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GHG emission implications of second NDC targets in Nepal

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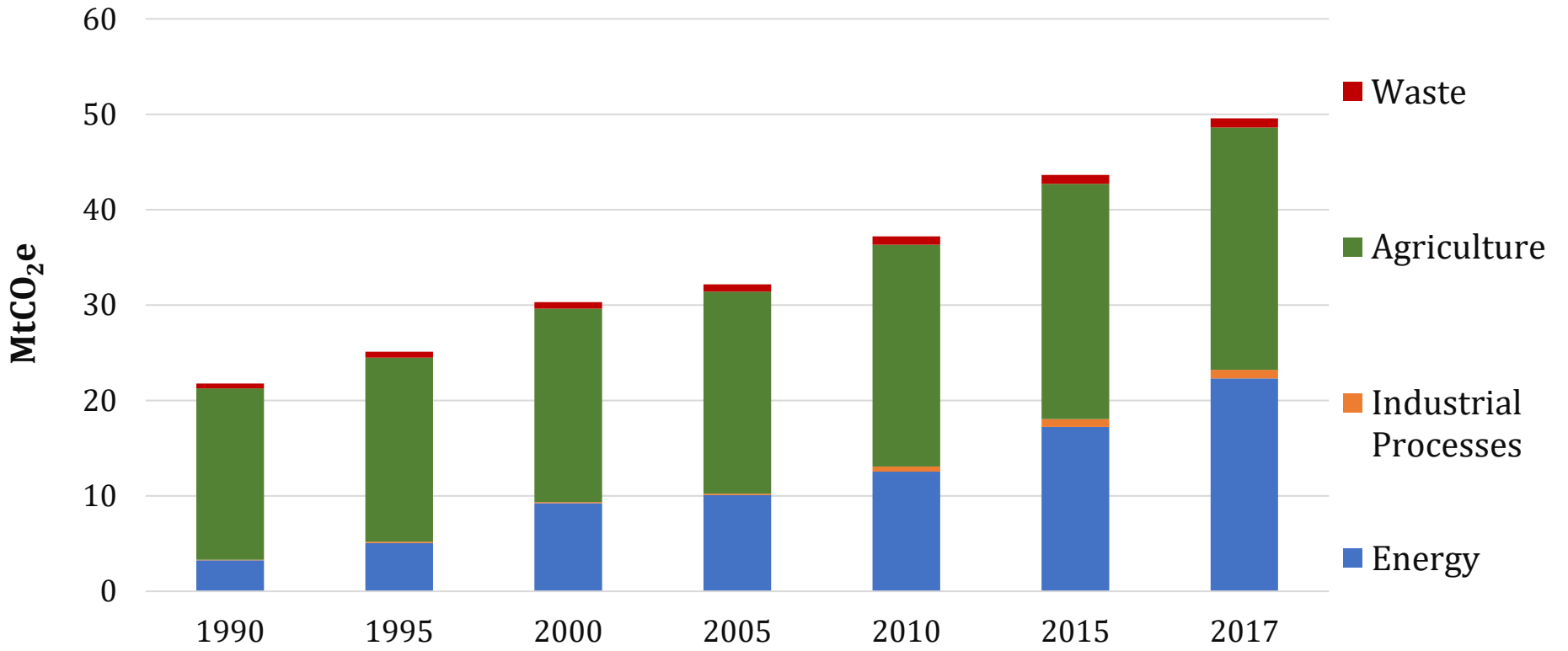
Outline

1. GHG emission trend
2. Energy use trend
3. NDC and SDG targets
4. Mitigation Actions and Plans
5. Model Analysis
6. Final Remarks and Future Works

GHG emissions in Nepal (1990-2017)

