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Low Carbon Strategies for Nepal: Preliminary Results from AIM/Enduse Model Analysis

Ram M. Shrestha

Asian Institute of Technology and Management
Nepal

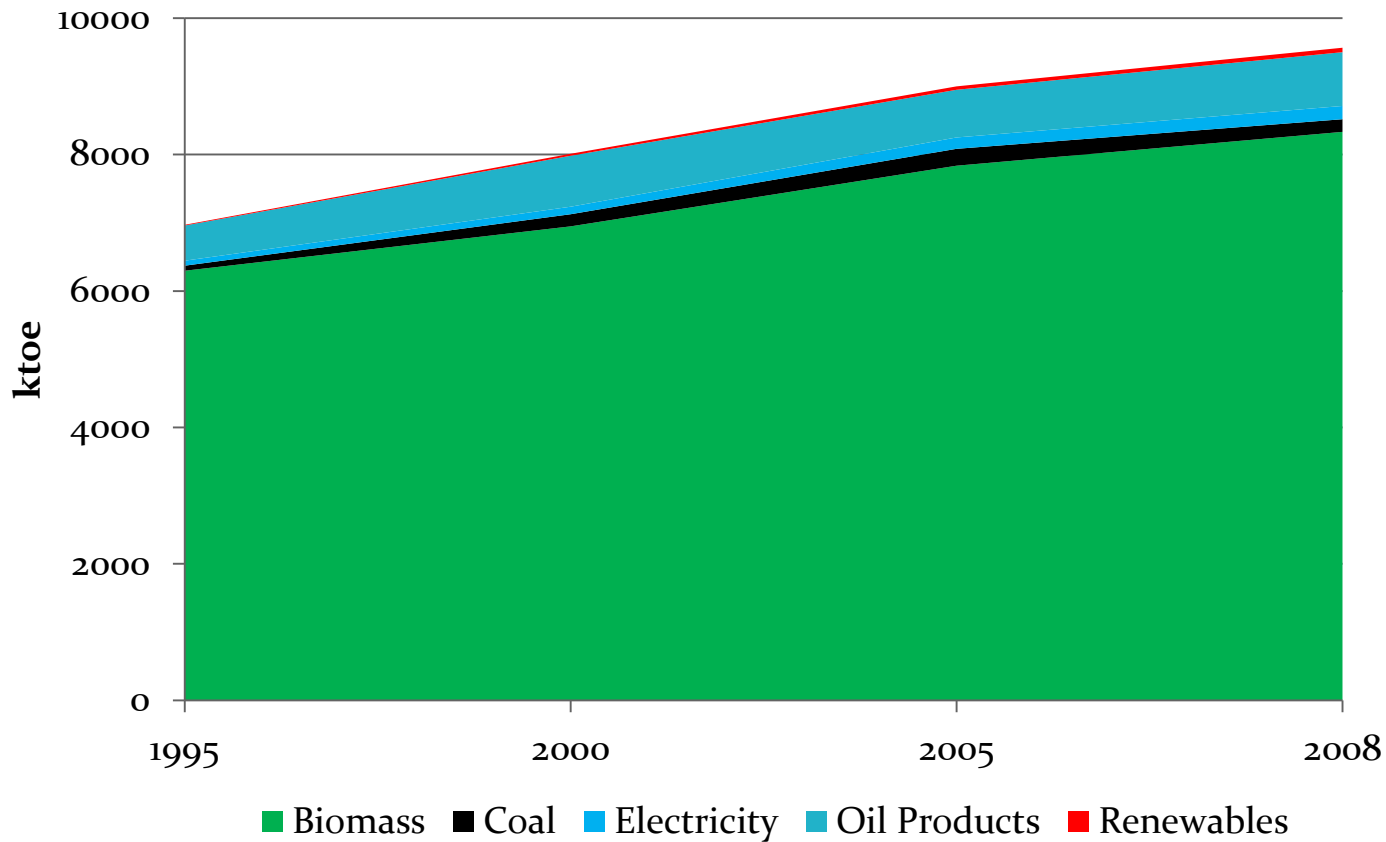
Country Overview

- Predominance of biomass in energy supply
- Fossil fuel consumption low but growing rapidly
- Largest share of the transport sector in oil consumption
- Oil import cost exceeds the total export revenue
- Large hydropower potential but mostly unexploited
- GHG emission low currently, but expected to grow rapidly
- Early stage of infrastructure development and opportunities for adopting low carbon development measures

Objectives

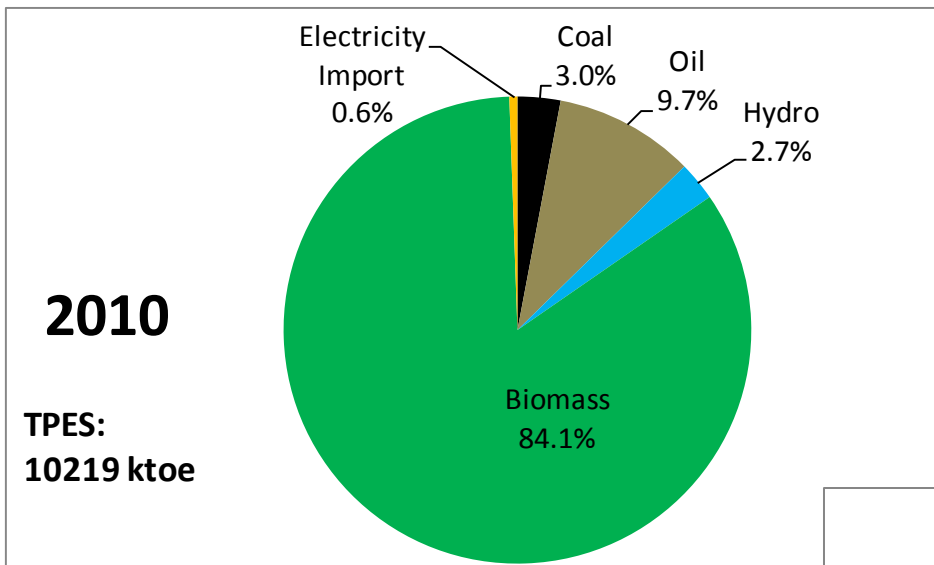
- To identify least cost energy resource and technology options to achieve GHG emission reduction targets.
- To analyze the sectoral contributions in meeting the GHG abatement targets
- To assess environmental and energy security cobenefits of low carbon development

