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ACHIEVING NET ZERO CO2 EMISSIONS IN NEPAL: THE ROLE OF CLEAN ENERGY OPTIONS

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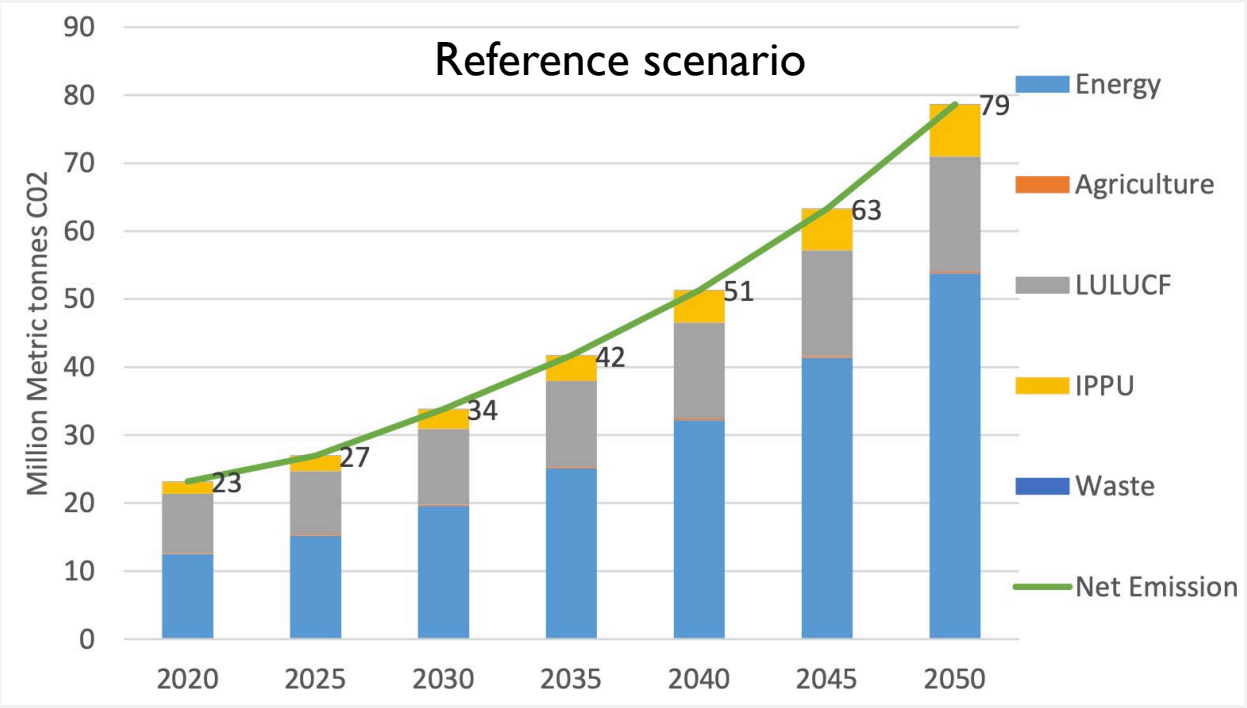
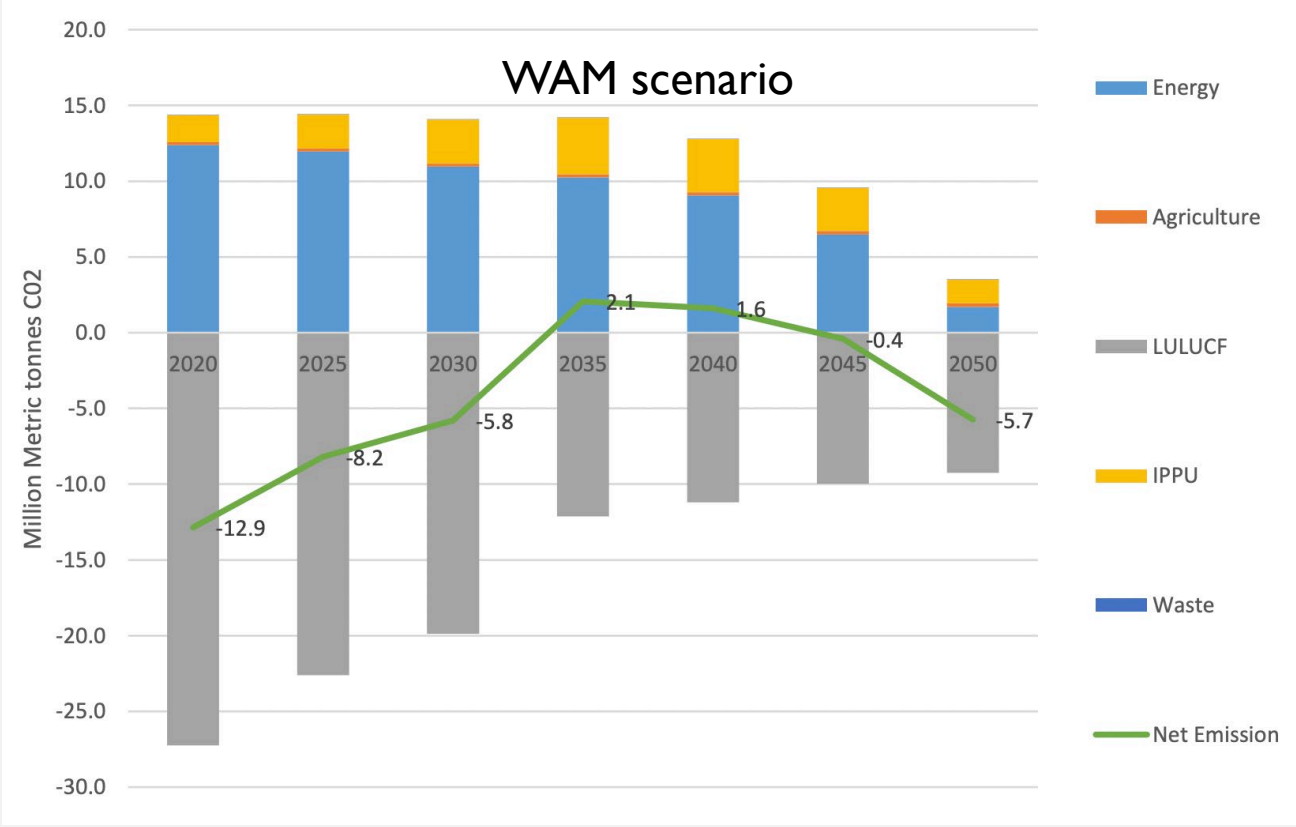
OUTLINE