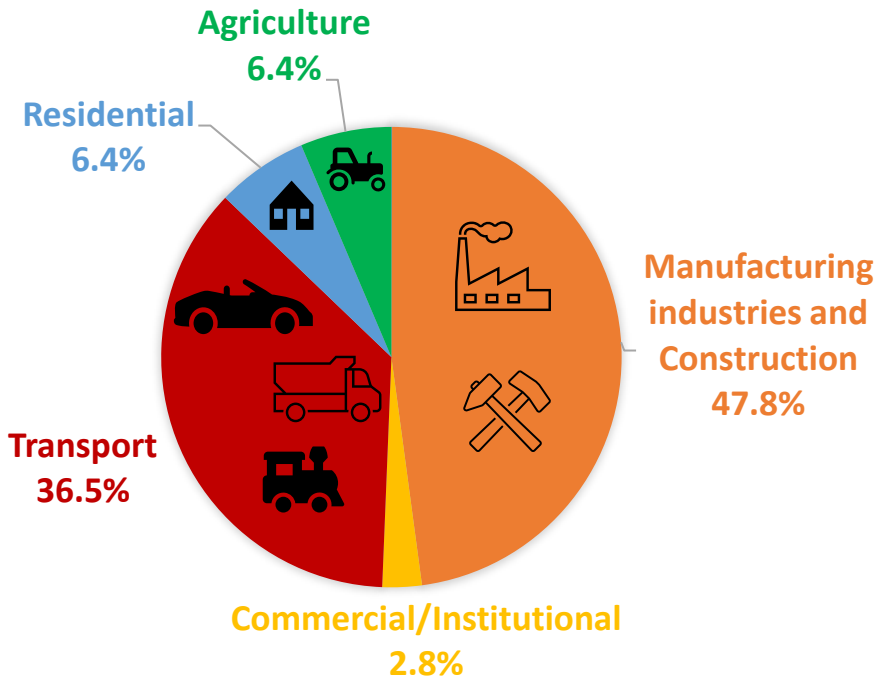


*The Emissions and removals from land use sector are not included

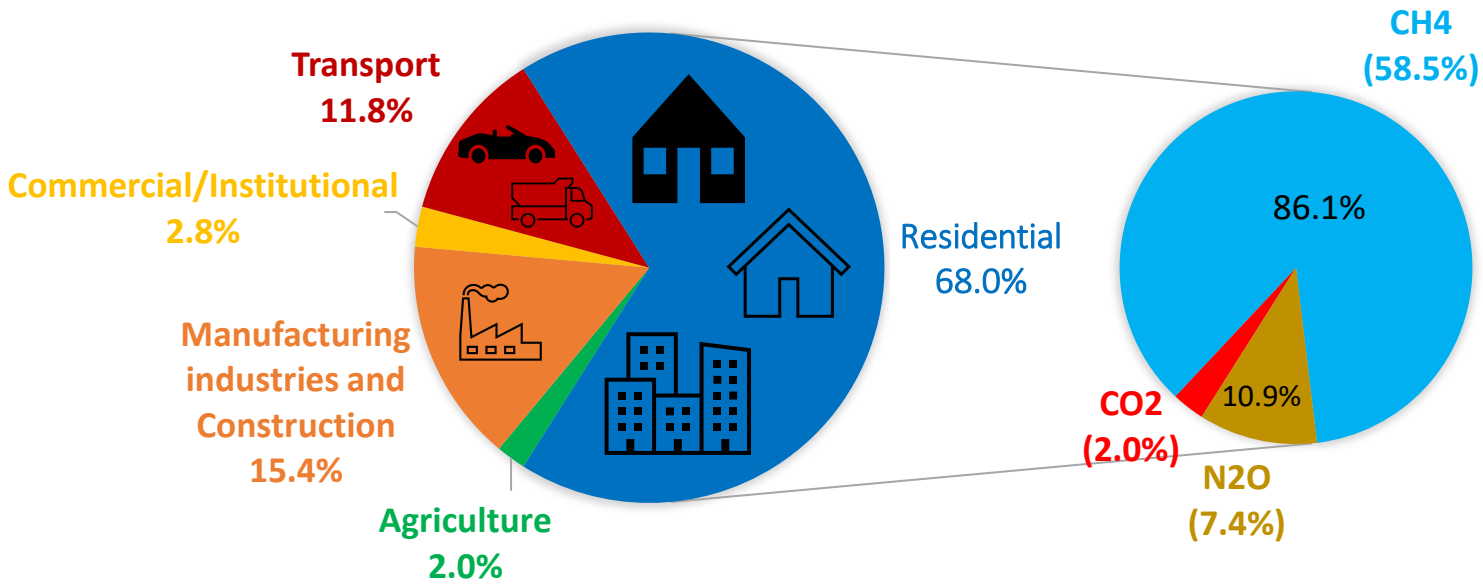
Source: WRI CAIT

- The agricultural sector is the largest GHG emitter (51.2% in 2017)
- Energy and industrial processes increased at higher rates during last three decades
- Emissions from Energy sector increased at 7.4% (1990-2017) and 5.3% (2000-2017)
- Emission from Industrial processes increased at faster rate (12.1% during 2000-2017), but its share in total GHG emission is still low (< 2% in 2017)

GHG emissions from energy sector (2011)



