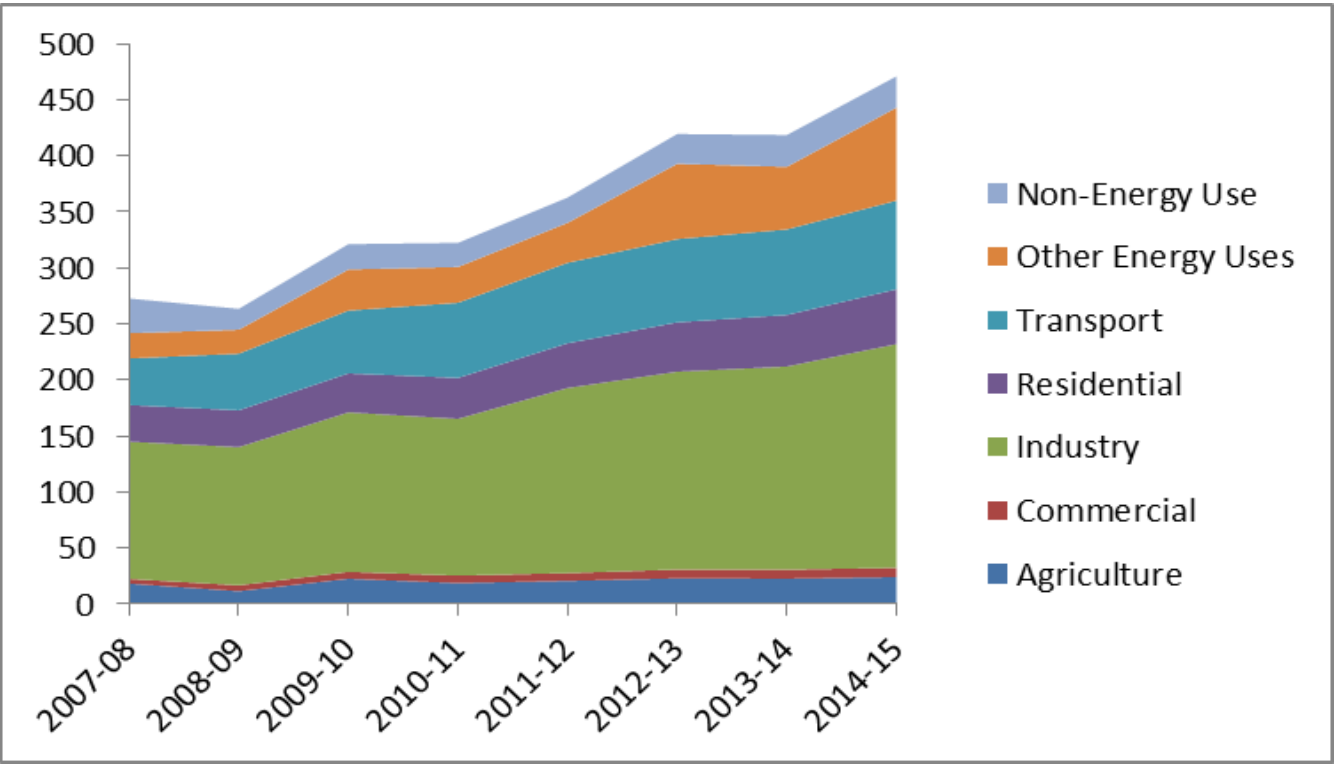
Examining the potential of Energy Efficiency in India