1. Nepal's Long-term Strategy for Net Zero CO2 Emissions
2. Nepal's Energy Resources
3. Scenario Description
4. Analysis of BAU and NZE Scenarios
5. Final Remarks and Future Works

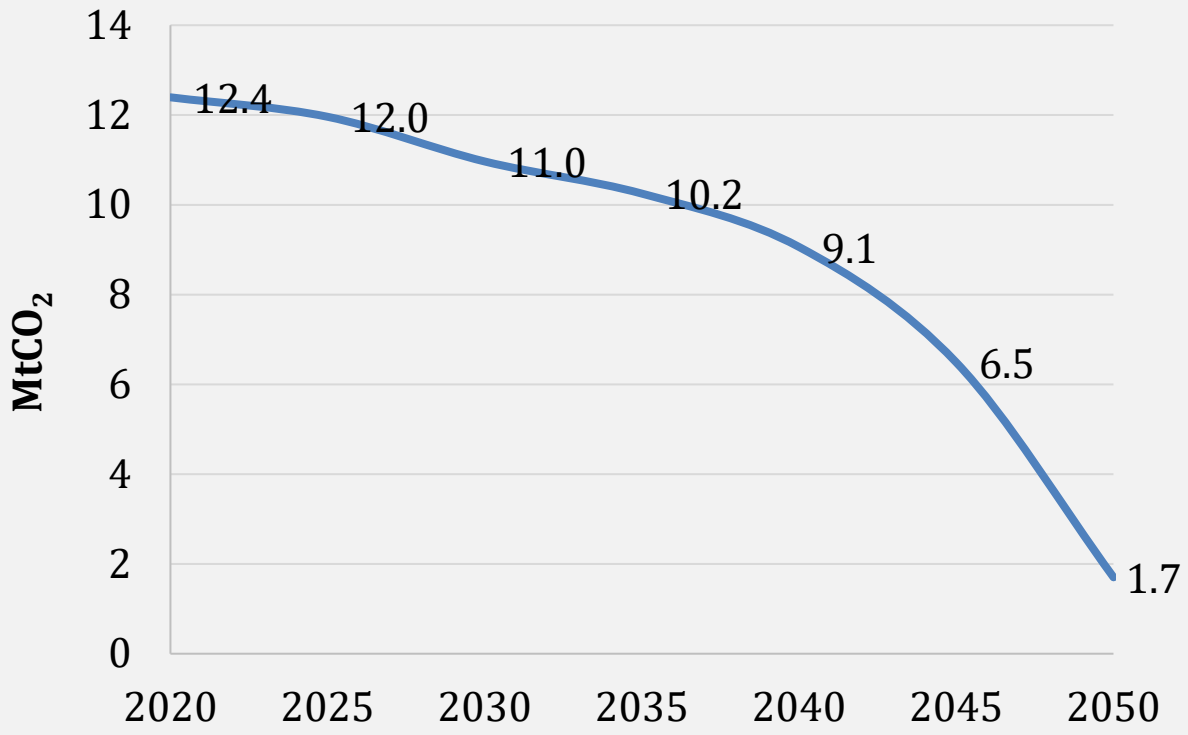
NEPAL'S LONG-TERM STRATEGY (LTS) FOR NET ZERO CO2 EMISSIONS





Source: GoN (2021), Nepal's Long-term Strategy for Net-zero Emissions

CO2 EMISSION PATHWAY OF ENERGY USING SECTORS UNDER THE ALTERNATIVE MEASURES (WAM) SCENARIO OF LTS



Source: GoN (2021), Nepal's Long-term Strategy for Net-zero Emissions

SCENARIOS DESCRIPTION

BAU

- Energy and technology usage follow historical pattern

NZE_ELY (i.e., NZE without H2)

- CO2 emission pathway in the energy sector follows LTS trend
- Electrification in all possible end-uses
- No hydrogen-based technologies

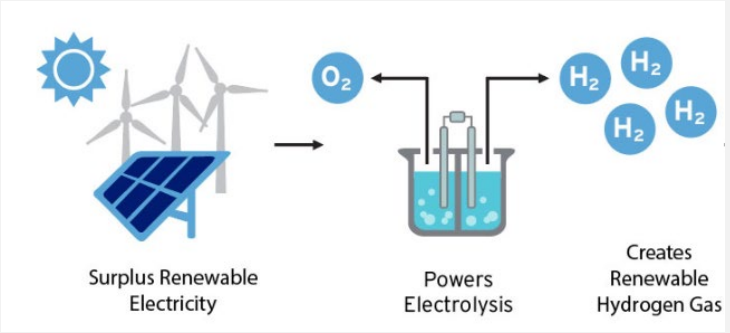
NZE_ELY+H2 (NZE with H2)

- CO2 emissions pathway in the energy sector follows LTS trend
- Electrification in all possbile end-uses
- Hydrogen based technologies to reduce emissions from hard-to-abate sectors from 2035 onwards

NEPAL'S CLEAN ENERGY RESOURCES ARE HIGHLY UNDERUTILIZED

	TWh	MW	Capacity utilized (MW)
Hydropower[a]	-	83,000	2,081
Solar[b]	66-98	-	54
Wind[c]	-	3000	NA
Oil reserve	nil	-	
Coal reserve	nil	-	
Natural gas reserve	nil	-	

Shrestha(1966), [b]ADB (2021), [c]AEPC(2008)