Total Energy Consumption during 1995-2008



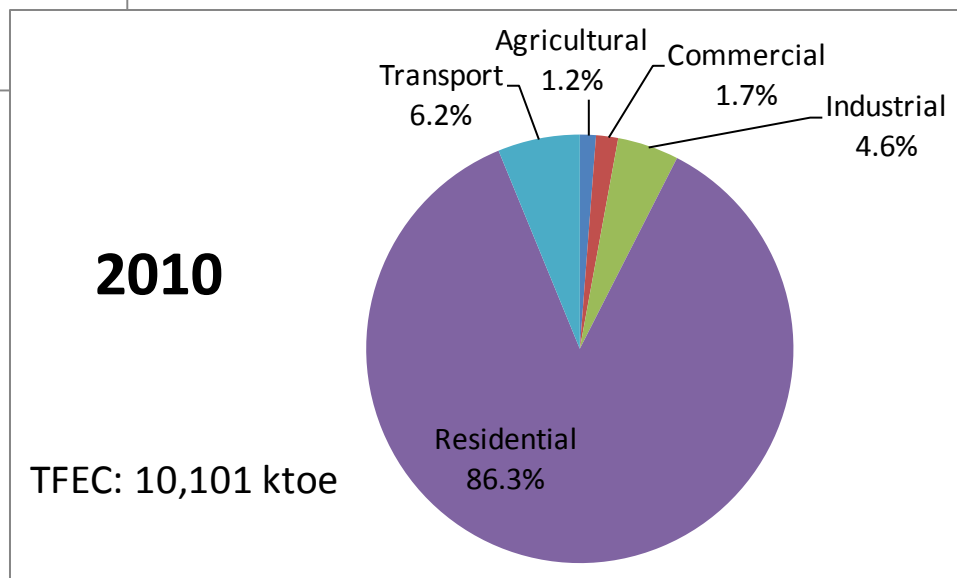
- Predominant share of biomass in total energy consumption (86%).
- Presently, low share of fossil fuels (about 10%)

Total Energy Supply and Sectoral Consumption in 2010



Predominance of biomass energy in TPES.

Predominant share of Residential sector in Total Final Energy Consumption (TFEC), followed by transport, industrial and other sectors.



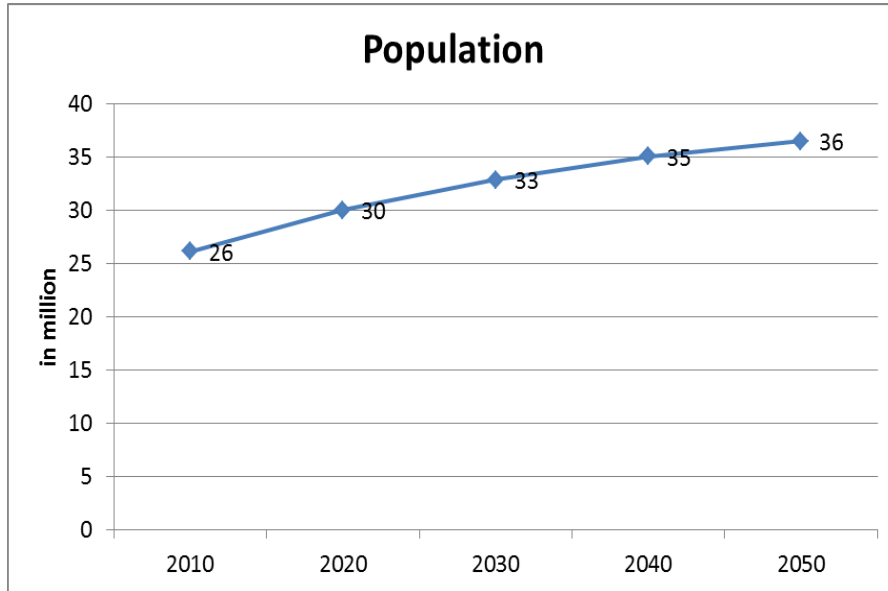
Source: IEA (2013)

Scenario Description

- Base case
- Three GHG reduction target cases:

Case	2020	2030	2040	2050
Low Emission Reduction (ERL)	5%	10%	15%	20%
Medium Emission Reduction (ERM)	10%	15%	20%	30%
High Emission Reduction (ERH)	15%	25%	35%	50%

Population and Economic Growth



Population Growth Rates, %	
2010-2020	1.4
2020-2030	0.9
2030-2040	0.7
2040-2050	0.4