Ritu Mathur
Girish Sethi
Swapnil Shekhar
Sachin Kumar

November 8th , 2017

Current Energy Demand Profile

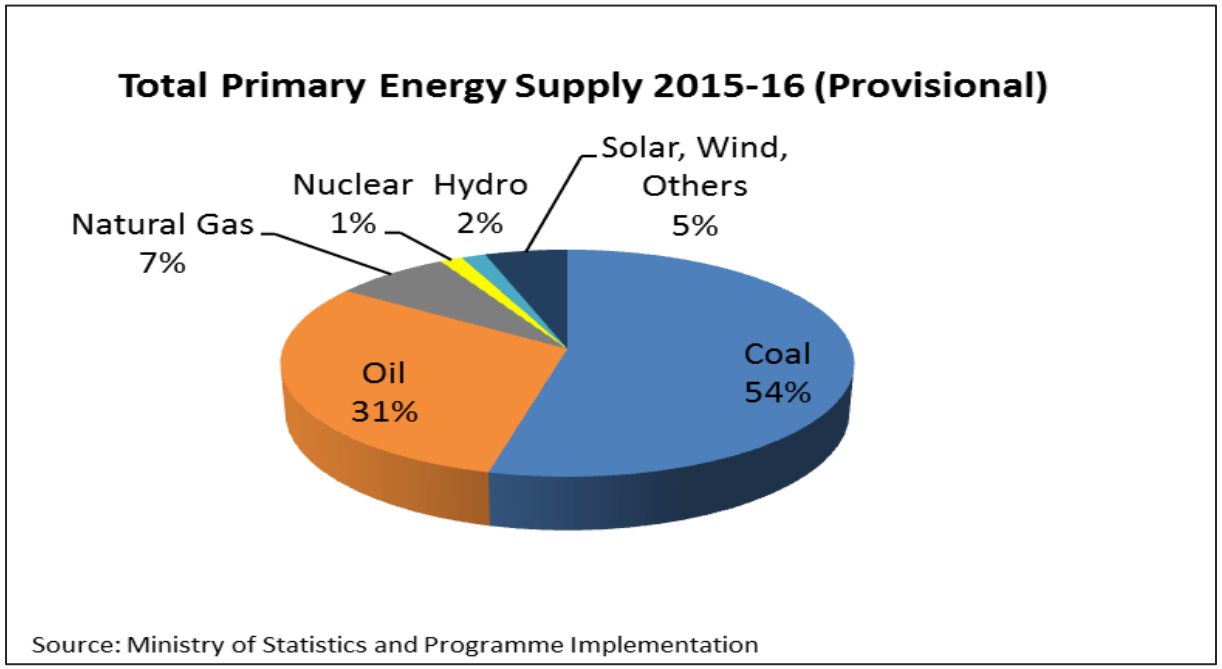


Energy consumption-2014-15

Industry: 24Mtoe
Transport: 79Mtoe
Residential: 49Mtoe
Agriculture: 24Mtoe
Commercial: 8Mtoe

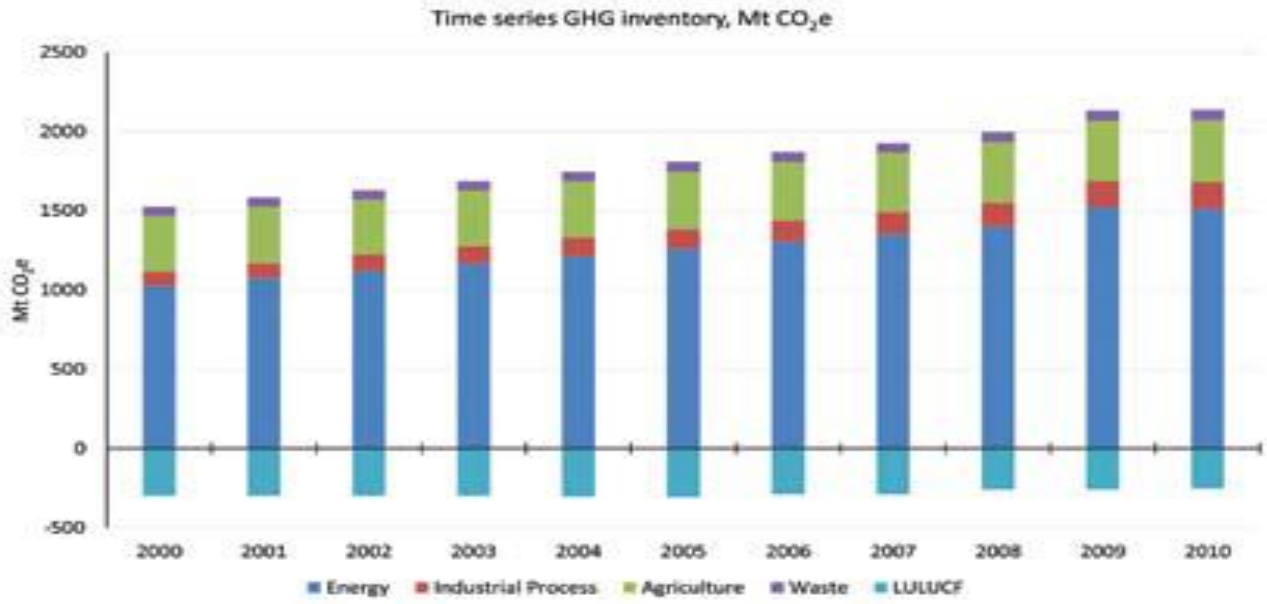
Source: TERI Analysis

Current Energy Supply Profile



Coal has the largest share in energy supply- mainly goes to power & industry sector
Second largest source is oil- supplied mainly to transport sector