HARD-TO-ABATE SECTORS IN NEPAL

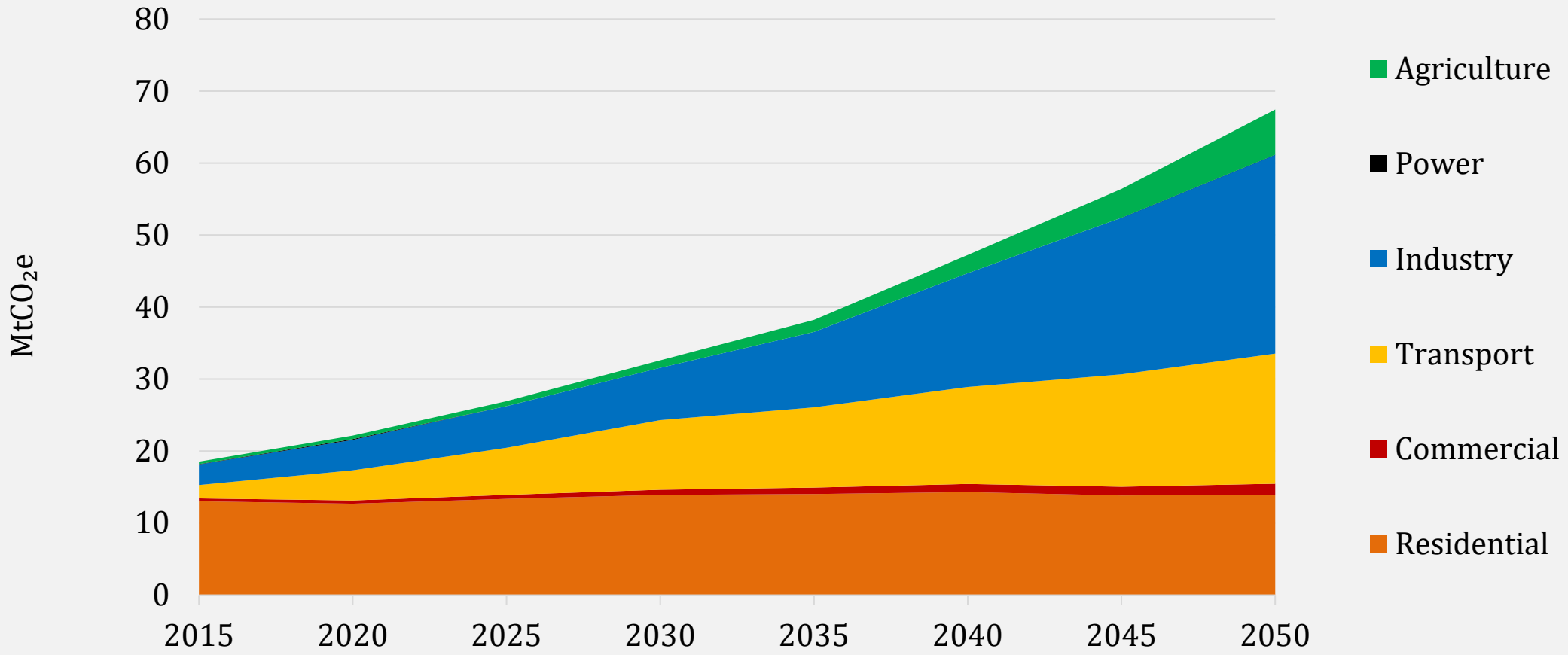
- Long-distance road transport
- Aviation
- Cement industry

SCENARIOS ASSUMPTIONS

		Business-as-usual	NZE_ELY	NZE_ELY+H2
Electric-transport	LDVs	-	Full	Full
	HDVs	-	**Partial**	Full
Biofuels in transport	All		Full	Full
Hydrogen-based fuel and technologies in transport	LDVs	-	-	Full
	HDVs	-	-	Full
	Aviation	-	-	**Partial**
Electrification in industry	Cement	-	-	-
	Brick	-	Full	Full
	Paper and pulp	-	Full	Full
	Iron & steel			
	Others (Process heat)	-	Full	Full
Hydrogen-based fuel and technologies in industry	Cement	-	-	**Partial**
Electrification in residential and commercial	All heating applications	-	Full	Full