Total: 4.6 $MtCO_2$



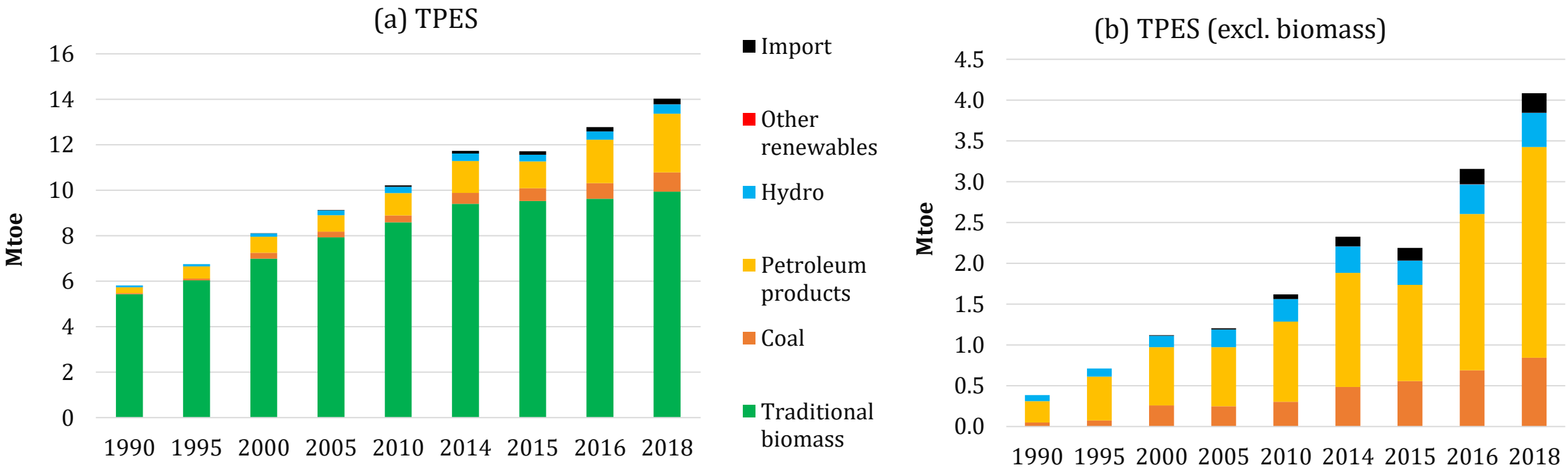
Total: 14.7 $MtCO_2eq$

* Biomass is considered carbon neutral

Source: Third National Communication

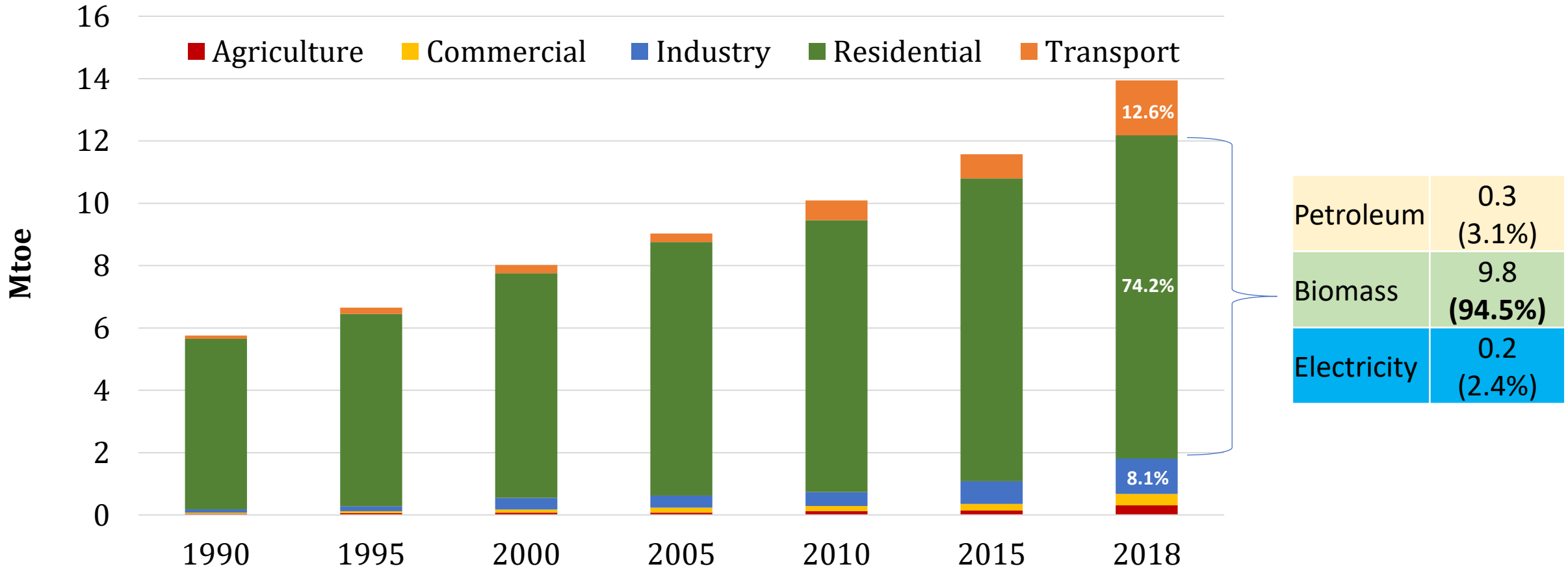
- Manufacturing industries and Construction major source of CO_2 emissions.
- Residential sector accounted for 68% in GHG emissions.
- Methane is the main source of emissions in the other sector representing 60.2% of total GHGs

Primary Energy Supply (1990-2018)



- Biomass is the dominant fuel in TPES; its share decreased from 86% to 71% during 2000-2018
- Fossil fuels and hydropower energy grew at faster rate during last three decades
- Share of fossil fuels in TPES increased from 12% to 24.4% (2000-2018)
- Fossil fuels use in TPES increased more than 3 folds (2000-2018)

Final Energy Consumption (1990-2018)



- Residential sector is the highest FE consuming sector
- High dependence on biomass and low-conversion efficiency of biomass technologies is one of the reasons for high FEC in residential sector
- Final energy consumption in the transport and industry sector increased by 500% and 200% respectively during 2000-2018

Energy related NDC Targets

Sector	Target indicators	Target year	Target
Electricity Generation	Installed capacity (85% hydro and 15% other renewables)	2030	15,000 MW
	Share of clean energy sources in total energy demand	2030	15 %
Transport	Sales of e-vehicles in all **private vehicles** sales	2025	25%
	Sales of e-vehicles in all **public vehicles** sales	2025	20%
	Sales of e-vehicles in all **private vehicles** sales	2030	90%
	Sales of e-vehicles in all **public vehicles** sales	2030	60%
Residential	Share of **electric** mode of **cooking**	2030	25%
	Installation of Improved CS (biomass)	2025	300,000 units
	Installation of household biogas plants	2025	50,000 units
	Installation of large-scale biogas plants	2025	500 units

Energy related SDG(7) Targets

Targets	Indicators	Baseline 2015*	Target 2019*	Progress 2019**	Target 2030*
Target 7.1	By 2030, ensure universal access to affordable, reliable and modern energy services				
7.1.1	Proportion of population with access to electricity	74	80.7	88	99
1	Per capita energy (final) consumption (in gigajoules)	16	18.1	20	24
7.1.2	Proportion of population with primary reliance on clean fuels and technology				
1	Households using solid fuel as primary source of energy for cooking (%)	74.7	65	68.6	30
2	People using liquid petroleum gas (LPG) for cooking and heating (%)	18	23.6	26.6	39
3	Electricity consumption (kWh per capita)	80	230	260	1500
Target 7.2	By 2030, increase substantially the share of renewable energy in the global energy mix				
7.2.1	Renewable energy share in the total final energy consumption	11.9	22.1	5	50
1	Installed capacity of hydropower (MW)	782	2301	1250	15000

Source: *SDGs Status and Roadmap: 2016-2030; **SDGs Progress Assessment Report (2016-2019)

Limitations of NDC

- Power generation in terms of installed Capacity (MW) only is misleading
- Capacity factors varies widely in case of renewable energy => energy generation (MWh) per MW varies
- Installation target of ICS and biogas for cooking are set for 2025 only
- Electrification focused on passenger vehicles and cooking technologies only

Mitigations Plans and Actions

- National Rural and Renewable Energy Programme (2012)
- Urban Solar Programme (2013)
- Subsidy Policy for Renewable Energy (2015)
- Biomass Energy Strategy 2017
- National Energy Efficiency Strategy (2018)
- Financial incentives for EVs

	FY 2019/2020 (EV)	FY 2020/2021 (EV)	Fossil fuel vehicles
Custom tax	40%	10%	80%
Excise duty	30%	10%	55-100%
VAT	13%	13%	13%
Road Maintenance tax	5%	1%	8-10%
Cumulative taxes	110%	37%	260%