Emissions Profile of India



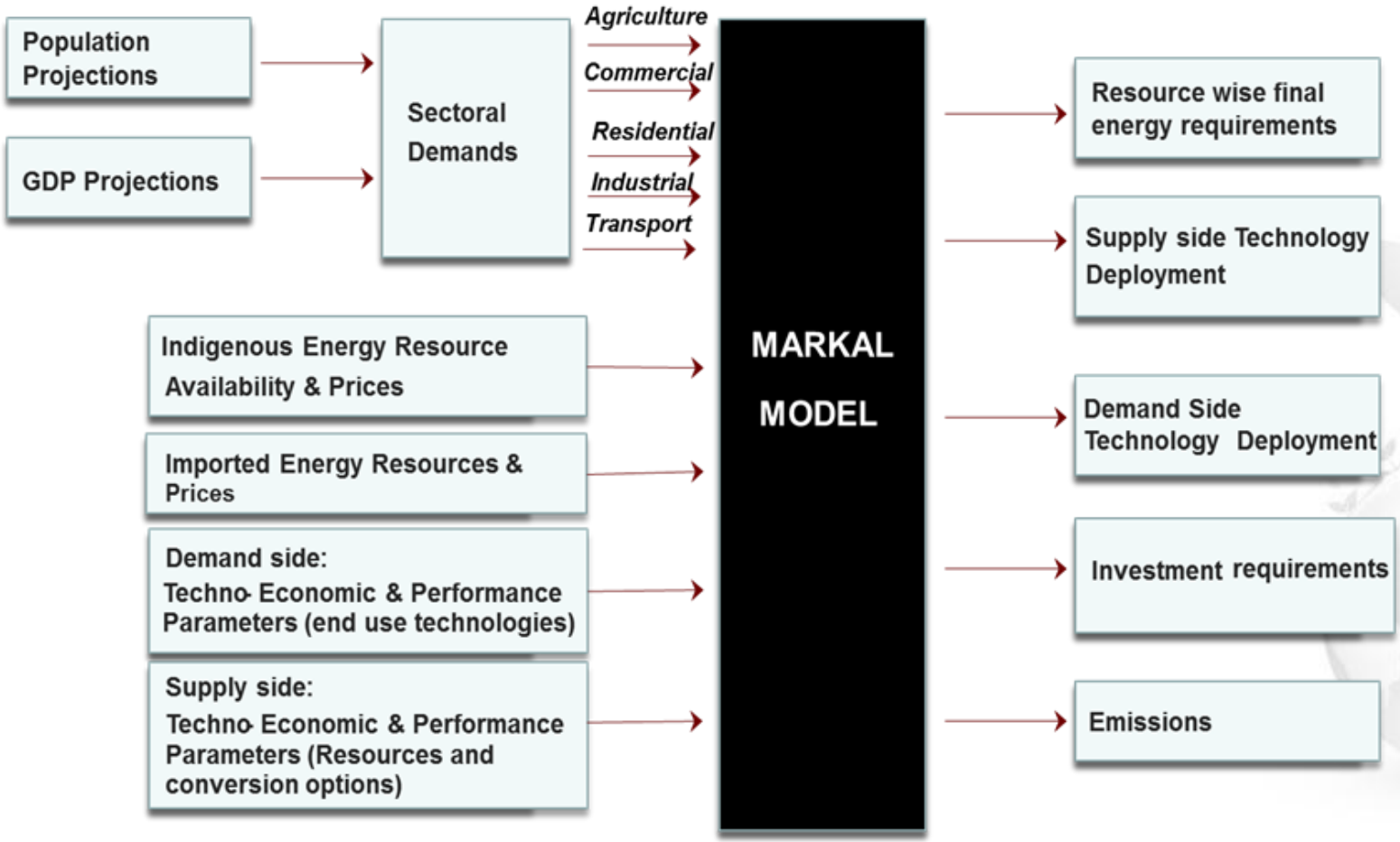
Largest emissions come from energy sources
Sector wise, power sector is the largest emitter
In Demand side, largest emissions come from industry and transport sector