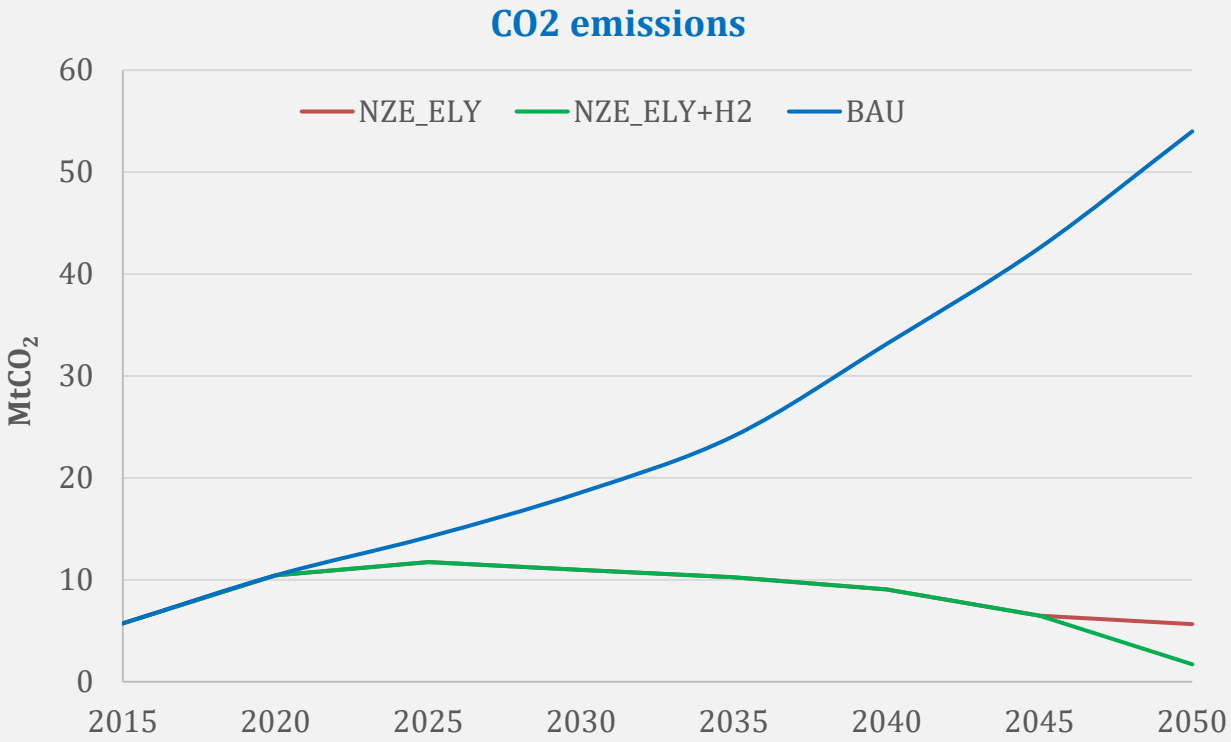
Analysis of BAU and NZE Scenarios

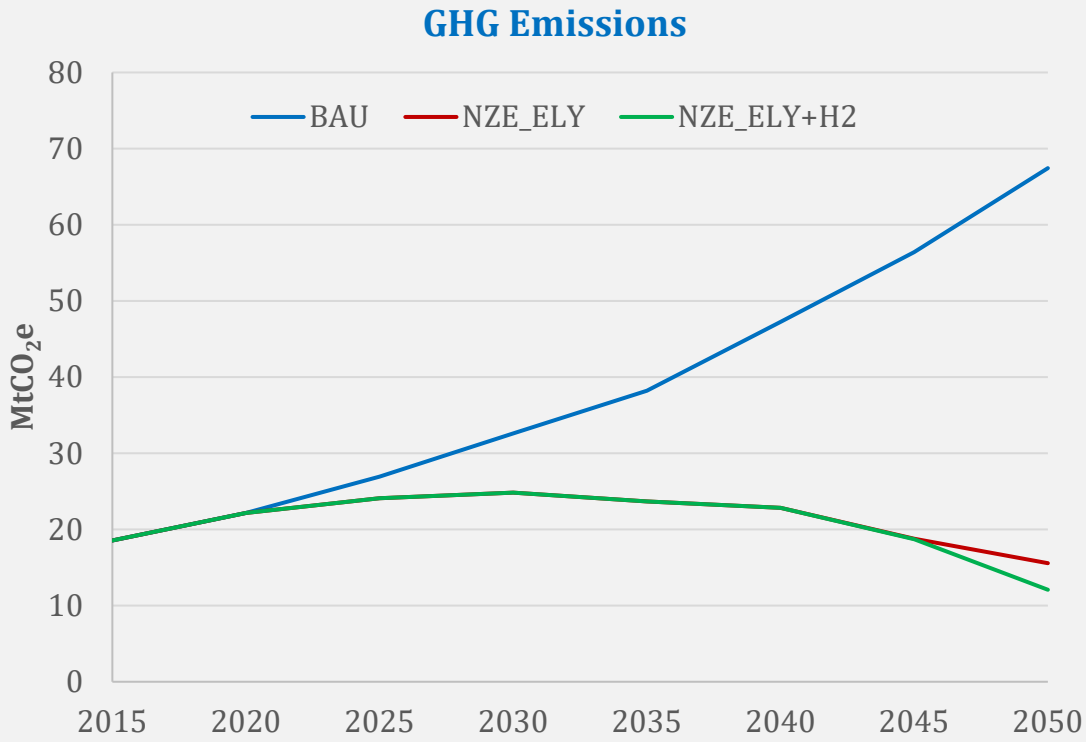
GHG EMISSIONS FROM ENERGY USING SECTORS IN BAU



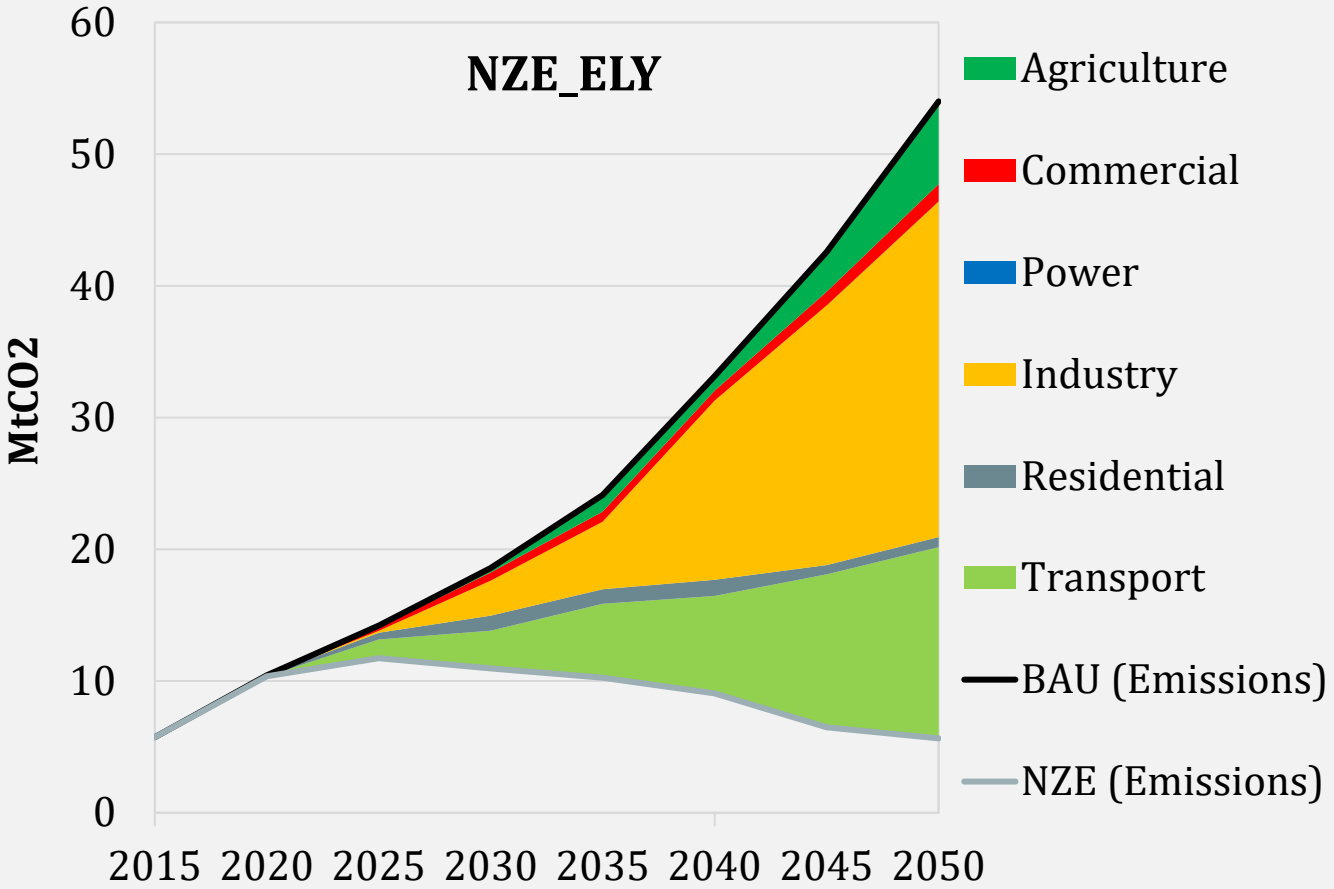
- GHG emissions in BAU would increase by 3 times during 2020-2050
- Industry and transport sectors would be the two highest emitting sectors by 2050