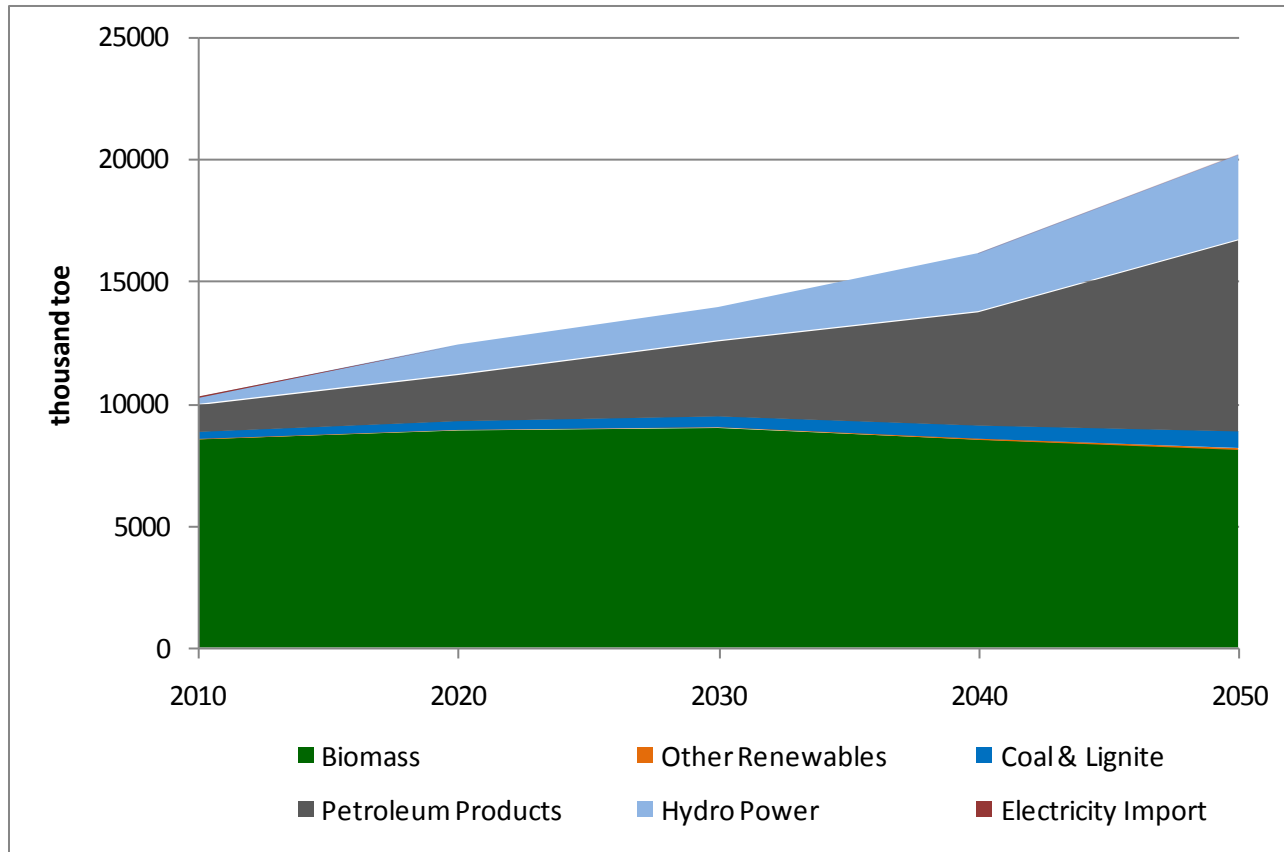
Low current GDP growth rate of 3.42%

Future GDP growth rate considered: 5.56%



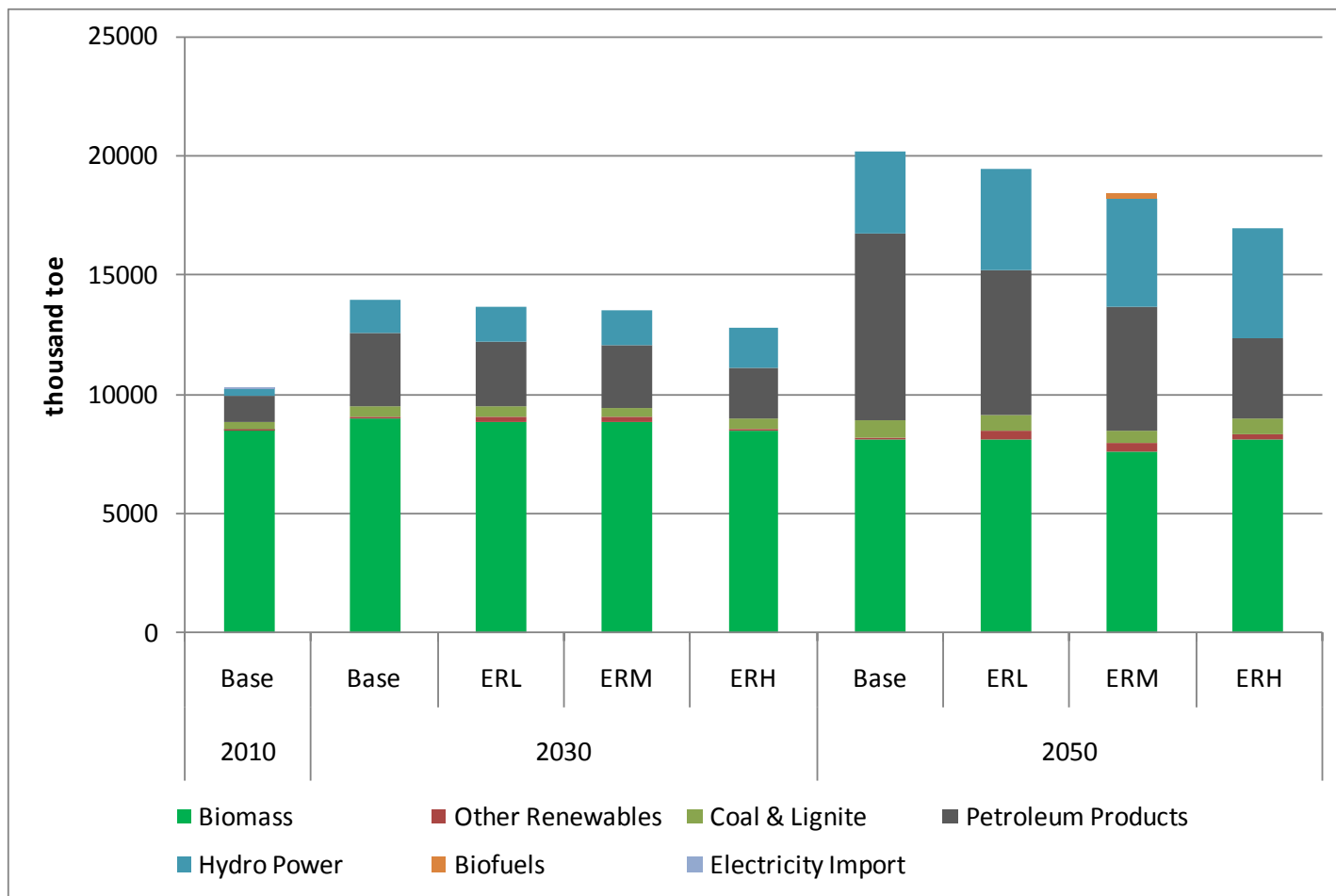
Preliminary Results

Total Primary Energy Supply in Base case, 2010-2050



- The total primary energy supply (TPES) is to be almost doubled during 2010-2050.