Overall Approach

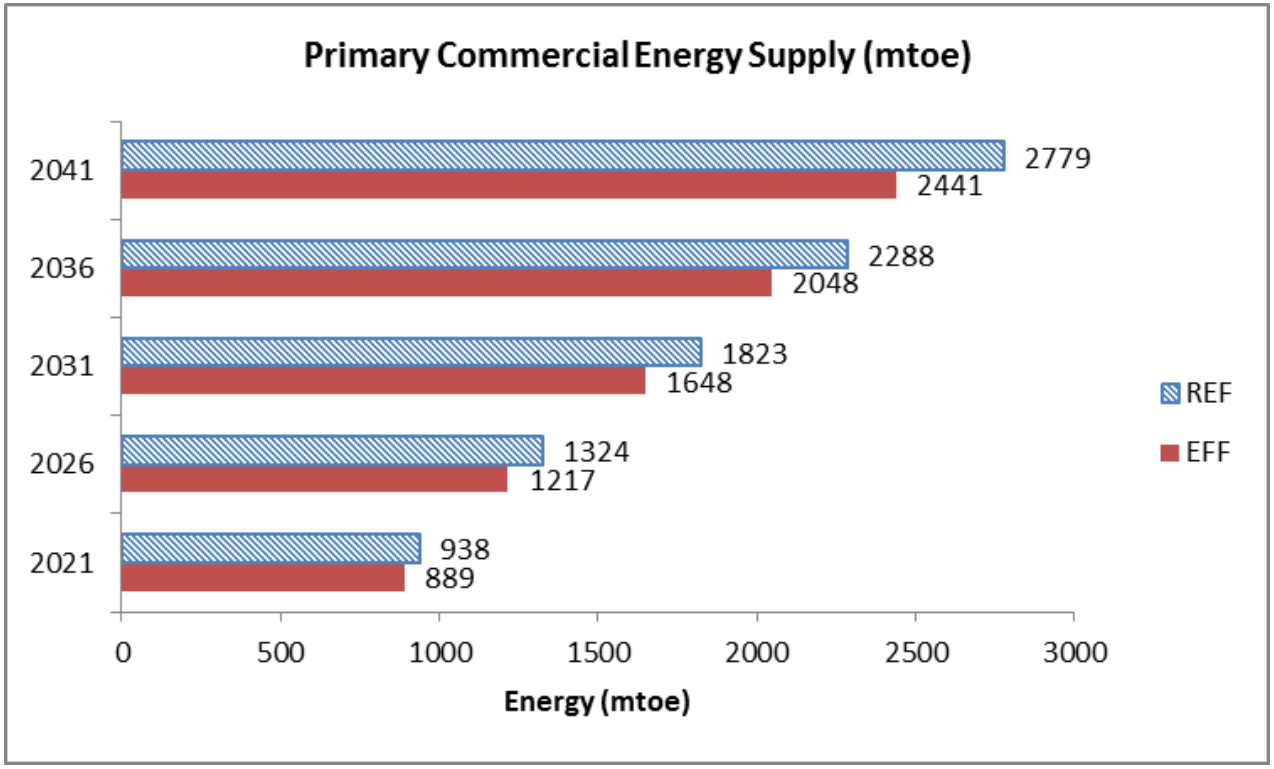
Scenarios developed for the study

- Reference scenario (REF)
  - Uptake of efficient options based on past trends
  - Shift constrained by high upfront costs
- Efficient scenario (EFF)
  - Increased penetration of efficient options
  - Phase out/ R&M of inefficient technologies
  - Based on discussions with various sector experts
- Sensitivity Analysis (EFF-S)
  - No new coal capacity added except those already commissioned