CO2 AND GHG EMISSIONS FROM ENERGY USING SECTORS IN BAU AND NZE SCENARIOS

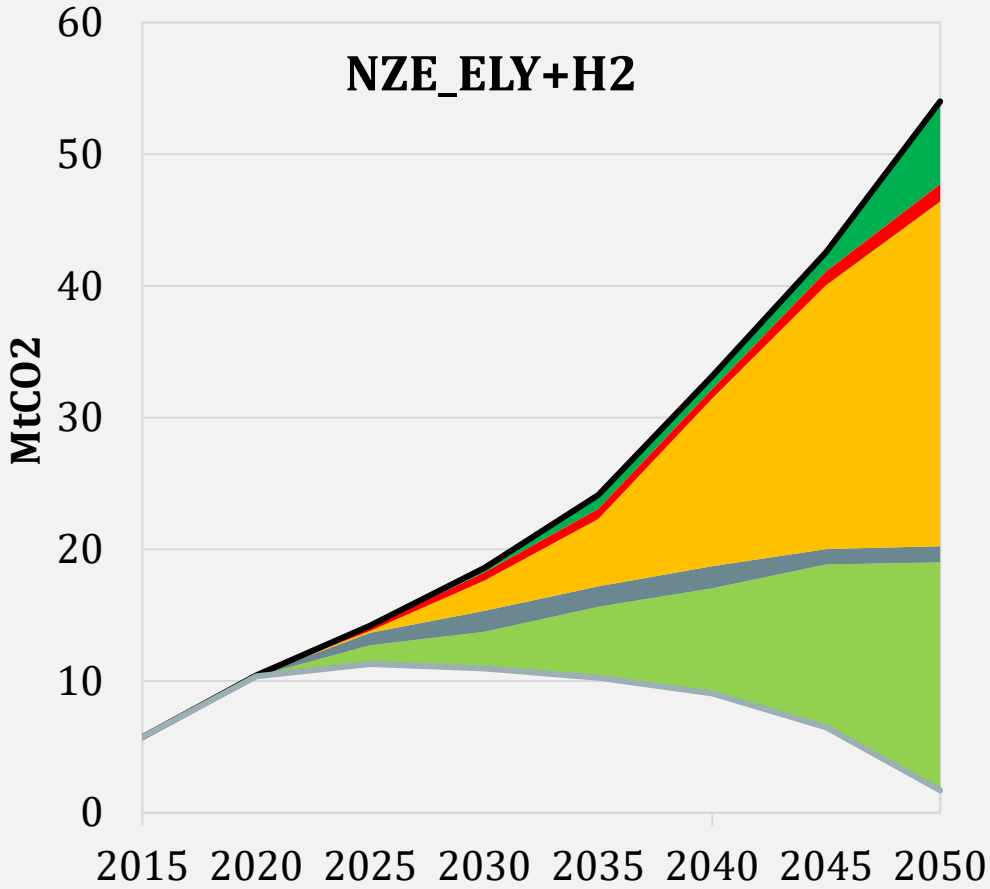




CO2 EMISSIONS REDUCTIONS BY SECTOR IN NZE SCENARIOS

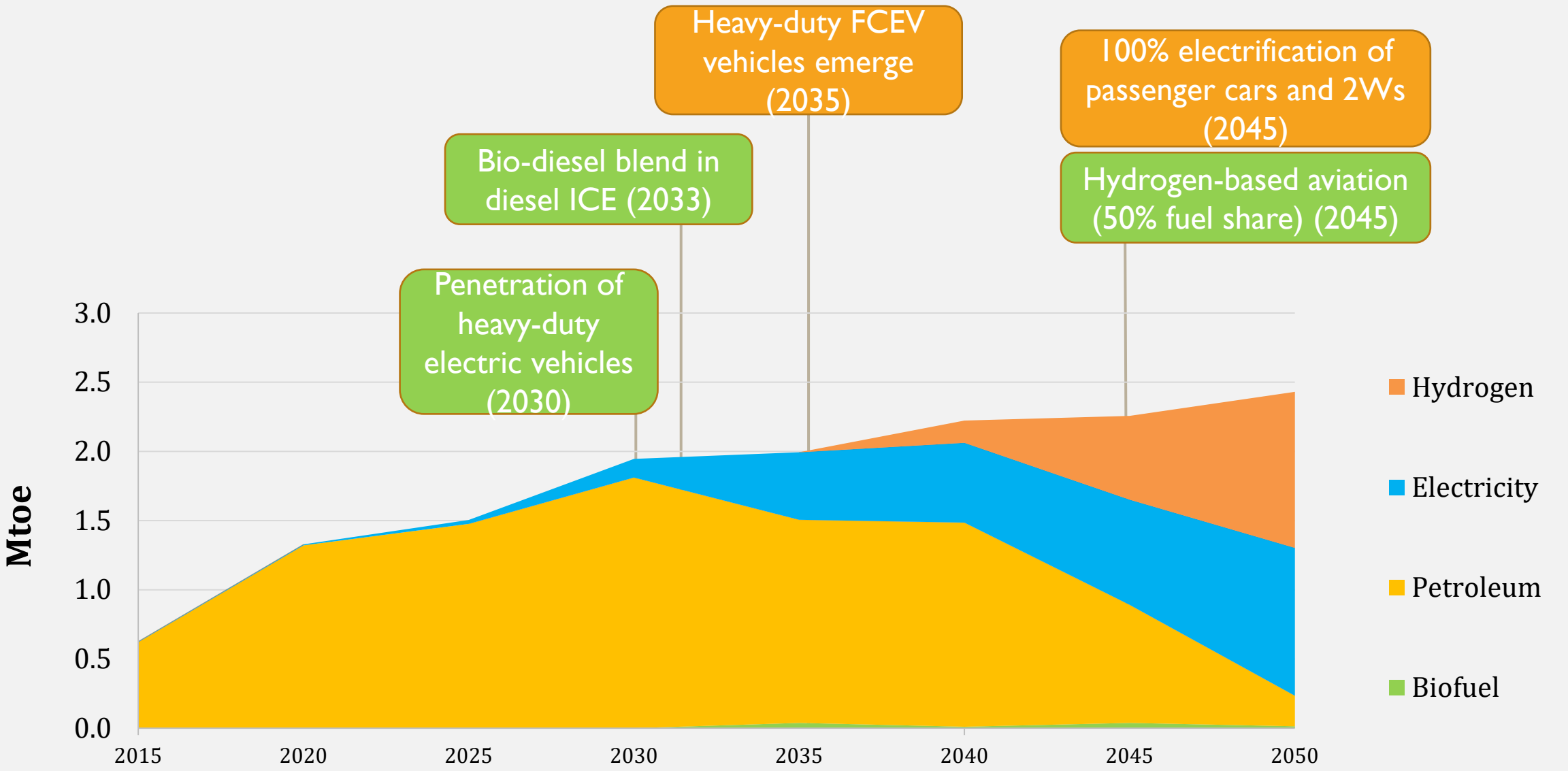


- Reduction in CO2 emissions in NZE_ELY
  - 90% (48.4 MtCO2 in 2050)
  - 63% in cumulative CO2 emission (560 MtCO2) during 2020-2050
- GHG emissions redution in 2050 by 77%