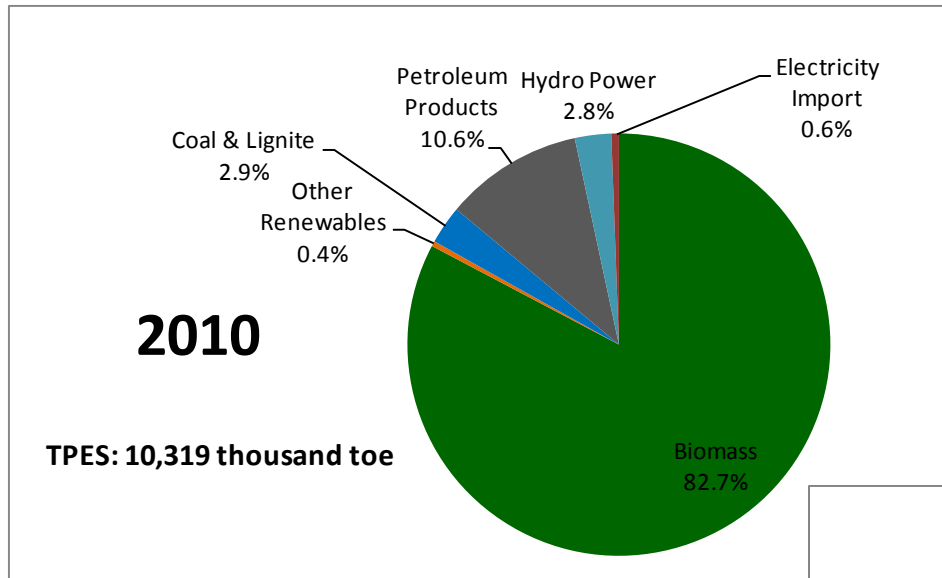
TPES during 2010-2050



TPES would decrease by 2.0%, 3.2% and 8.0% in 2030 under ERL, ERM and ERH cases as compared to the base case.

TPES would decline by 3.7%, 8.6% and 15.8% in 2050 under ERL, ERM and ERH cases.

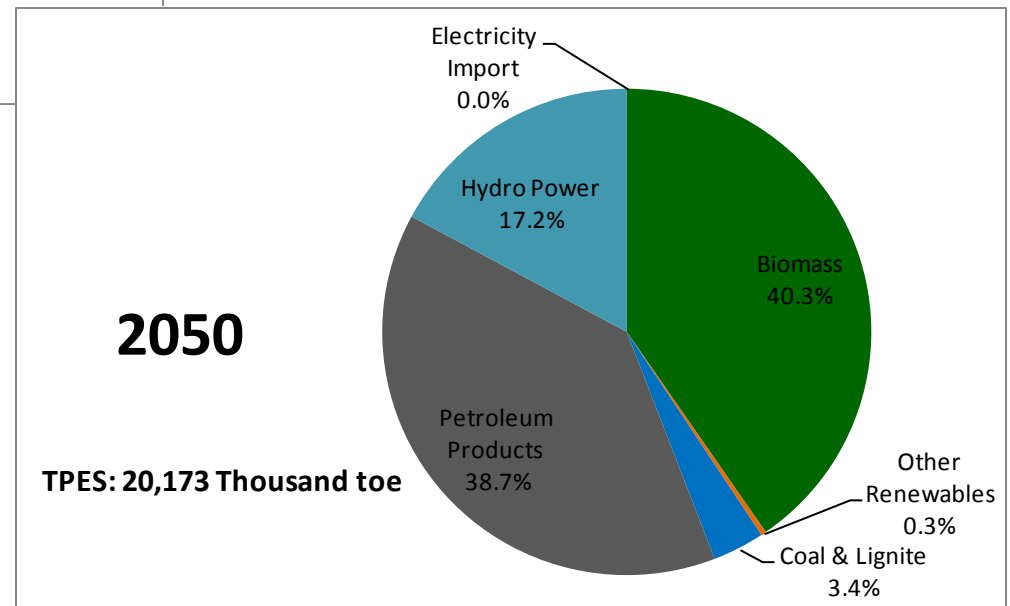
Structure of TPES in Base Case, 2010 and 2050



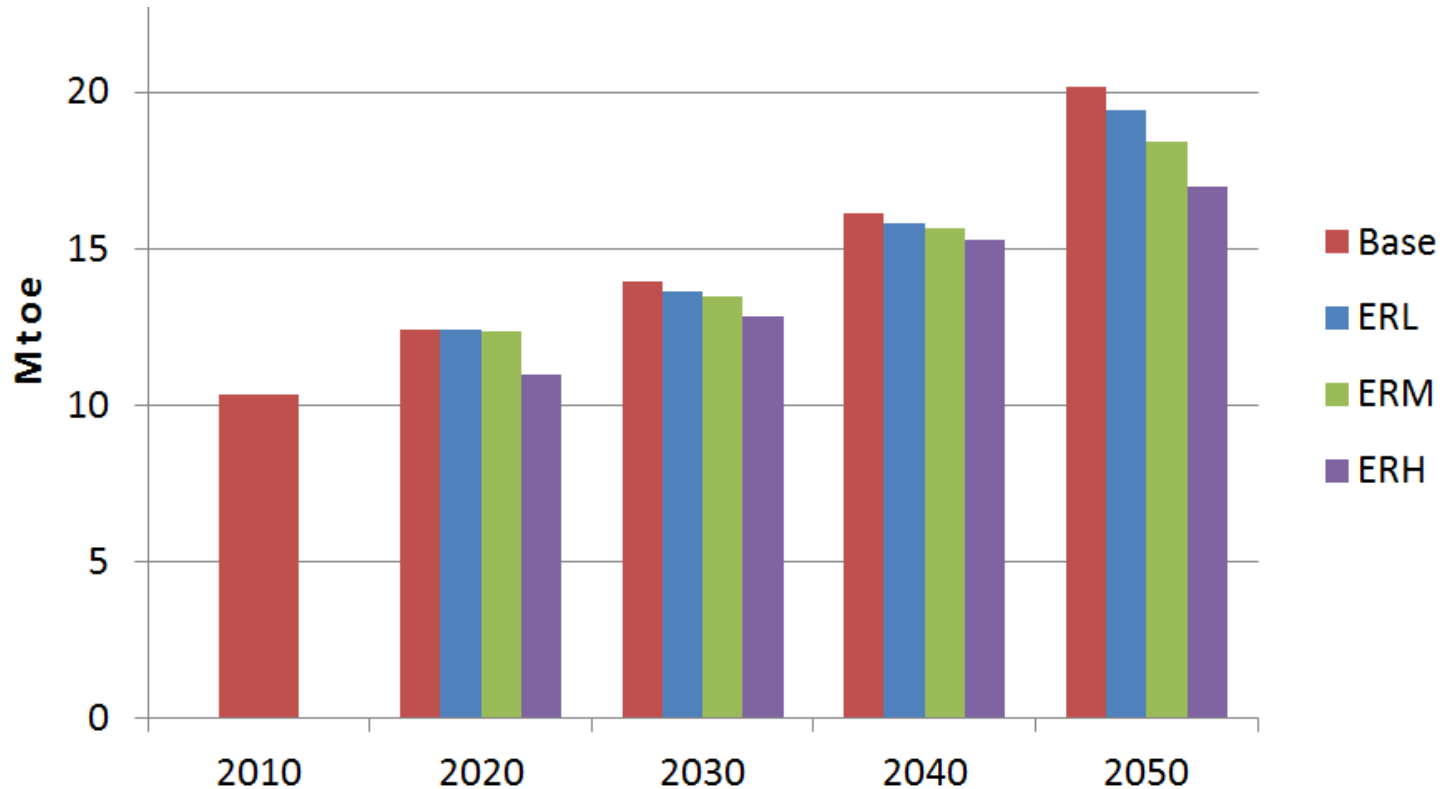
- Dominance of biomass to continue.
- However, its share is to decline significantly during 2010-2050. (high urbanization!)