Modelling Framework



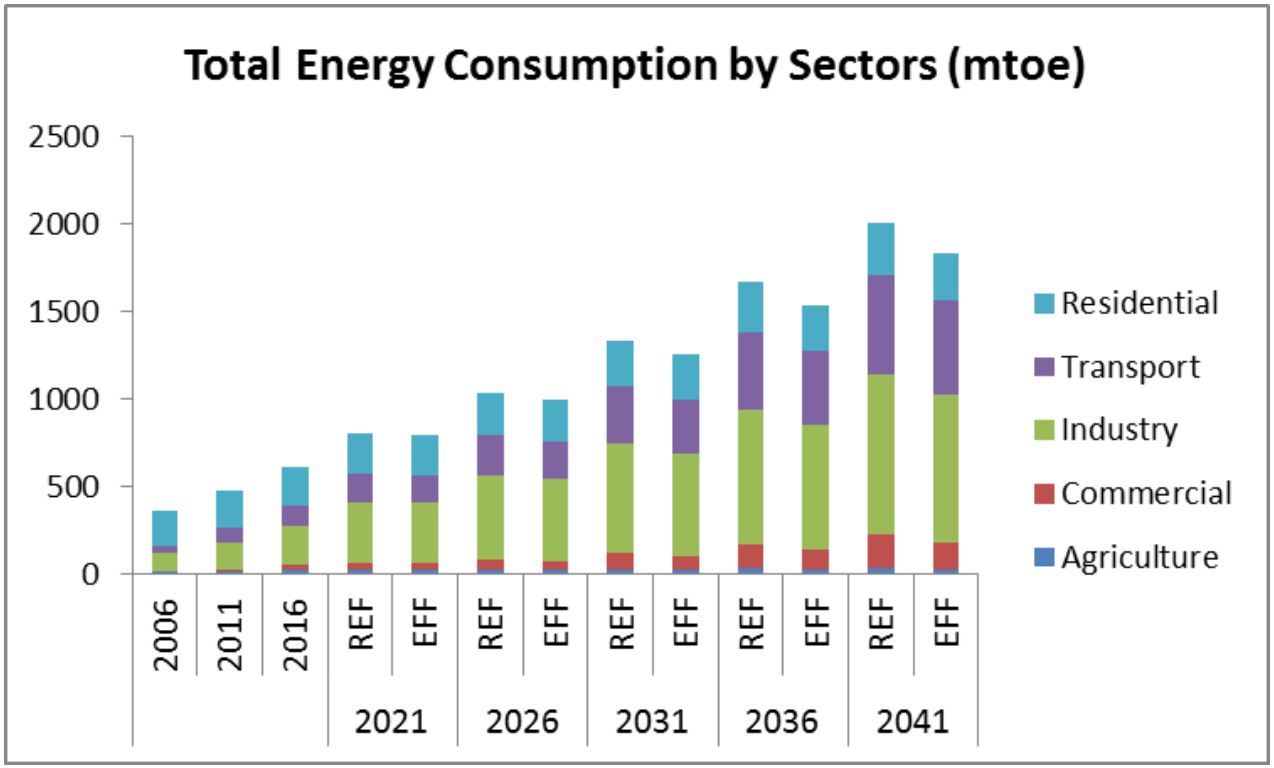
Key results



Energy savings of around 5%-12% are possible over the period 2021-2041.

In energy terms, the EFF scenario can achieve a reduction of around 49 mtoe in 2021, 174 mtoe in 2031 and 338 mtoe in 2041 respectively

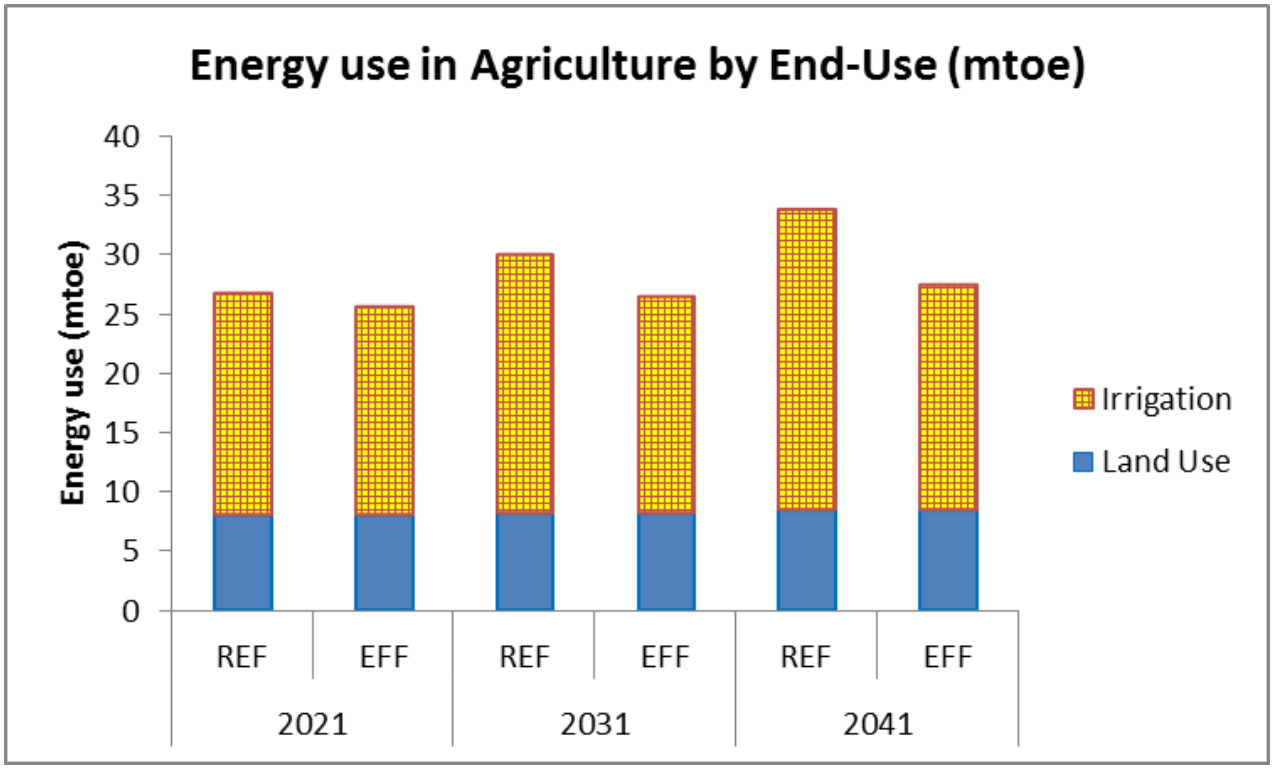
Sectoral energy consumption



Energy saving potential in decreasing order of magnitude:

