CHINA 2050: A FULLY DEVELOPED RICH ZERO-CARBON ECONOMY

DEMAND-SIDE DECARBONIZATION

DEMAND REDUCTION, ENERGY EFFICIENCY IMPROVEMENT, AND FUEL SWITCH

STEEL

- Scaling up secondary steel production with scrap and EAF;
- Promoting hydrogen direct reduced iron (DRI) and other technologies;
- Applying CCS to traditional steelmaking.

CEMENT

- Improving material efficiency;
- Using zero-carbon energy as heat input;
- Applying CCS for emissions from fossil fuel and production process.

CHEMICALS

- Promoting efficient use of fertilizers and plastics circularity;
- Applying CCS to fossil fuel-based production routes;
- Substituting conventional feedstocks with CO_2 and zero-carbon H_2, or biomass.

SURFACE TRANSPORT

- Controlling travel growth with smart planning and development of subways and railways;
- Promoting electrification for light vehicles and heavy road transport with BEVs and FCEVs.

SHIPPING AND AVIATION

- Applying electric engines for short-distance travels;
- Promoting hydrogen and ammonia as shipping fuels;
- Supporting bio and synthetic jet fuel development and application.

BUILDING

- Stepping up electrification, including expanding use of heat pumps;
- Demanding higher building energy efficiency;
- Utilizing biomass, industrial waste heat, and solar thermal where applicable.

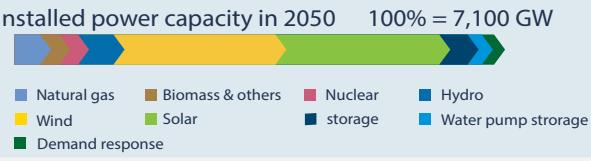
SUPPLY-SIDE DECARBONIZATION

TECHNICALLY AND ECONOMICALLY FEASIBLE

ELECTRICITY

- 0.8%: China's land for 2,500 GW solar PV
- 70%: onshore wind resource to utilize
- 660 GW+230 GW: hydro + nuclear power standing by
- Energy storage, flexible generation,and demand response: to address flexibility
- >60%: LCOE reduction for renewables and batteries by 2050

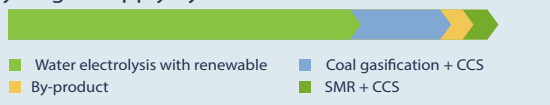
Installed power capacity in 2050 100% = 7,100 GW



H_2 HYDROGEN

- $20/MWh, $370/kW: max electricity price and electrolyzer capital cost for electrolysis to achieve cost parity with coal gasification without CCS
- 2600 TWh: electricity use to produce 58 Mt hydrogen

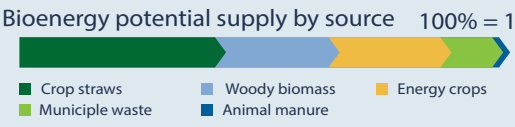
Hydrogen supply by source 100% = 81 Mt



BIOMASS

- 17 EJ/a: max potential biomass resource, considering loss and land use
- 13 EJ/a: prioritized demand for aviation, chemical, and power generation
- Supply uncertainties: resource limitation, land use competition, collection costs and technology improvement

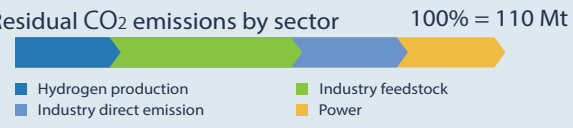
Bioenergy potential supply by source 100% = 17 EJ



CO_2 CARBON CAPTURE & STORAGE

- 1,500 Gt: practical storage capacity
- $55/tonne CO_2: average total costs of capture, transportation and storage now with likely further cost reduction in future
- 1.1 Gt CO_2: total CCS capacity required per annum, with 90% capture efficiency to leave only 110 Mt residual emission

Residual CO_2 emissions by sector 100% = 110 Mt



Meeting these energy demands in a zero-carbon fashion will require a major change in the mix of energy supply, with massive direct or indirect electrification, use of biomass and CCS, and significant reduction of fossil fuels.

Final energy mix in a zero-carbon scenario

Electricity demand by sector

100% = 15,000 TWh

TOTAL COST TO DECARBONIZE < 1% CHINA'S GDP
With minimal cost to end-users

POLICY INSTRUMENTS

For more information: www.energy-transitions.org