The share of oil products to increase to 38.7% in 2050 from 10.6% in 2010.

Share of hydro power to increase by 14.4% during 2010-2050.

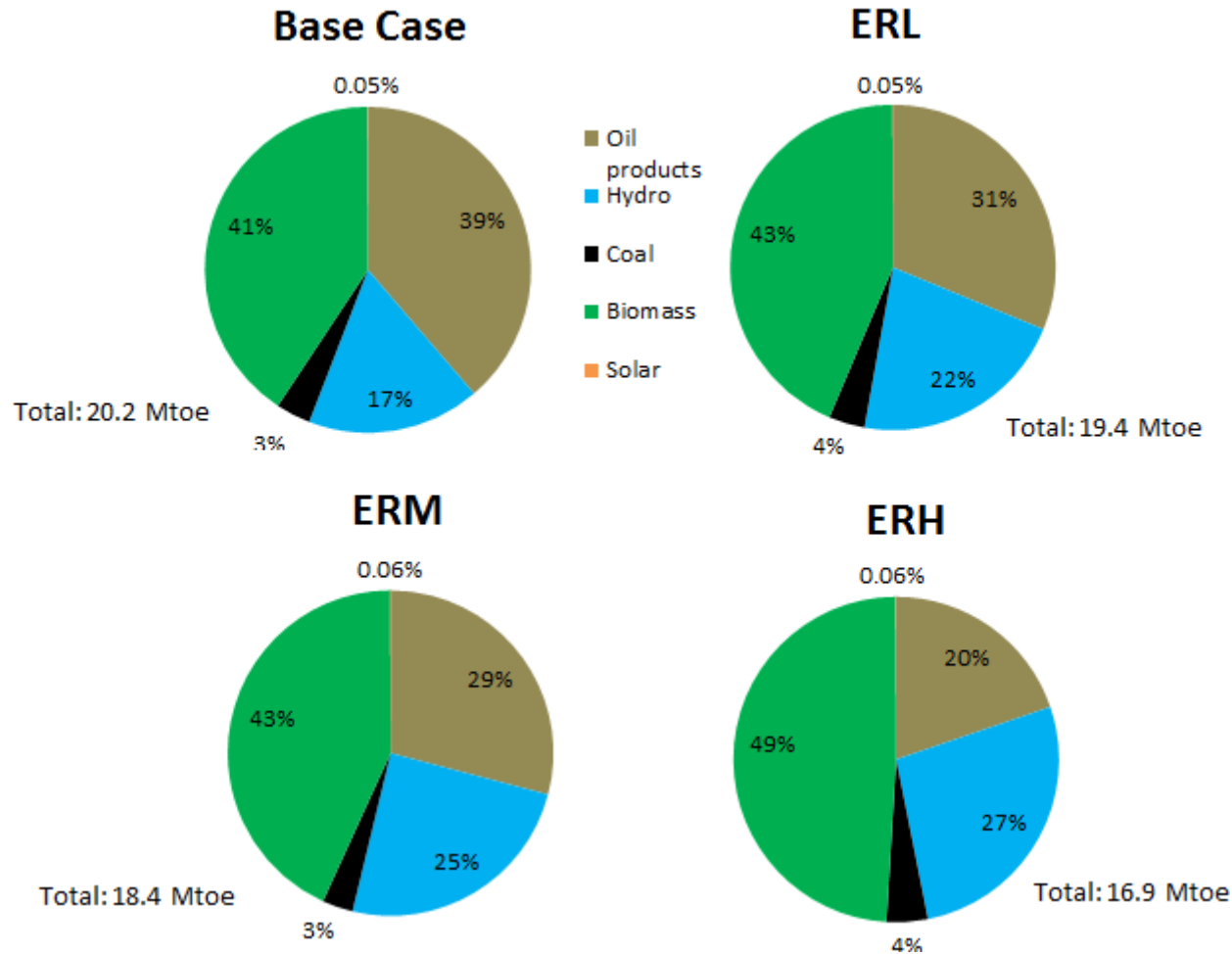


TPES in Base Case and Low Carbon Scenario



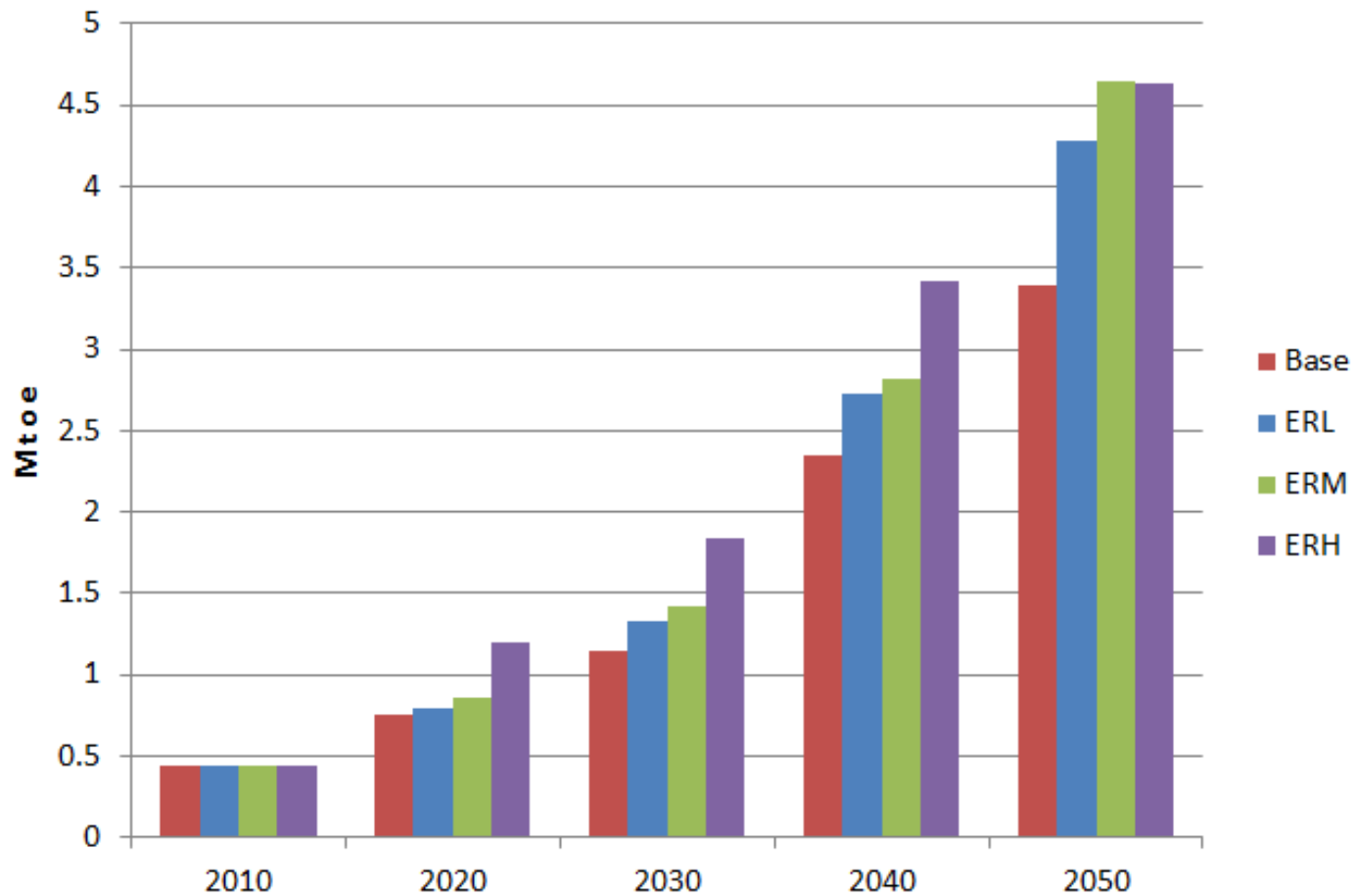