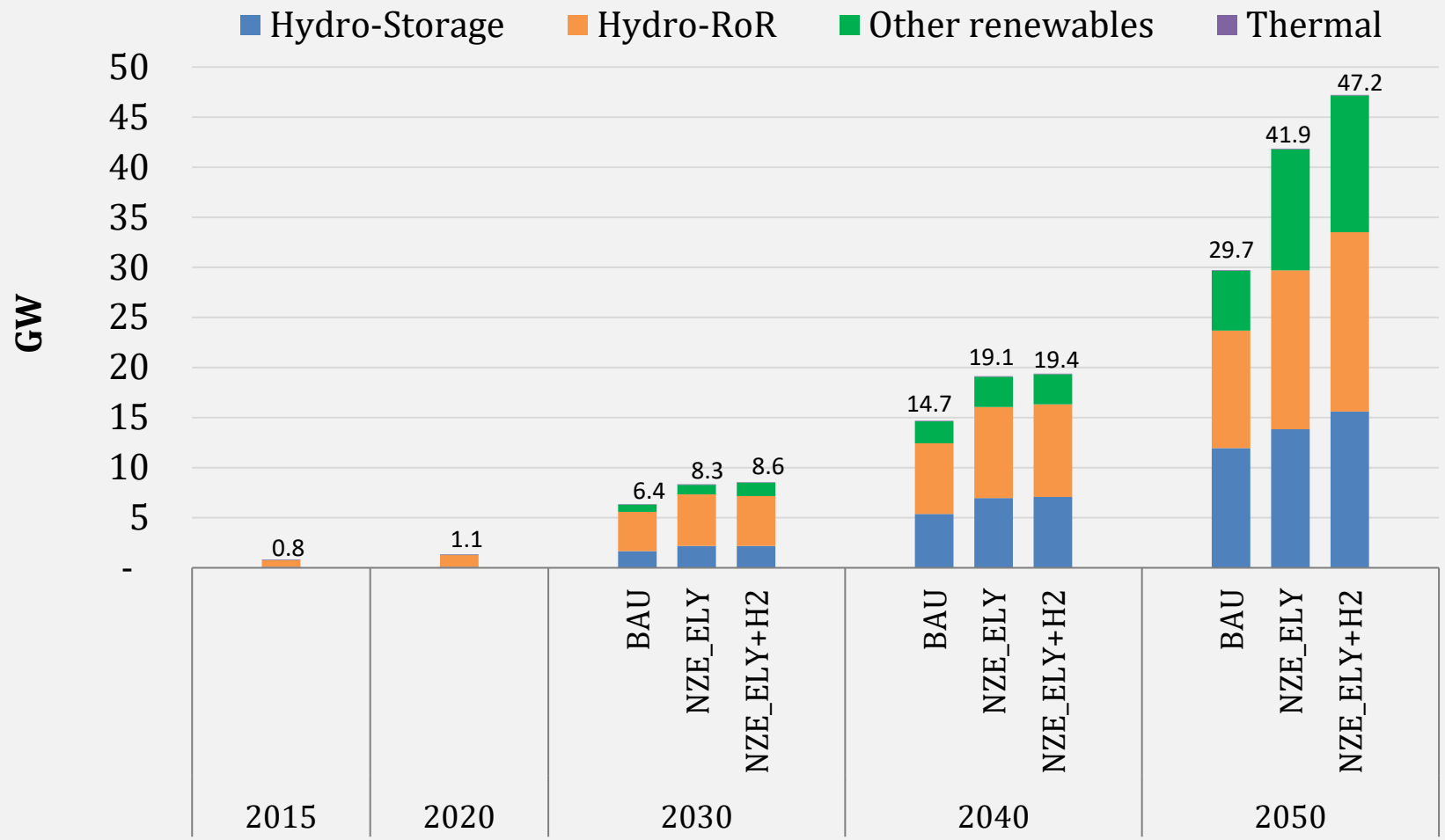


- Reduction in CO2 emissions in NZE_ELY+H2
  - 97% (52.3 MtCO2 in 2050)
  - 66% (573.6 MtCO2) during 2020-2050
- GHG emissions redution in 2050 by 82%

