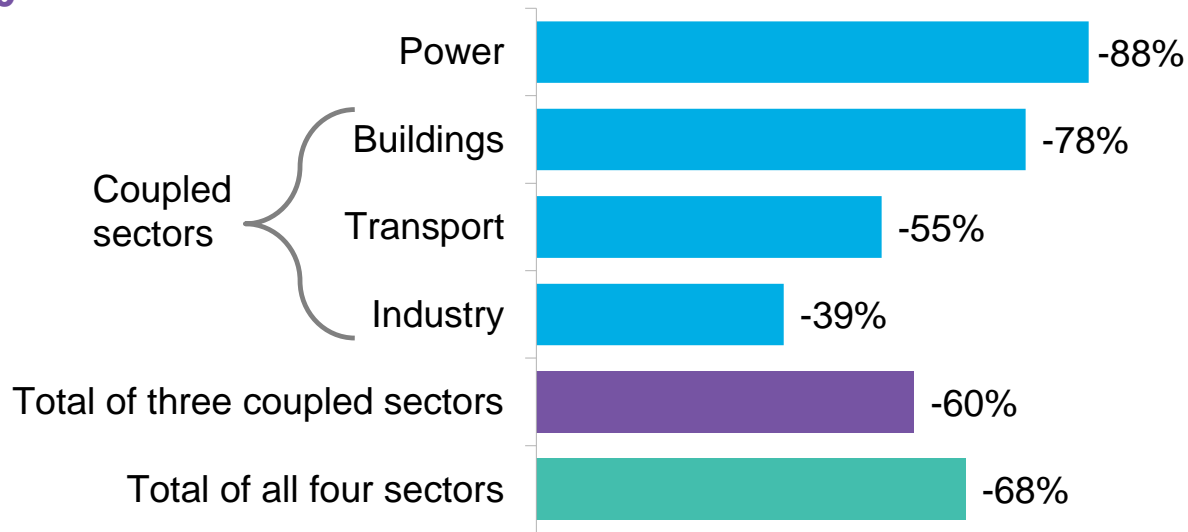
Energy consumption by fuel source in the Northern European archetype



Source: BloombergNEF. Note: Electrification totals include direct and indirect. Direct electrification includes EVs, PHEVs and heat pumps.

Impact on emissions (2020 base)

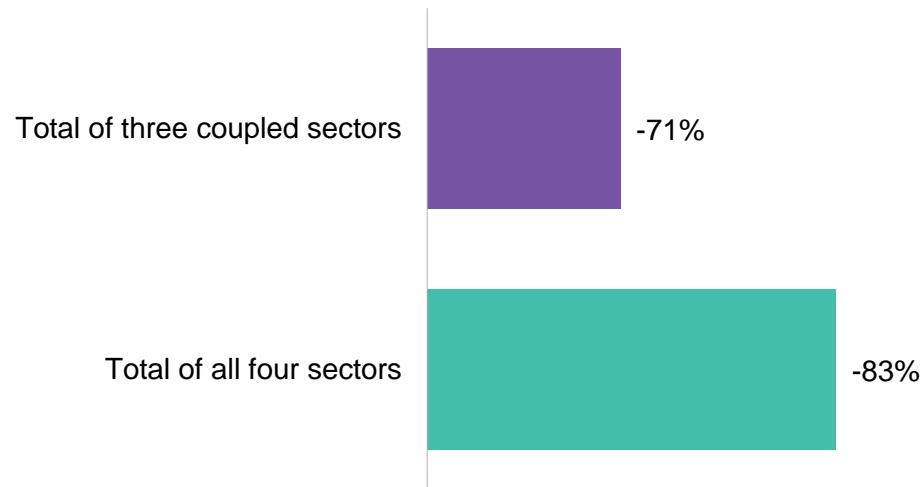
Reduction of greenhouse-gas emissions based on sector coupling pathway over 2020-50*



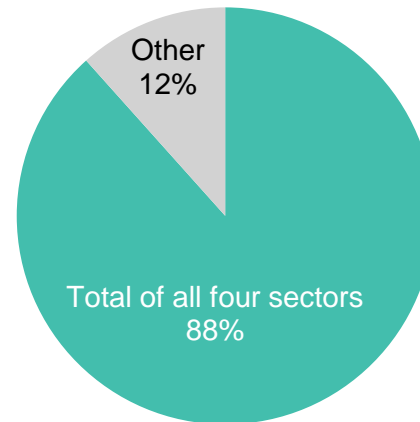
Source: BloombergNEF based on conversion factors from the U.K. government Note: * Emission-reduction estimates assume that all compatible boilers in buildings are fuelled by green gas or hydrogen.