- The overall energy efficiency would be improved under ER cases
- TPES in 2050 would decrease by 3.7% in ERL, 8.6% in ERM and 15.8% in ERH case.

Structure of TPES in Low Carbon Scenarios in 2050



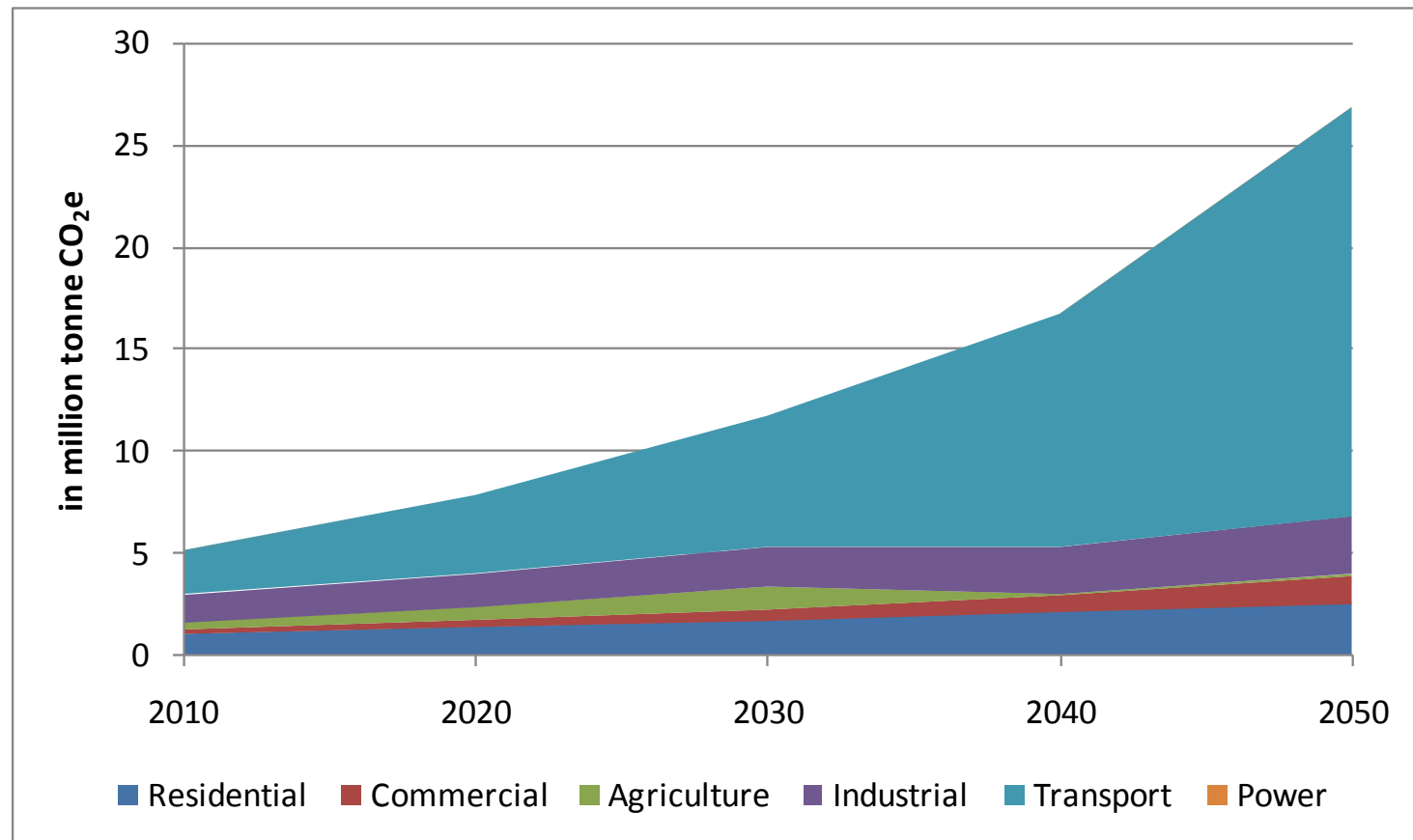
- Large increase in the share of hydro and biomass; decrease in share of oil in ERH case