1. Industry
2. Transport
3. Commercial
4. Residential
5. Agriculture

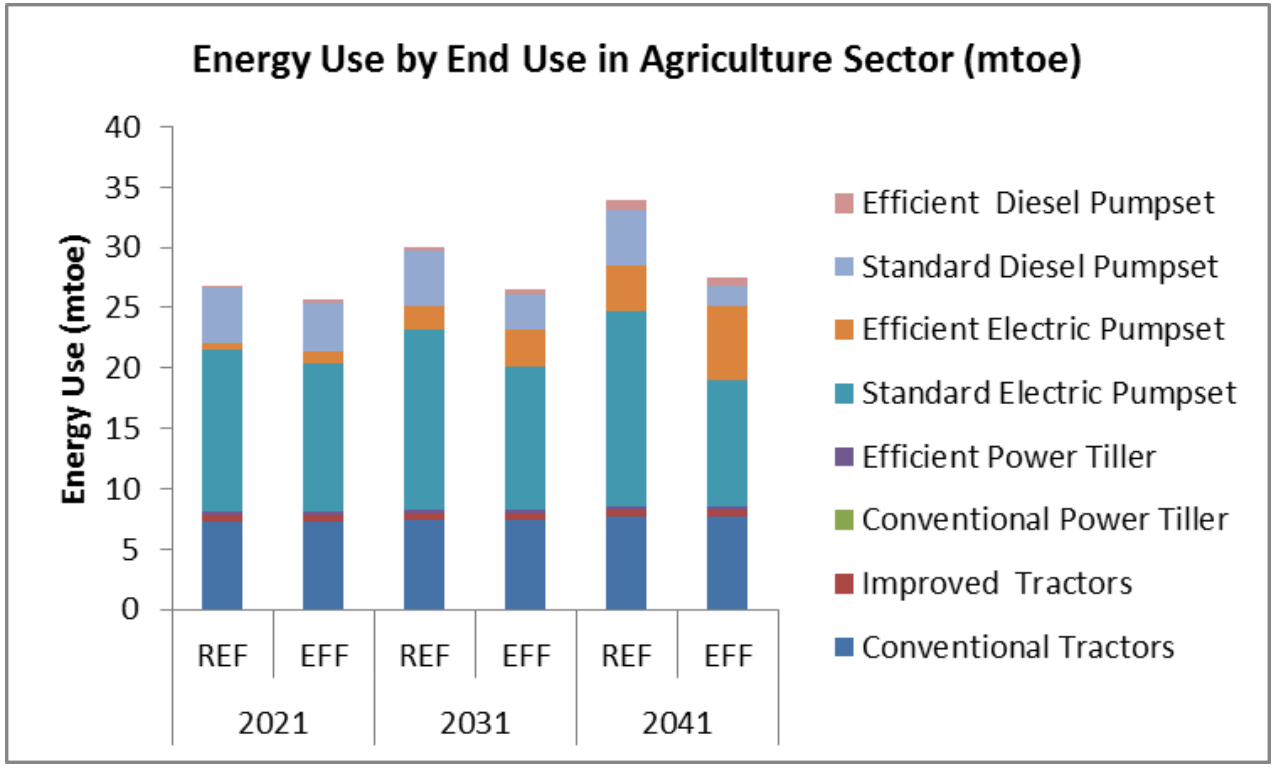
Potential in Agriculture sector



By 2021, 2031 and 2041 approximately 1 mtoe, 4 mtoe and 6 mtoe respectively can be saved due to EE improvements in this end-use across the 2 scenarios.