Impact on emissions (1990 base)

Reduction of greenhouse-gas emissions based on sector coupling pathway over 1990-2050*







Breakdown of greenhouse-gas emissions in 2018



Source: BloombergNEF based on conversion factors from the U.K. government. U.K. and German government for 2018 breakdown.

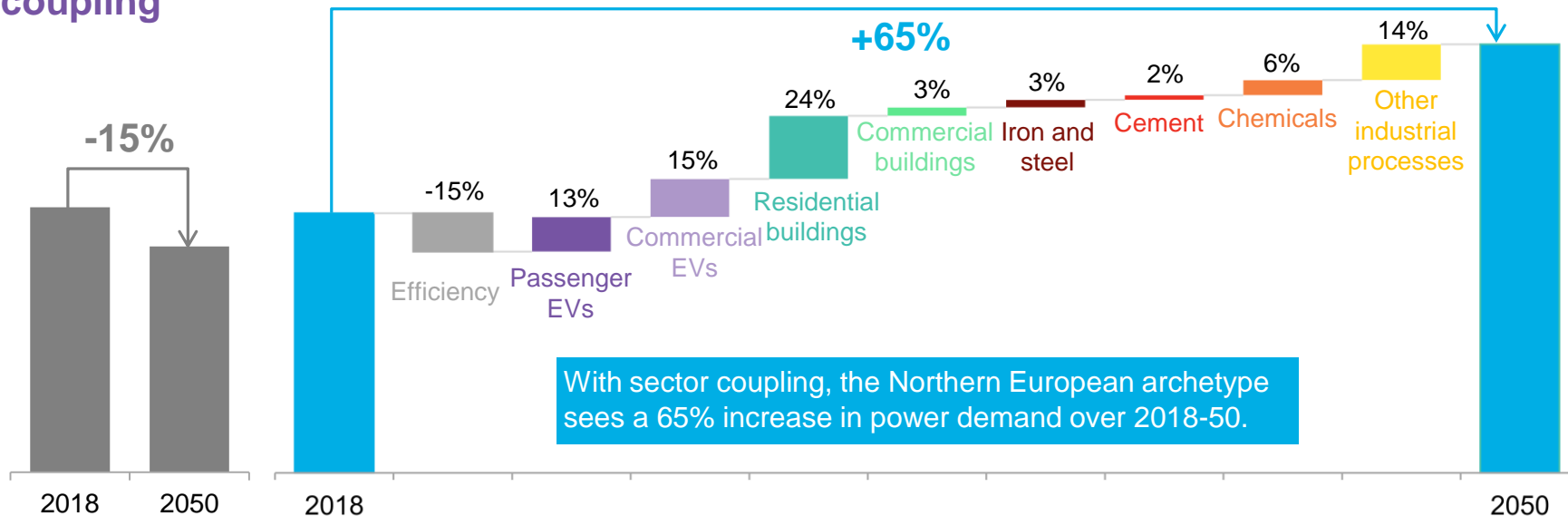
Note: * Emission-reduction estimates assume that all compatible boilers in buildings are fuelled by green gas or hydrogen

Policy enablers

-  Incentivize the reduction of emissions from building heat through, for example, bans on new connections to the gas grid, usage of oil-fired boilers, and mandates on rental properties
-  Successful implementation of ICE ban for passenger vehicles
-  Implement policies to promote decarbonization of industry while preventing carbon leakage
-  Introduce incentives, and eliminate regulatory barriers, to enable the development of a market for green hydrogen, to drive investment and reduce costs