Electricity generation in Base and Low Carbon Cases



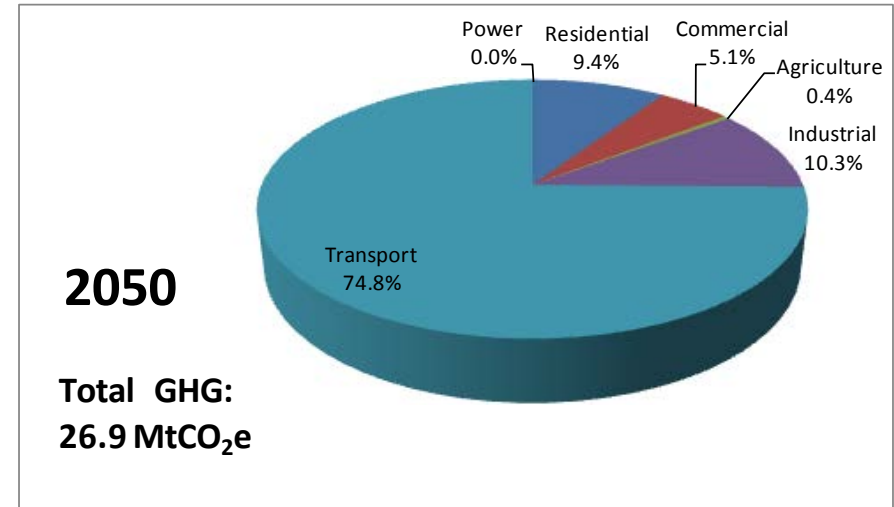
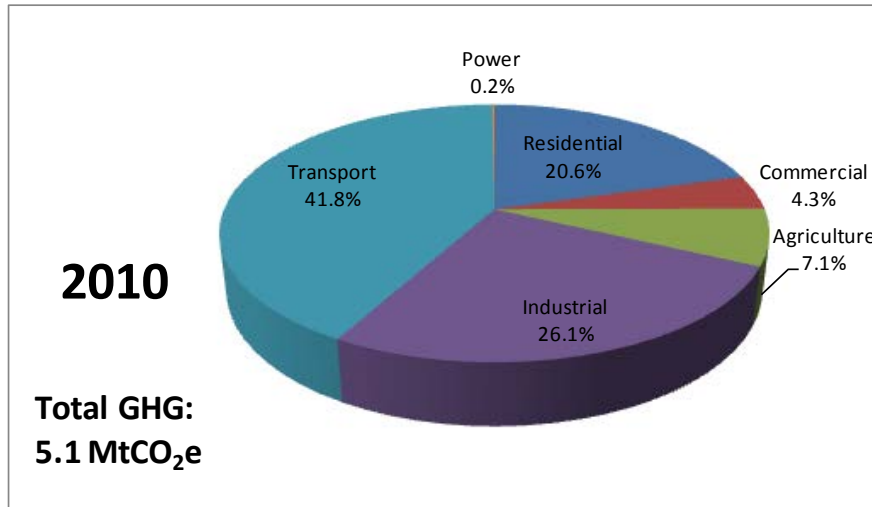
In 2050, hydroelectric generation to increase by 26% in ERL, 37% in ERM and ERH cases.

Total Energy Related GHG Emissions in Base Case



Over 4 fold increase in the total GHG emissions by 2050.

Total Energy Related GHG Emissions in Base Case



- Highest share of Transport in GHG Emission, followed by the residential sector
- Transport sector share to nearly double during 2010-2050
- Shares of residential and industrial sectors to be nearly halved by 2050.

GHG Reduction in Low Carbon Scenarios, MtCO₂e

Cumulative
2020-2050

ERL:	38
ERM:	56
ERH:	94

- Contribution of transport sector: 79% to 85%
- Contribution of residential sector : 14% to 15%



Cost Effective Options in Low Carbon Scenarios

Cost Effective Low Carbon Options in **Transport sector** (in ERH Scenario)

Both fuel switching to hybrid and electric road vehicles and modal shift to electric railways

- Freight rail (electric)
- Gasoline hybrid 2-wheelers
- Biodiesel tractor
- Electric passenger vehicles (battery operated)
- Diesel hybrid vehicles

Cost Effective Low Carbon Options in **Industrial Sector**

Mainly energy efficient technologies:

- CFL
- Vertical shaft brick kiln (brick industry)
- Conventional bleaching (in large pulp and paper mill)
- Energy efficient diesel boiler
- Energy efficient coal boiler
- Energy efficient motor

Cost Effective Residential Sector Options in Low Carbon Scenarios

Mainly energy efficient technologies

- LED lamps
- Electric Cooking
- Improved Biomass Cook stoves
- Solar cooking
- LPG Gas Geyser
- Energy efficient Fan
- Energy efficient Refrigerator
- LED TV

Cost Effective **Commercial Sector** Options in Low Carbon Scenarios

- Mainly energy efficient and electric devices
 - LED lamps
 - Efficient LPG cooker
 - LPG space heater
 - Electric Geyser
 - LPG Gas Geyser
 - Energy efficient Fan
 - Energy Efficient AC
 - Solar Cooker