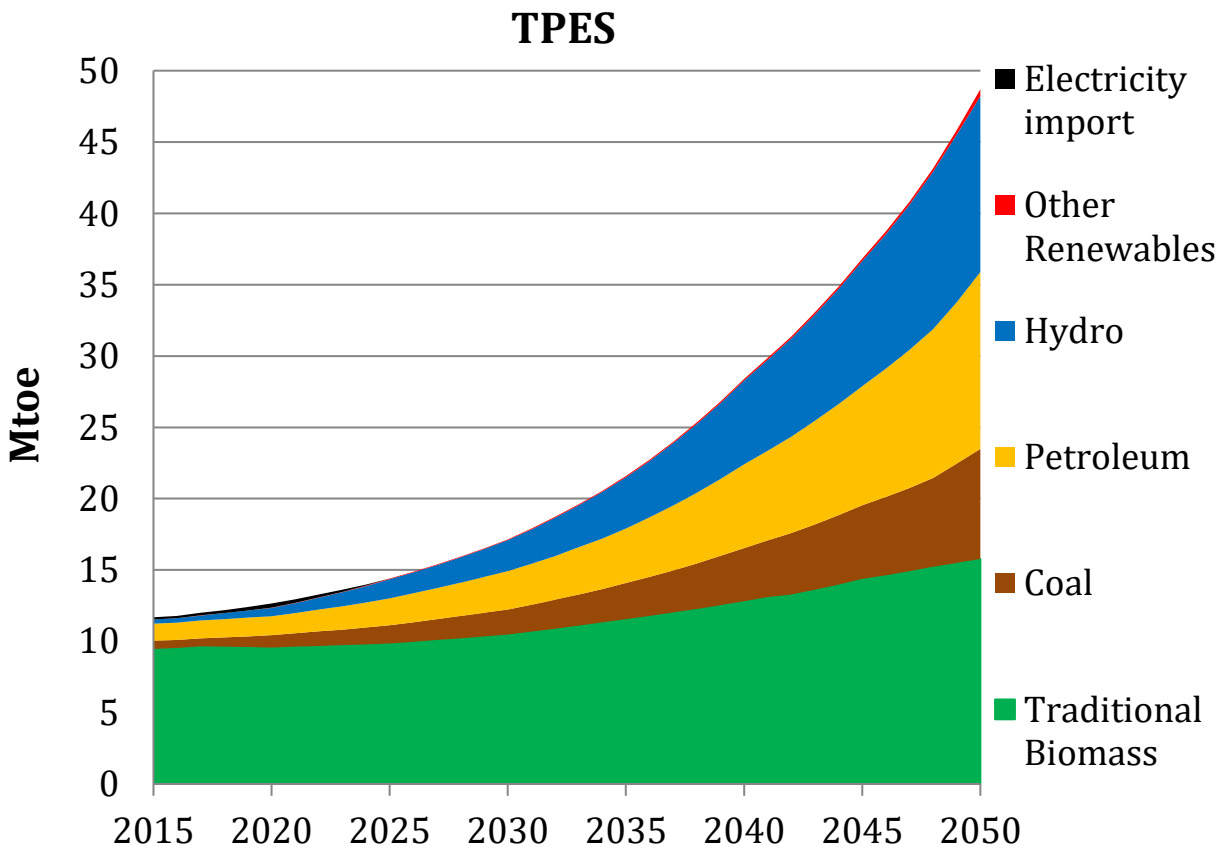
- Rural and renewable energy/technologies includes Improved Cookstove, biogas, solar PV systems, improved water mill
- Urban solar programme provided subsidy to install solar PV system in households
- National Energy Efficiency Strategy (2018) aims to double the average efficiency improvement rate (1.68% from 0.84%)

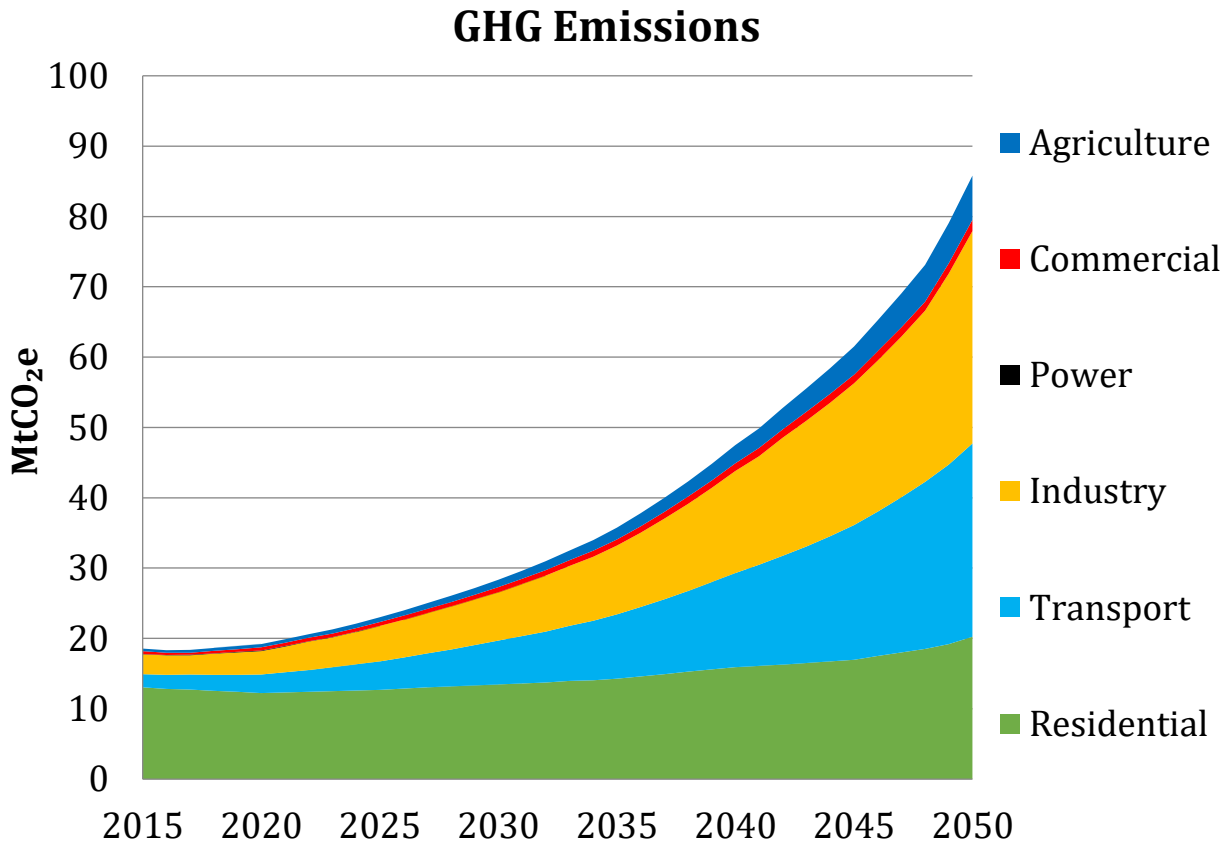
MODEL ANALYSIS

BAU SCENARIO

NDC SCENARIOS

Energy and GHG Emissions in BAU (2015-2050)





- Primary energy supply would increase by more than 3 times during 2015-2050
- TPES would reach **1.35 toe/capita** (World's per capita in 2018: 1.88 toe)
- GHG emissions in BAU would increase by 3.6 times during 2015-2050
- Industry and transport sectors would be the two highest emitting sectors by 2050