FINAL ENERGY CONSUMPTION IN TRANSPORT IN NZE_ELY+H2

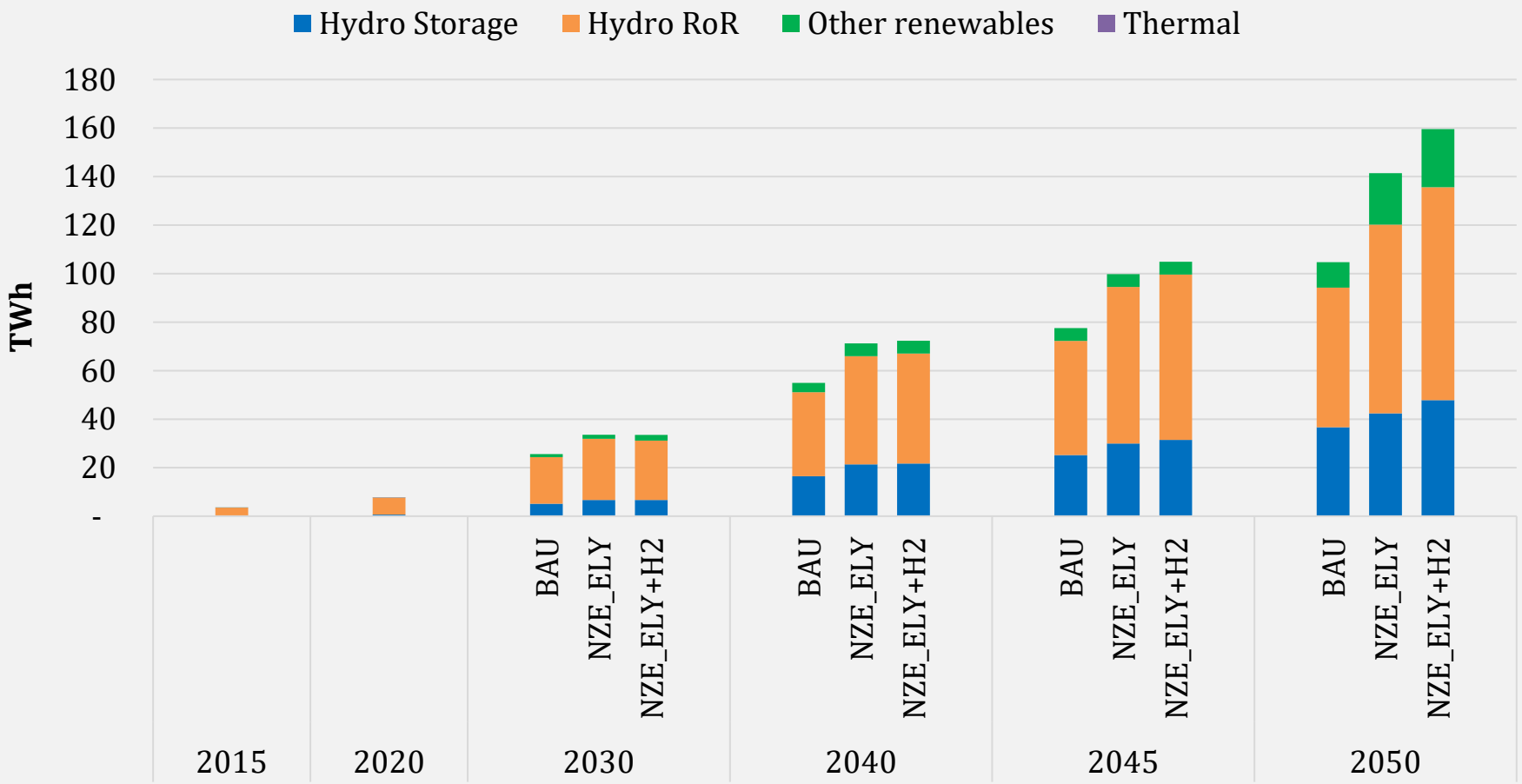


IMPLICATION FOR POWER GENERATION



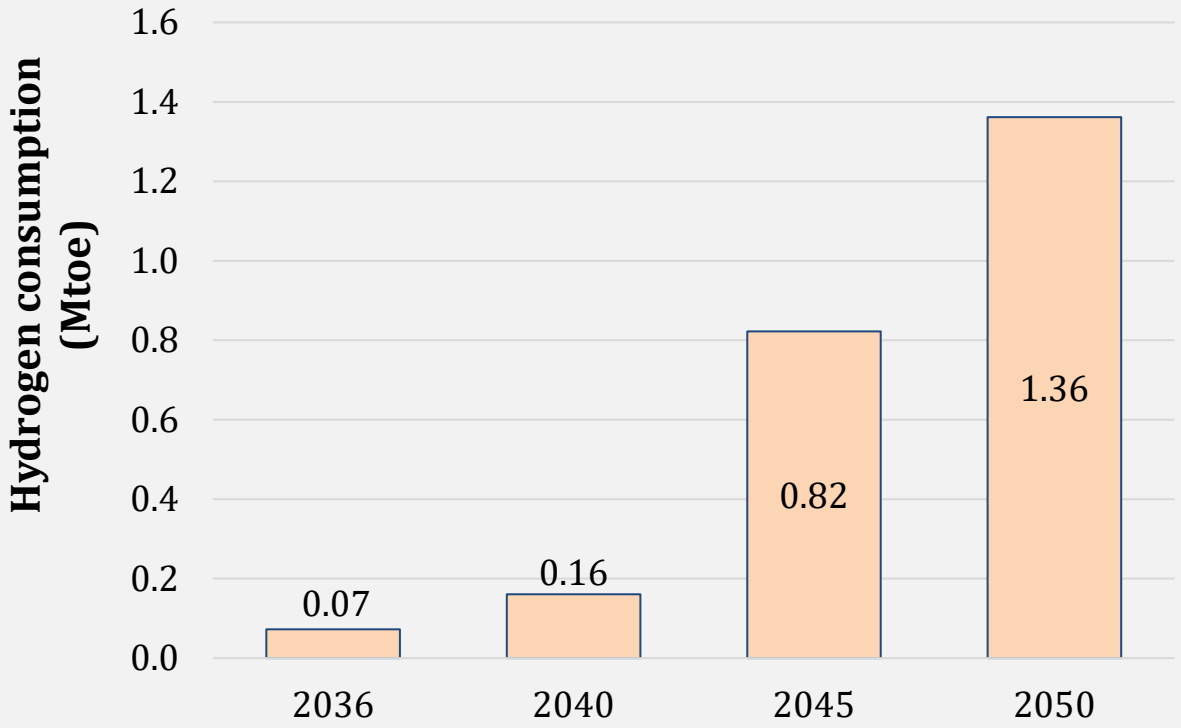
- Installed capacity would reach 29 GW in BAU, 42 GW in NZE_ELY and 47 GW in NZE_ELY+H2 by 2050