Cost Effective **Agriculture** Sector Options in Low Carbon Scenarios

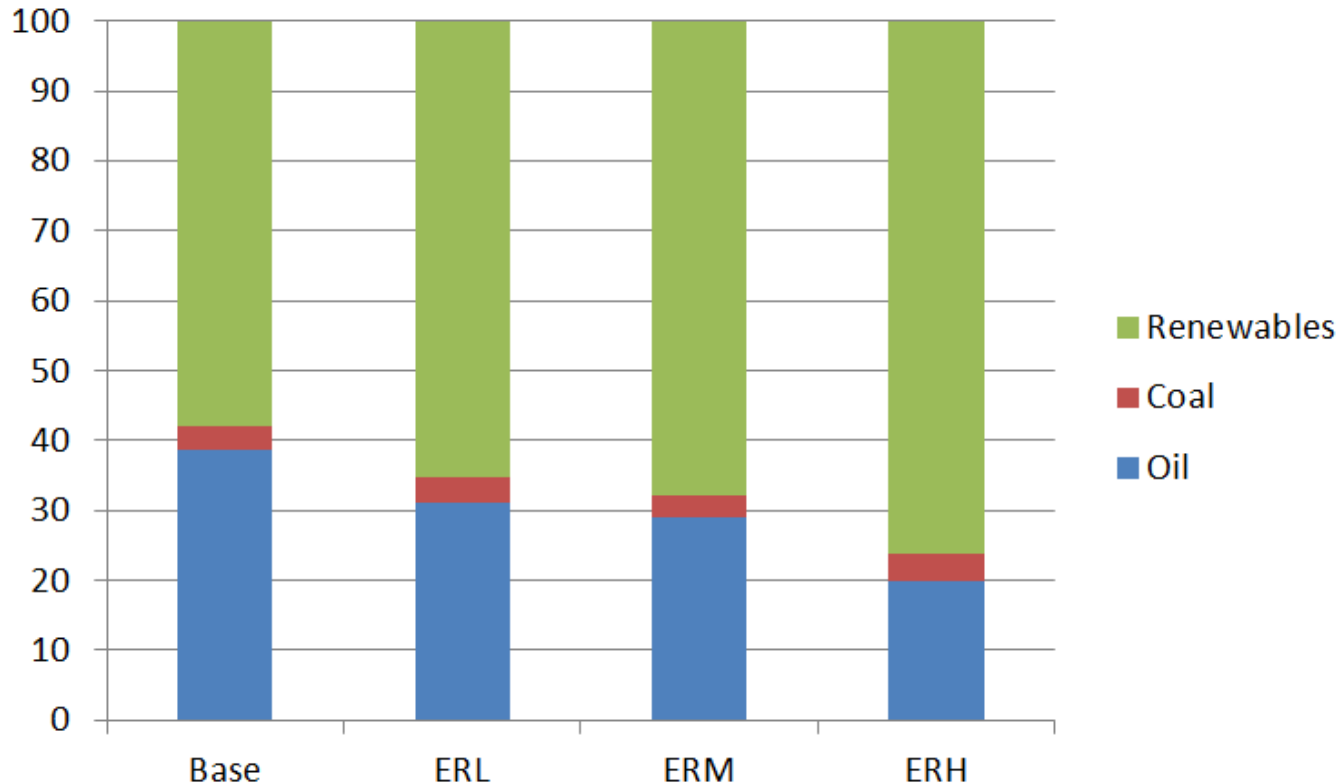
Switch to energy efficient and electric devices

- Energy Efficient Tractor
- Efficient Electric Pump
- Electric Motor for threshing



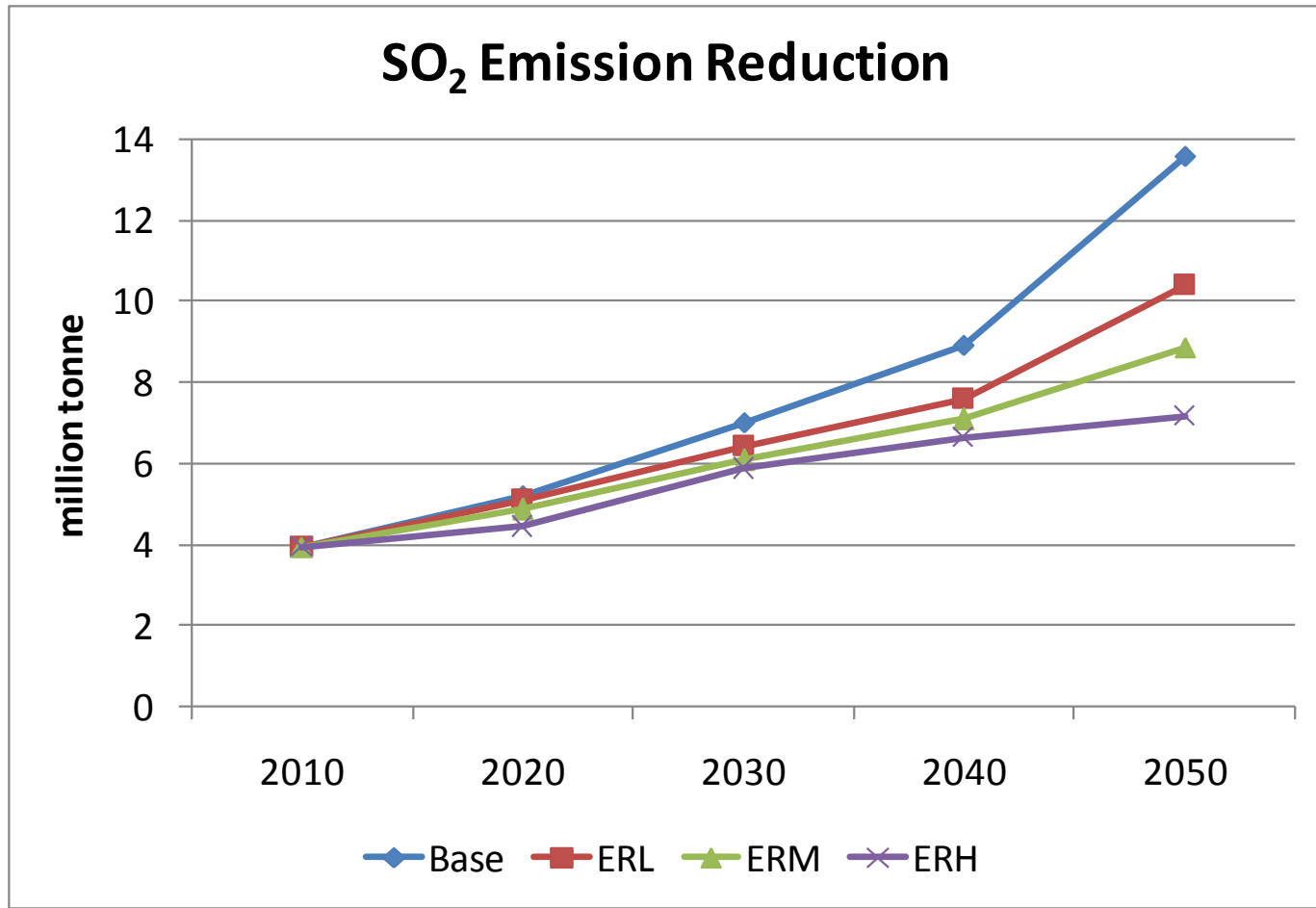
Some Co-benefits

Energy Security Co-benefit of Low Carbon Strategies: Change in Fuel Mix



- Share of oil products to decrease from to 38.7% in base case to 31.2% in ERL, 29.1% in ERM and 19.8% in ERH cases in 2050.
- Share of renewables to increase from 57.9% in base case to 65.2% in ERL, 67.9% in ERM and 76.2% in ERH cases in 2050.

Environmental Co-benefits



- Cumulative SO₂ emission reduction of 13.4%, 20.2% and 27.3% under ERL, ERM and ERH cases.



Thank You