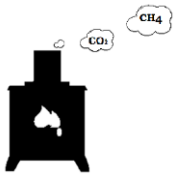
NDC Scenarios Description

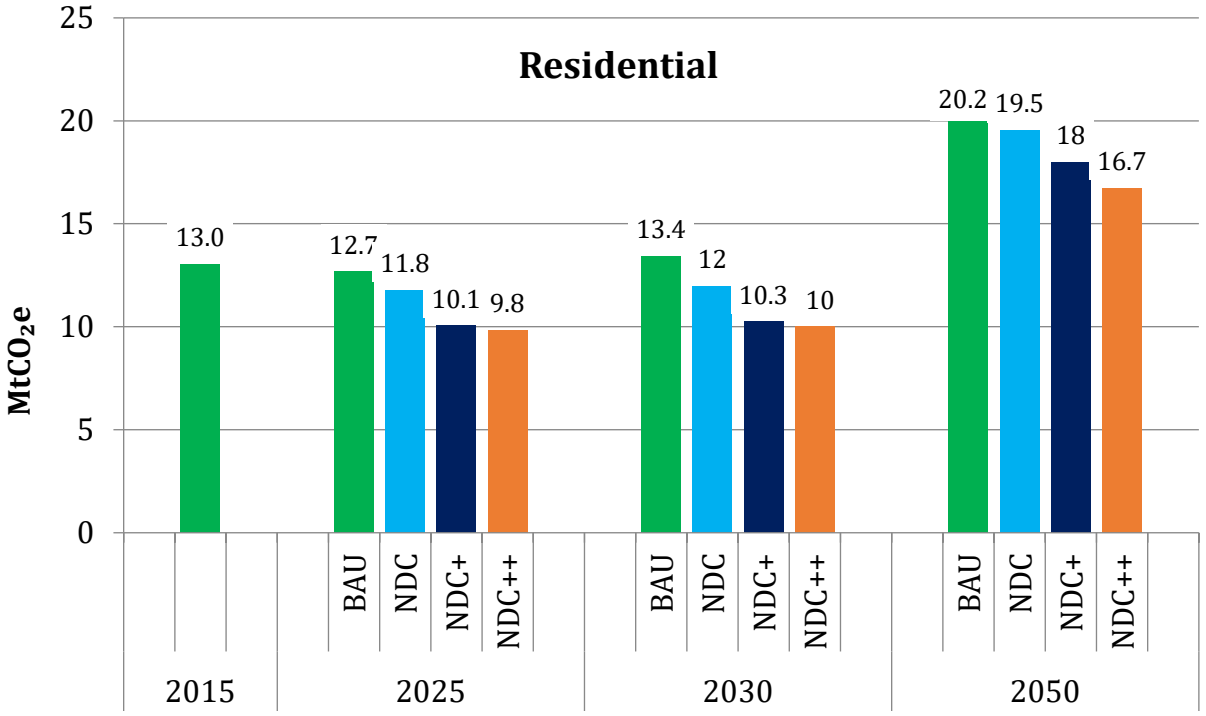
- Three NDC scenarios: NDC, NDC+ and NDC++
- Extended the second NDC scenarios (up to 2050) in NDC
- Higher level of electrifications in NDC+ and NDC++

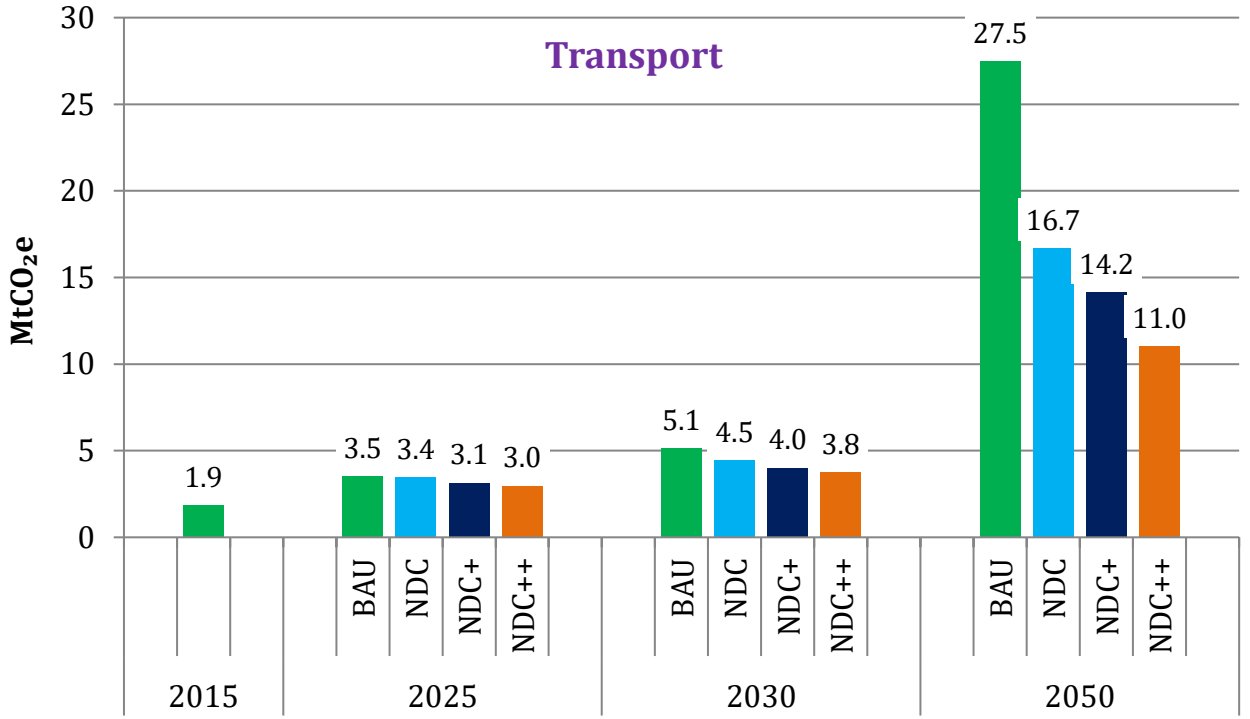
Table: Shares of Passenger transport by vehicle types and Electric cooking in three NDC scenarios

		2025			2030			2050		
		NDC	NDC+	NDC++	NDC	NDC+	NDC++	NDC	NDC+	NDC++
Private	Car	5.2	20	30	29.2	40	50	55	65	80
	2-wheelers	4.2	20	30	19.8	40	50	30	52.5	65
Public	3-wheelers	0	10	15	0.0	20	25	25	35	45
	Bus	1.8	10	15	12.1	20	25	20	35	45
	Minibus	3.1	10	15	14.6	20	25	25	35	45
	Micro bus	4.5	10	15	15.5	20	25	25	35	45
	Taxi	2.3	10	15	14.1	20	25	25	35	45
Urban/ Rural	Electric	20	41.3	43.8	25	45	47.5	45	65	80
Rural	Biogas	15	15	15	15	15	15	15	15	15