Change in total electricity demand in Northern European archetype

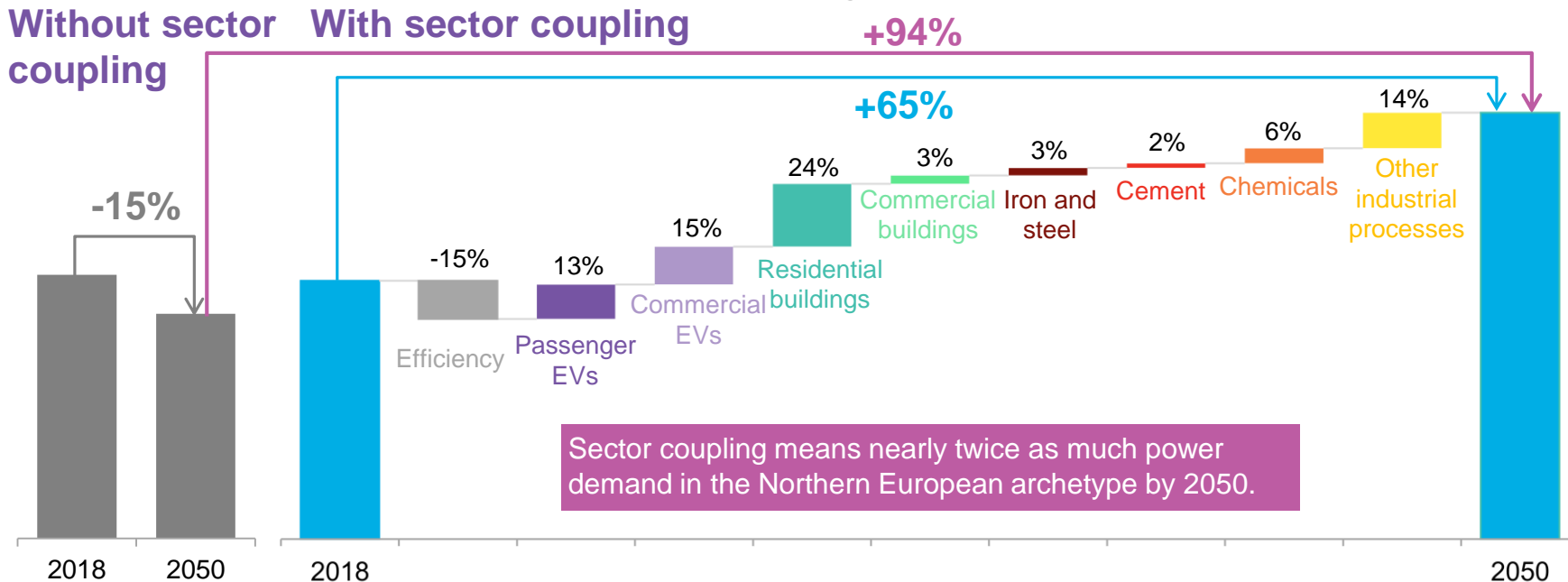
Without sector coupling With sector coupling
coupling



With sector coupling, the Northern European archetype sees a 65% increase in power demand over 2018-50.

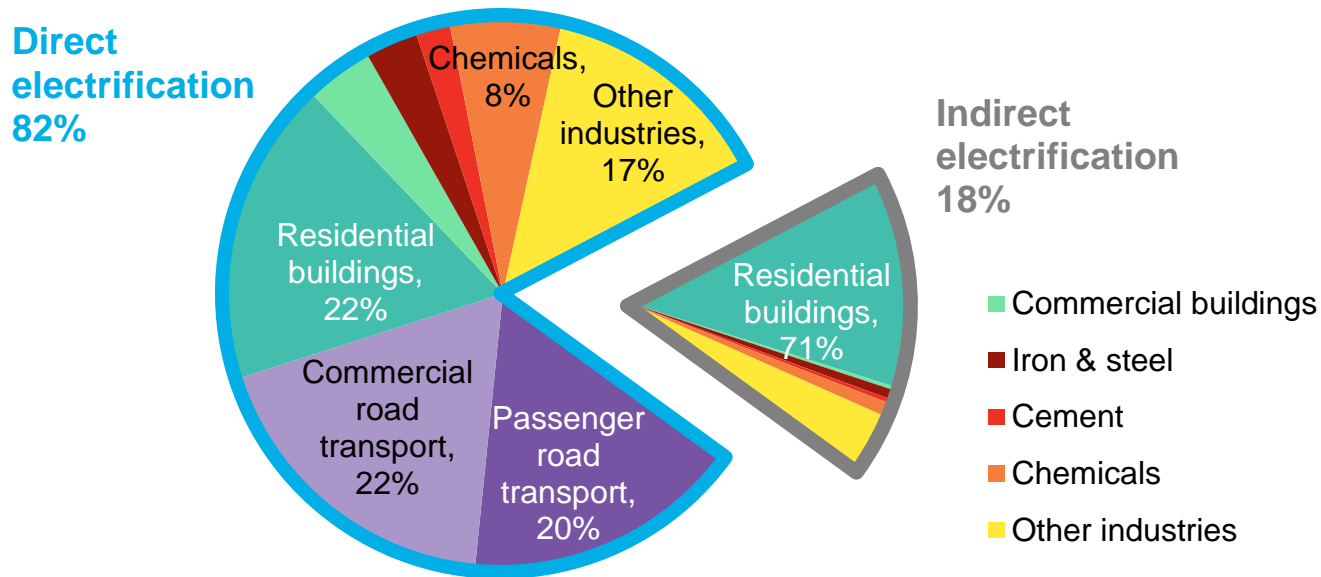
Source: BloombergNEF. Note: The waterfall chart includes direct and indirect electrification. Excludes the minor volume of power demand from aviation, shipping and district heating

Change in total electricity demand in Northern European archetype



Sector coupling means nearly twice as much power demand in the Northern European archetype by 2050.