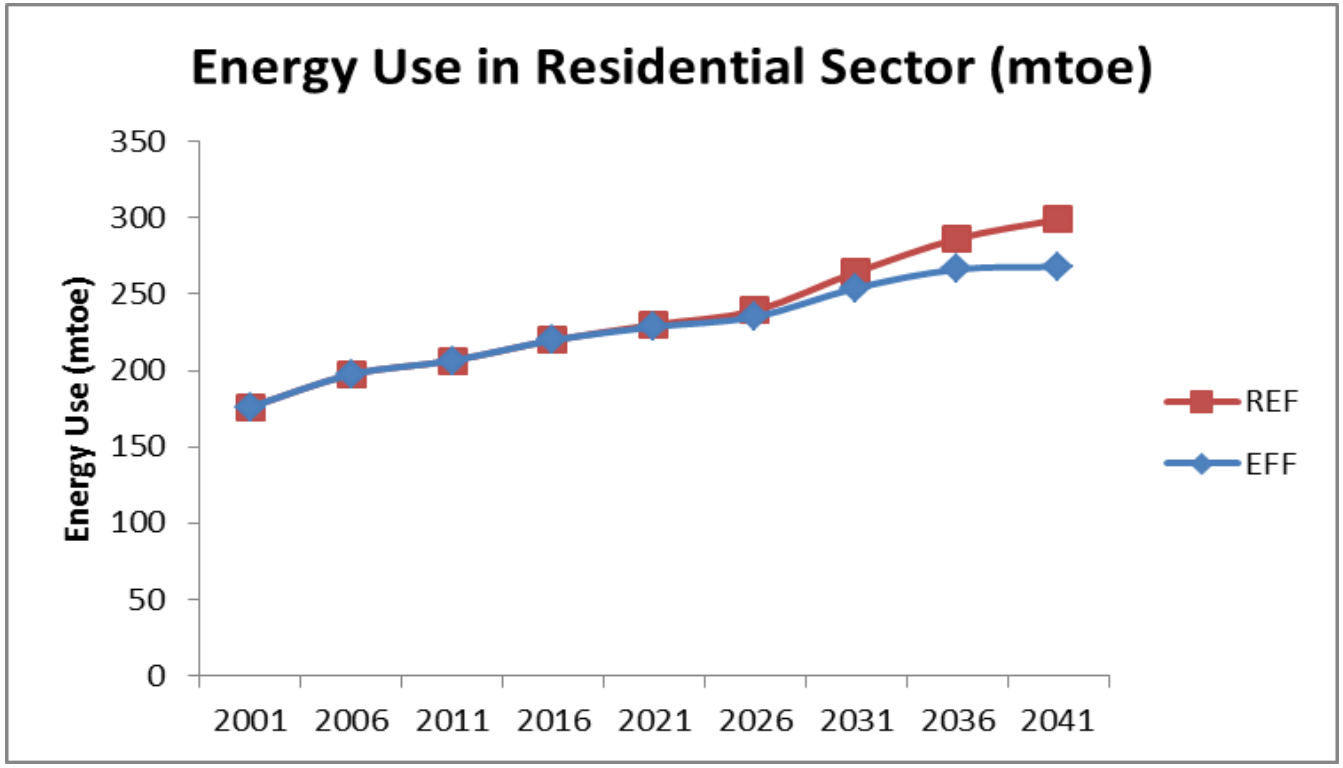
This accounts for nearly 4% - 19% savings during this time period

Agriculture sector choices



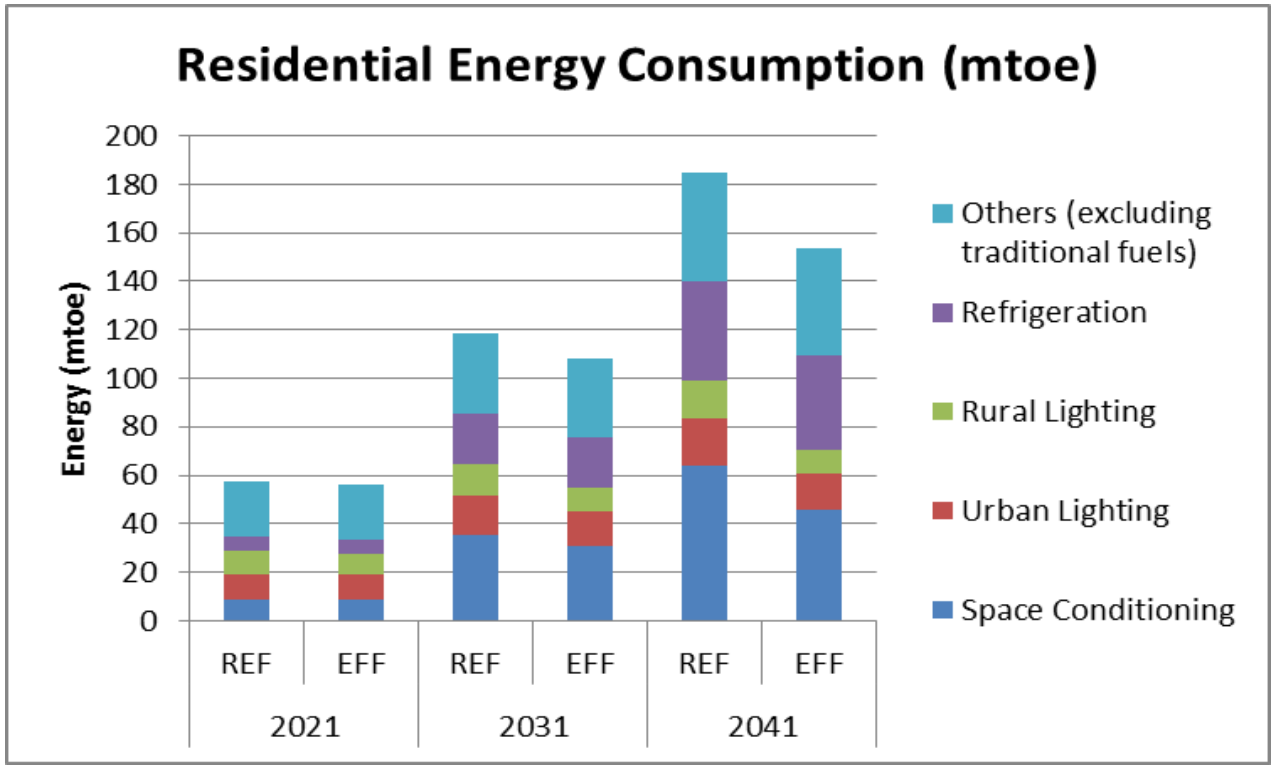
Efficiency improvements in both diesel and electric pumps needed