GHG Emissions in NDC scenarios

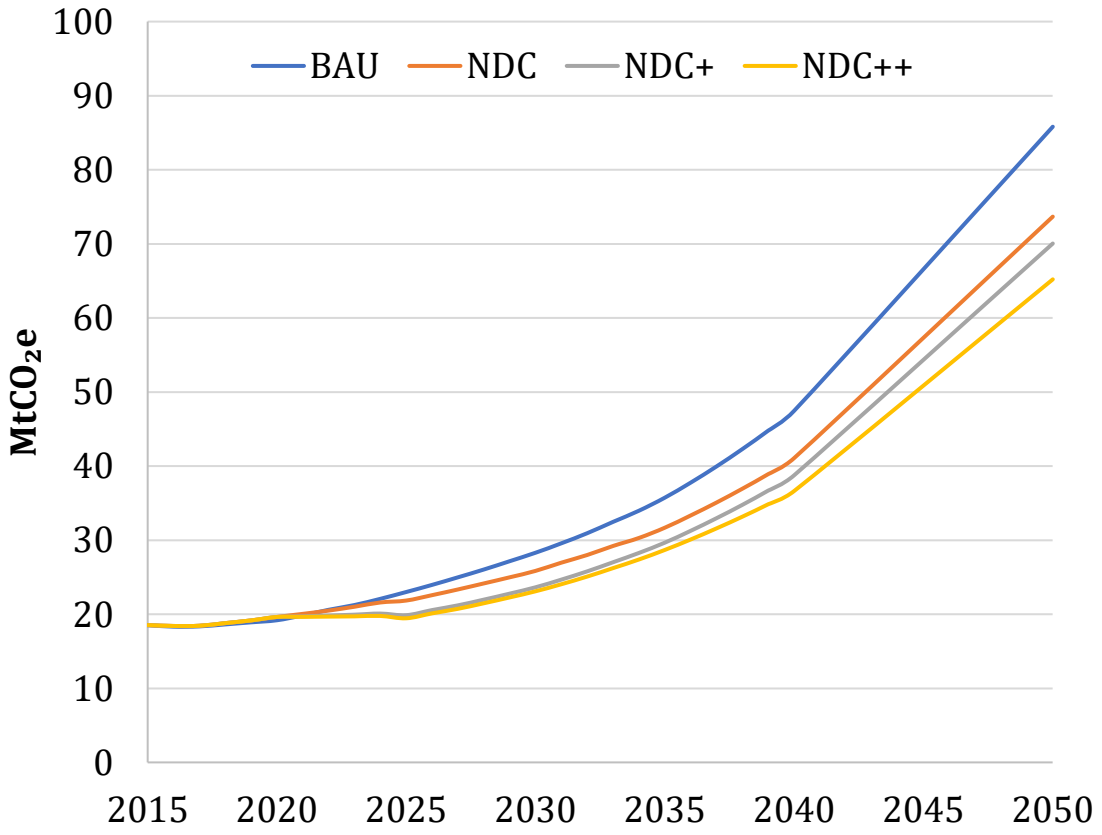


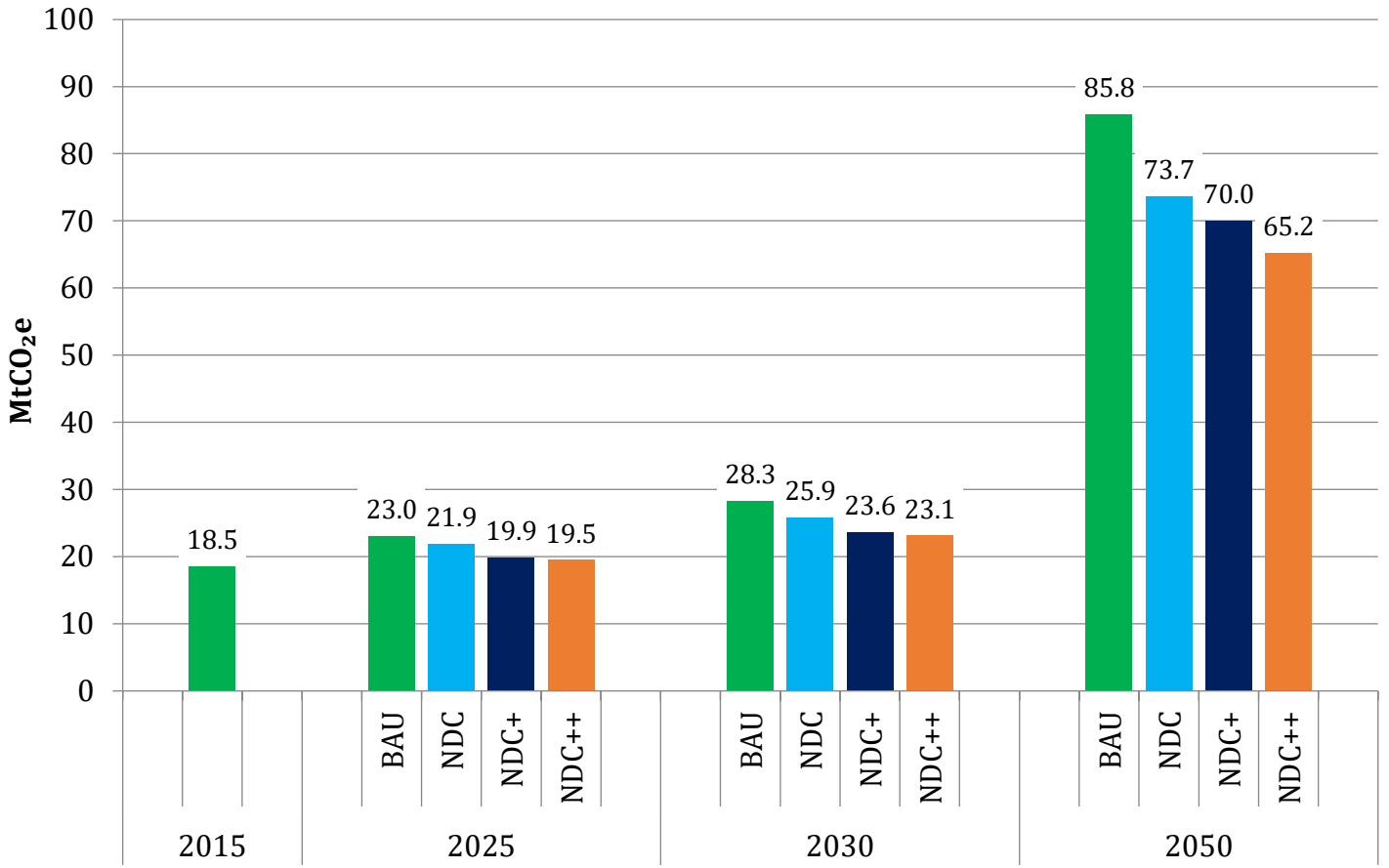




- Electrification of cooking end-use would not sufficiently decrease the emissions in residential sector
- NDC scenarios would not reduce GHG significantly in transport sector in 2030
- However, by 2050 NDC scenarios would reduce GHG emissions significantly (nearly 60% in NDC++)
- Electrification of other end-uses in residential sector and freight transport would be needed for further GHG reduction