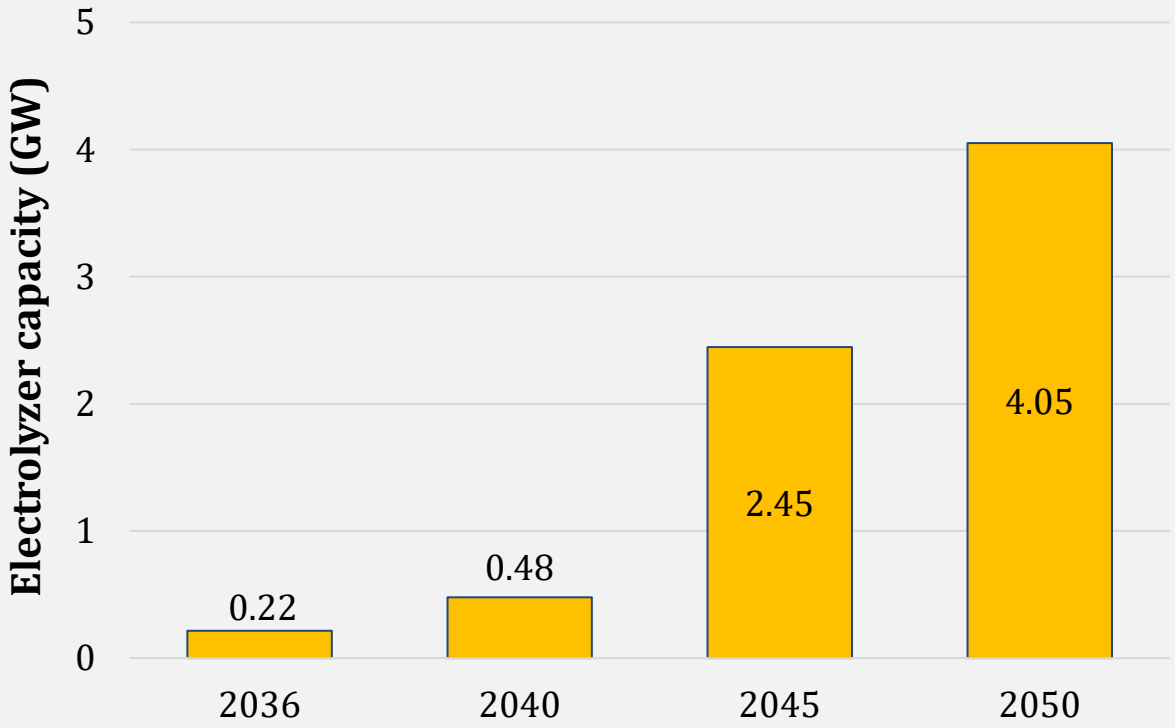
IMPLICATION FOR POWER GENERATION



- Electricity generation increases by 12 folds during 2020-2050 in BAU
- In 2045, electricity generation would increase by
  - 29% in NZE_ELY and 35% in NZE_ELY+H2
- In 2050, electricity generation would increase by
  - 35% in NZE_ELY and 52% in NZE_ELY+H2

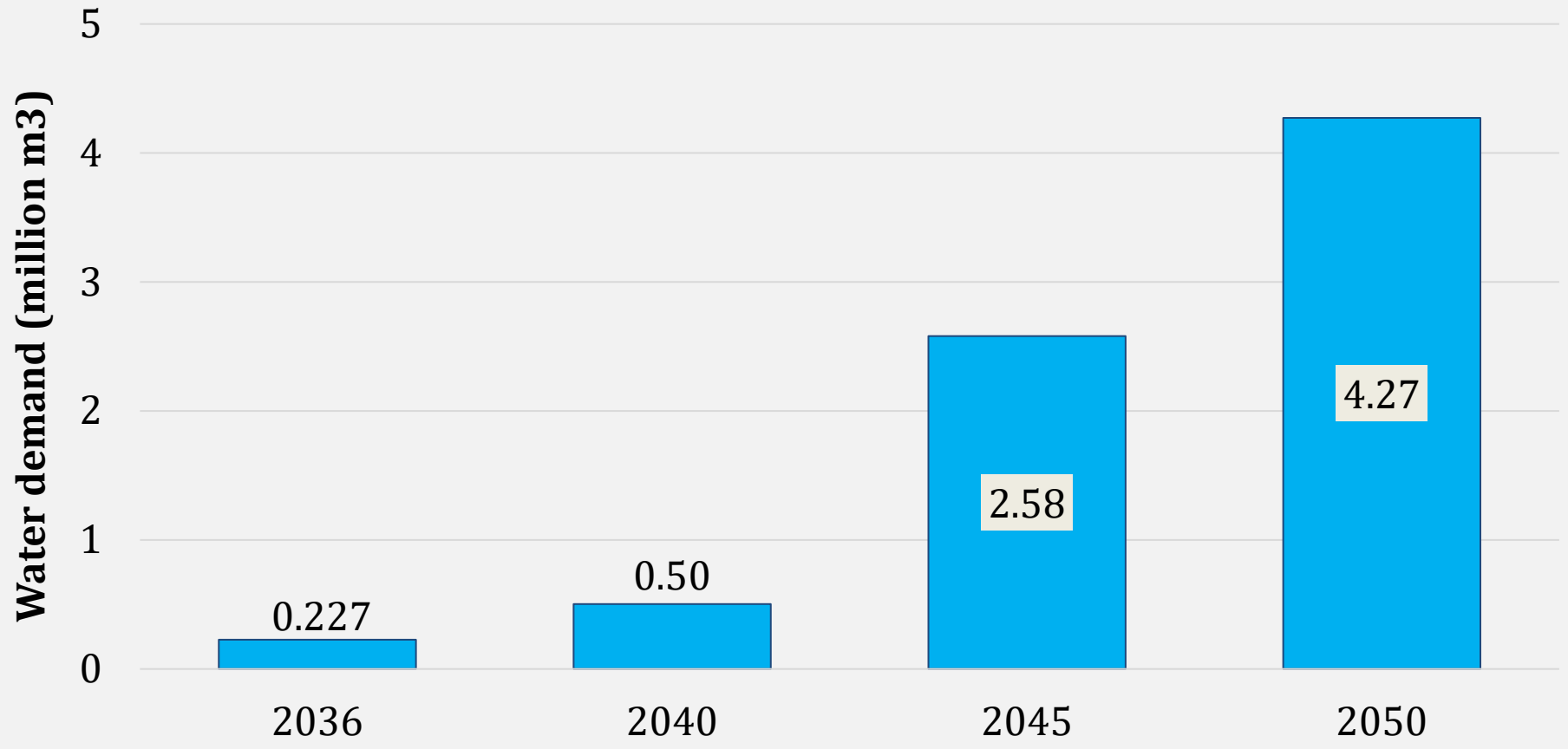
HYDROGEN REQUIREMENT IN NZE_ELY+H2





- Hydrogen would be mainly used in the transport sector
- In cement industry, hydrogen would be used to meet heat demand partially.

FRESH WATER DEMAND FOR HYDROGEN PRODUCTION IN NZE_ELY+H2



FINAL REMARKS AND FUTURE RESEARCH

- The levels of electrification and green hydrogen needed in this presentation are related to only CO2 emission mitigation from energy using sectors.
- If non-CO2 mitigations are considered, higher level of electrification and hydrogen use in the industry sector would be necessary.
- Larger CO2 emission reduction needed after 2045 will be highly dependent on development of hydrogen-based technologies, in particular, electrolyzers and technologies like FCEV, hydrogen based turbines, boilers, etc.
- The sustainability of NZE beyond 2045 will also depend on the level of carbon sequestration from LULUCF. The level of future sequestration presented in LTS seems controversial (difficult to understand!).
- Most importantly, the level of investment in infrastructure development for transition to electrification and hydrogen scenario as well as other additional costs can be very significant. Therefore a major question remains: if the investment requirements and other costs of meeting the NZE target in 2045 will be affordable to a country like Nepal?

THANK YOU