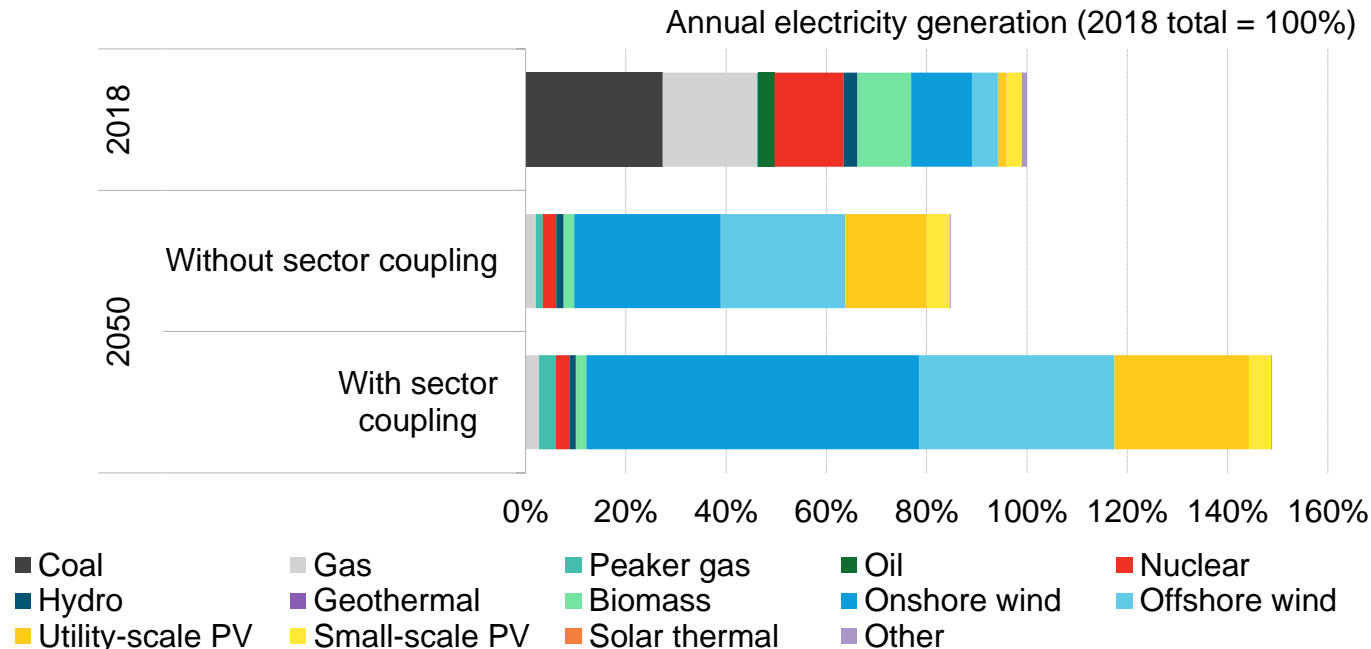
Breakdown of power demand from sector coupling, 2050



Source: BloombergNEF. Note: "Indirect" electricity demand refers to power-to-X / hydrogen electrolysis to meet energy demand. Percentages for each subsector relate to their share of direct and indirect electrification demand. Assumes residential and commercial buildings still on the gas grid are fuelled by hydrogen, of which 16% is produced by electrolysis.