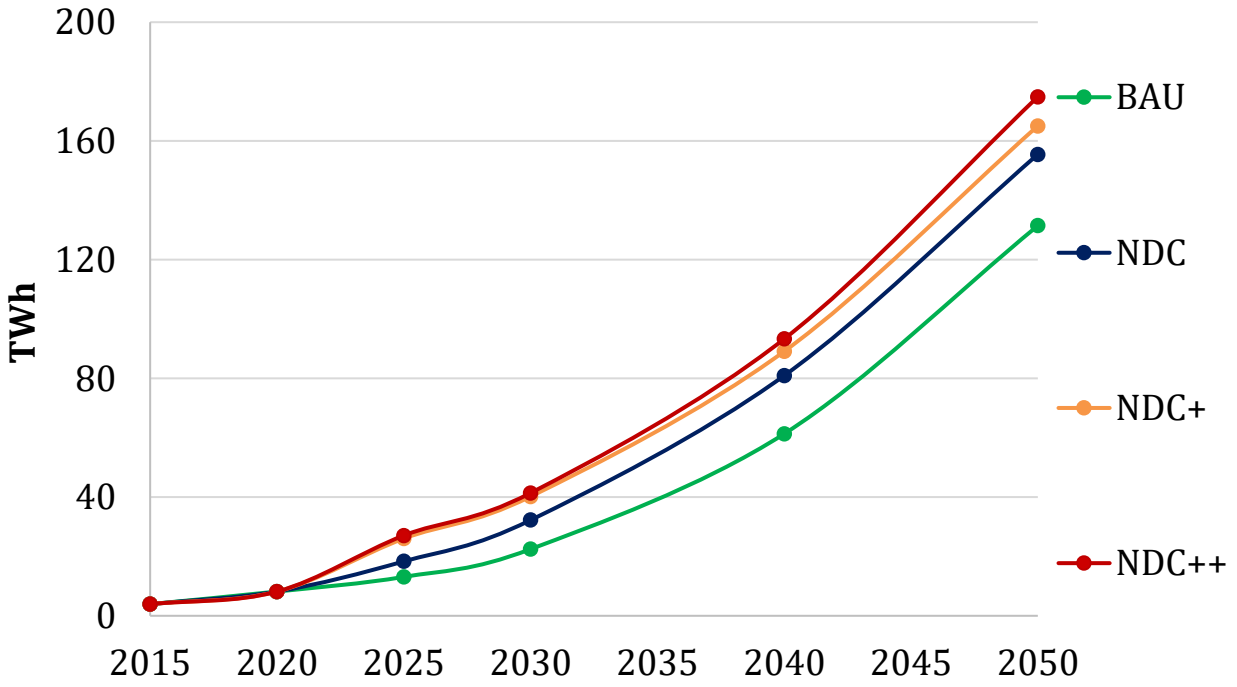
Economy-wide GHG Emissions

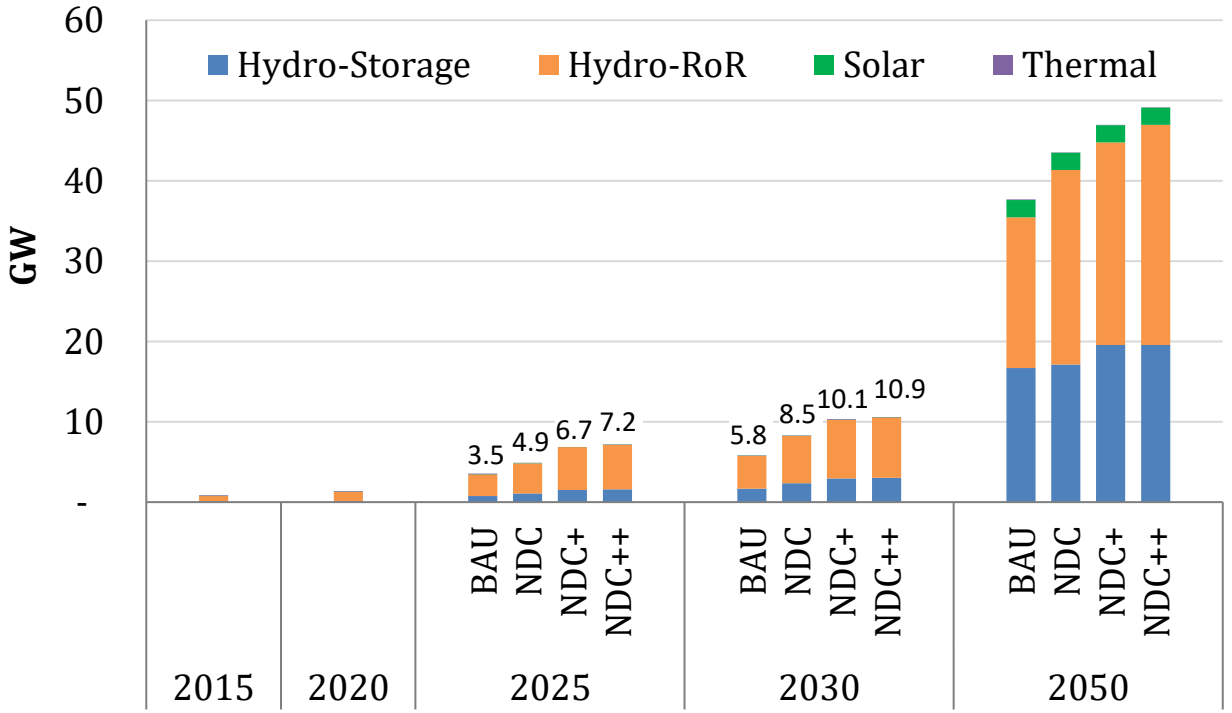




- Second NDC is effective to reduce GHG emission by less than 10% by 2030.
- Even NDC++ does not increase the mitigation very significantly.
- More stringent targets are needed to contribute towards global target of 1.5/2°C

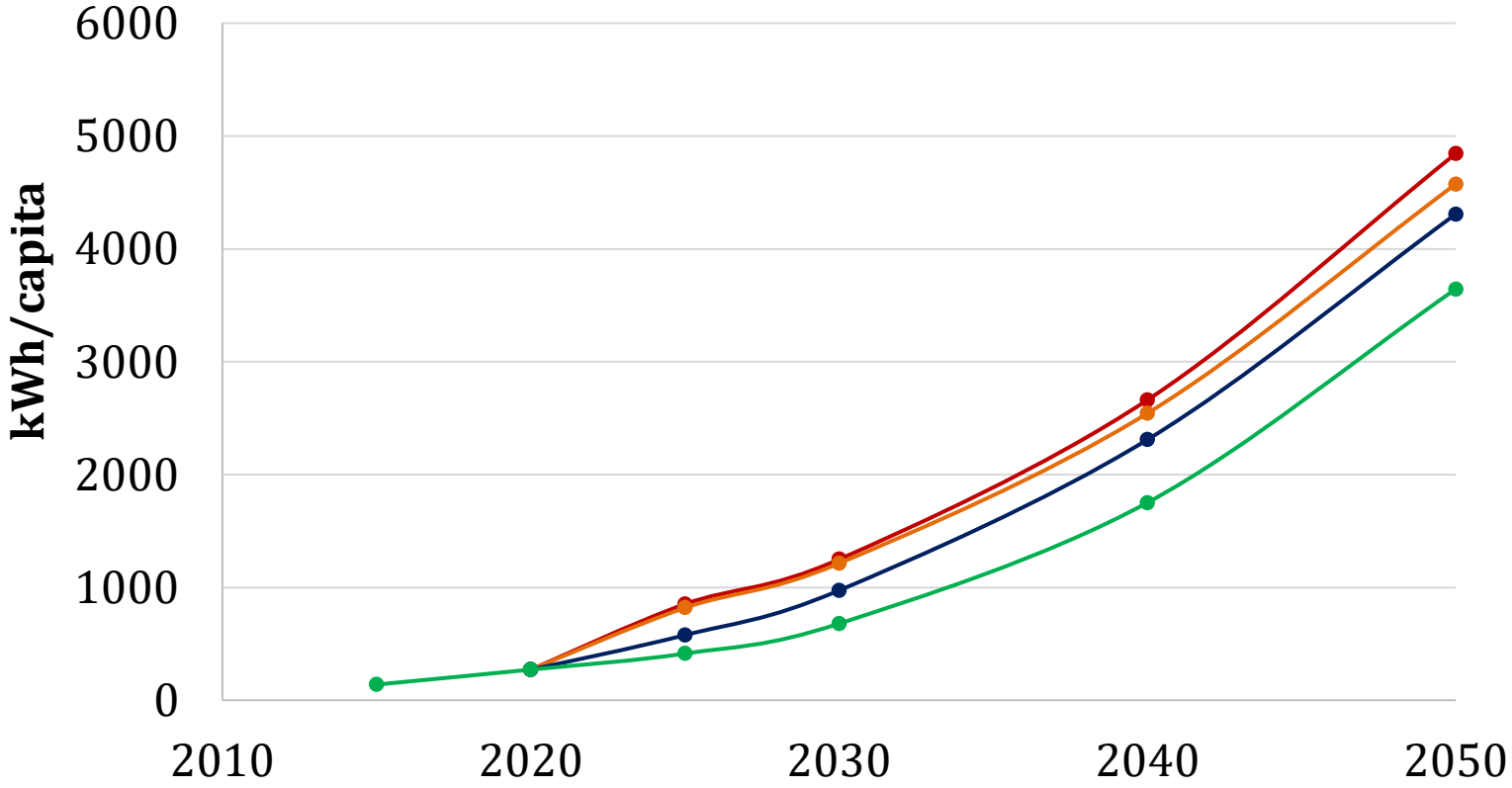
Implication for Power generation





- In 2030, Installed capacity would be
  - 5,800 MW in BAU
  - 10,900 MW in NDC++
- Even with higher level of private transport and cooking electrification in NDC++, the target for installed capacity of 15,000 MW would lead to underutilization of the capacity. => lack of harmonization of NDC targets.
- Electrification of other end-uses would be needed to use 15,000 MW domestically.

Electricity consumption per capita



	2025	2030	2050
NDC	415	680	1,751
NDC+	579	975	2,310
NDC++	821	1,214	2,543

- With NDC++ (higher level of electrification in private transport and cooking), per capita electricity consumption of 1500 kWh (in SDG target) would not be needed
- Mitigation options in other end-use sectors needed to consume **1500 kWh/capita** by 2030

Effects on Energy Security

Net-Energy Import Dependency (NEID), %

	BAU	NDC	NDC+	NDC++
2015	16.4			
2030	25.9	23.4	22.9	22.5
2050	41.3	35.2	34.6	32.7

Air-Transport	1.7%
Pass-Transport	3.8%
Freight-Transport	3.4%
Residential	0.27%
Industry	18.1%
Commercial	0.27%
Agriculture	5.27%

- NEID would be lower in NDC scenarios i.e., more energy secure
- NEID does not vary significantly in NDC scenarios in 2030
- Lower NEID with the increase in NDC levels in 2050
- Industry sector offers significant potential to reduce NEID further.
- Electrification in agriculture can further decrease NEID

Final Remarks and Future Research

- Enhancement of NDCs in the residential and transport sectors is not adequate to utilize 15,000 MW hydropower installation target (in NDC and SDG)
- Per capita electricity consumption of 1500 kWh by 2030 would require electrification of other end-uses
- The present NDC shows the inadequate contribution towards achieving the global $2^{o}C/1.5^{o}C$ target.
- Mitigation options such as energy efficiency and decarbonization of other end-uses are needed for higher GHG reduction to contribute towards global 1.5/2 °C

Future works:

- Energy implications of electrification and decarbonization of other end-uses to achieve net zero emission
- Macroeconomic implications of NDC scenarios using CGE model

Contribution to promote mitigation options in Nepal

- **Consultancy service to the UNDP to support Ministry of Forests and Environment on preparing**
  - *Assessment Report on Long-Term Strategy for Net Zero Emission for Nepal*
  - *Second NDC Implementation Plan*

Thank you