Impact on supply

Change in electricity mix by 2050, Northern European archetype

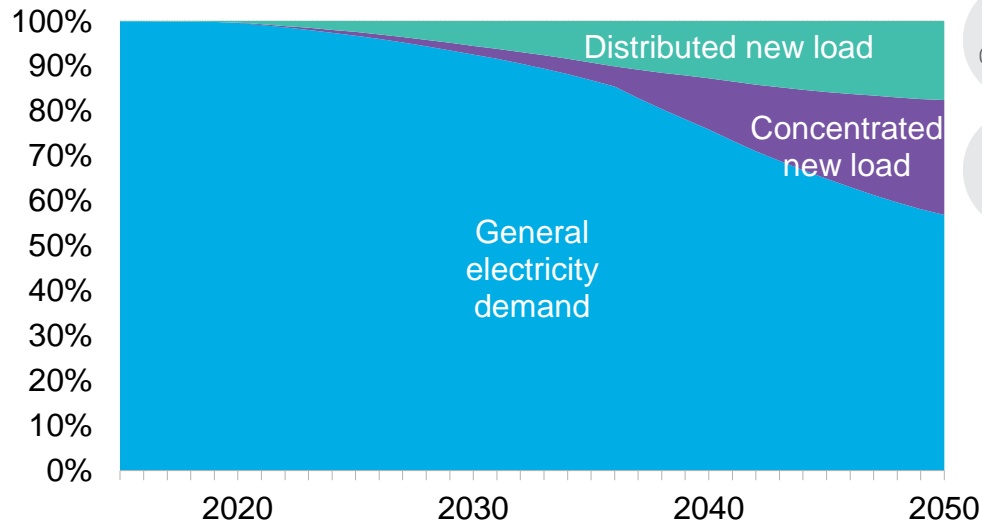


Source: BloombergNEF. Note: Includes direct electricity demand only

New sources of flexibility

Share of coupled demand by load type in Northern European archetype

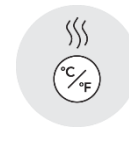
Share of electricity demand



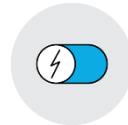
Examples of new demand-side flexibility sources



Dynamic* EV charging



Smart heating, thermal storage



Industrial demand response

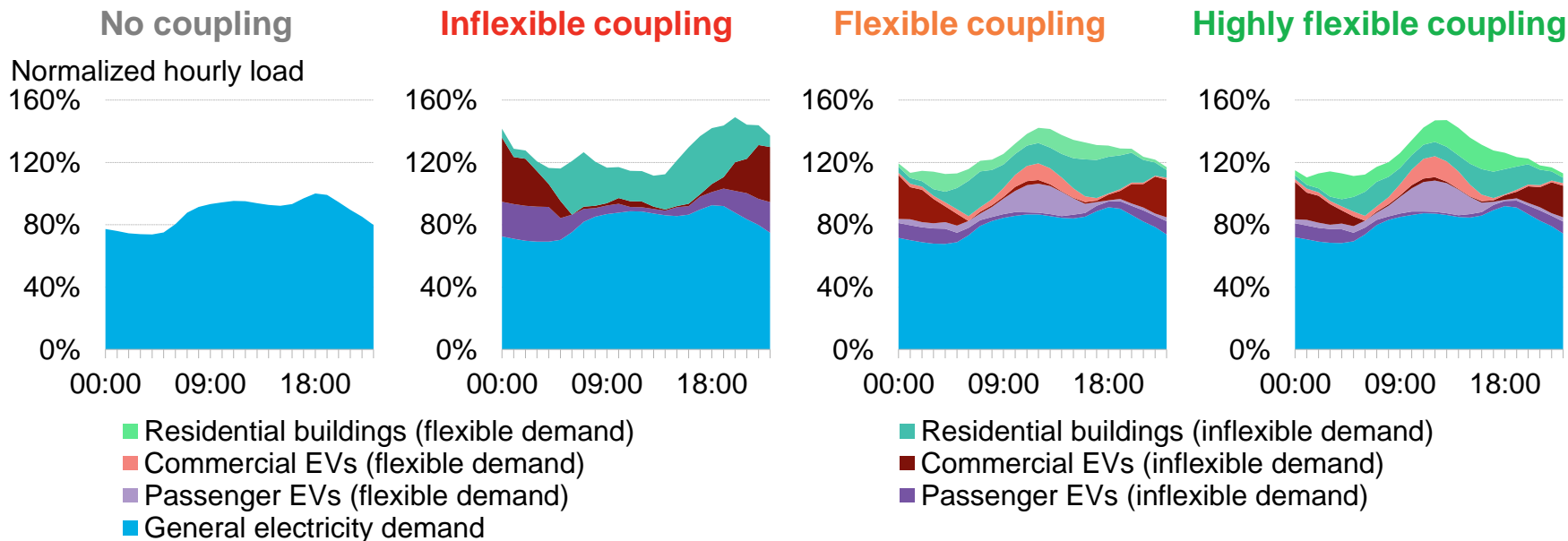


Commercial EV fleet hubs

Source: BloombergNEF. Note: Commercial buildings, industrial heat electrification and commercial EV demand are assumed to be potential sources of concentrated new demand

Impact on intraday demand (EVs and residential buildings)

Demand profiles for Northern European archetype (typical winter day in 2050)



Source: BloombergNEF. Note: Charts are normalized to the value of the peak load in the 'no coupling' scenario.

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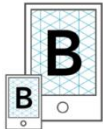
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