Potential in Residential sector



Although the appliances in the residential sector have already been improving their efficiencies in the past continuously, and this is partly already reflected in the REF scenario as well, by 2041, another 10% energy saving potential is envisaged.

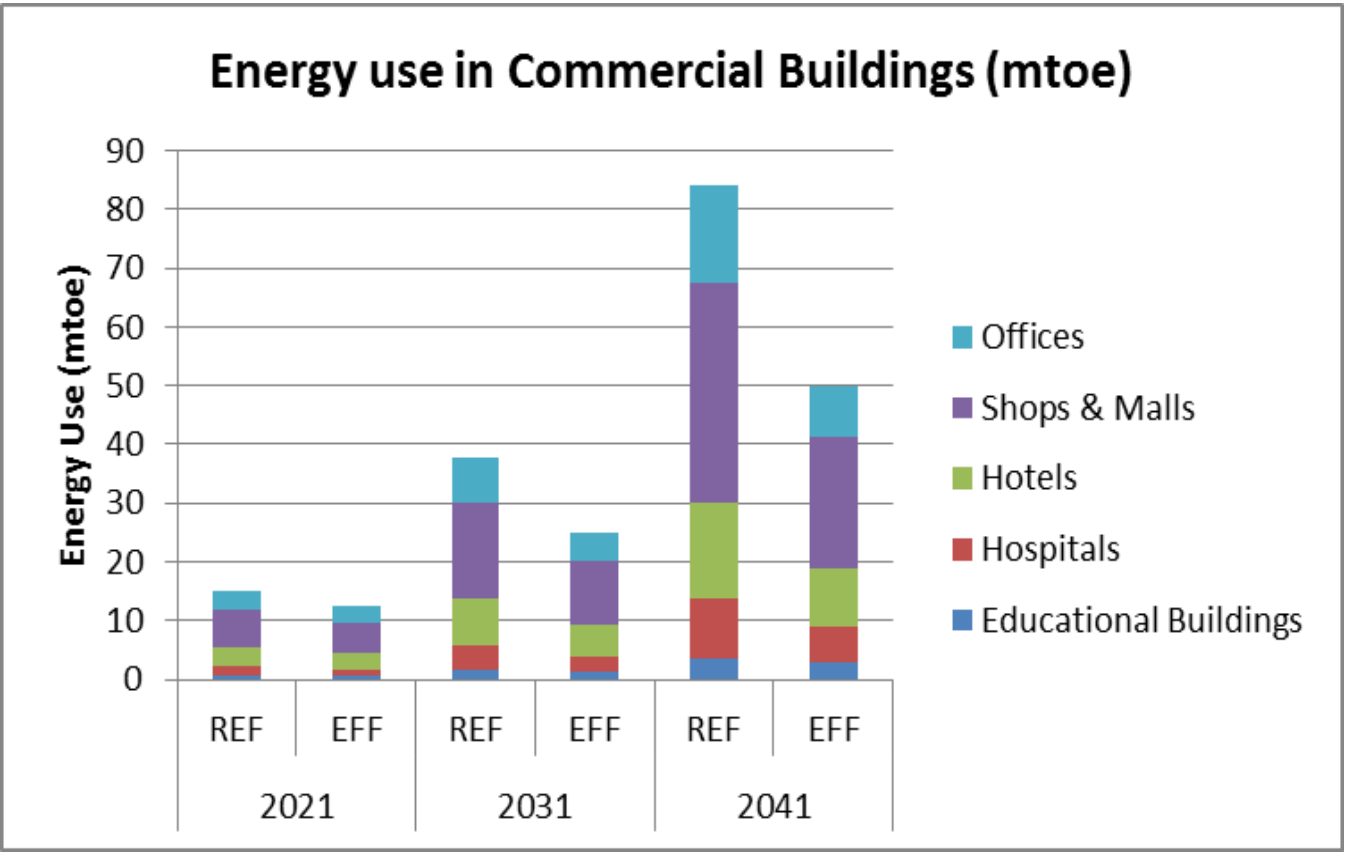
Residential sector choices



Space conditioning and lighting are the most promising end-uses

Rural lighting offers more saving because current stock is highly inefficient

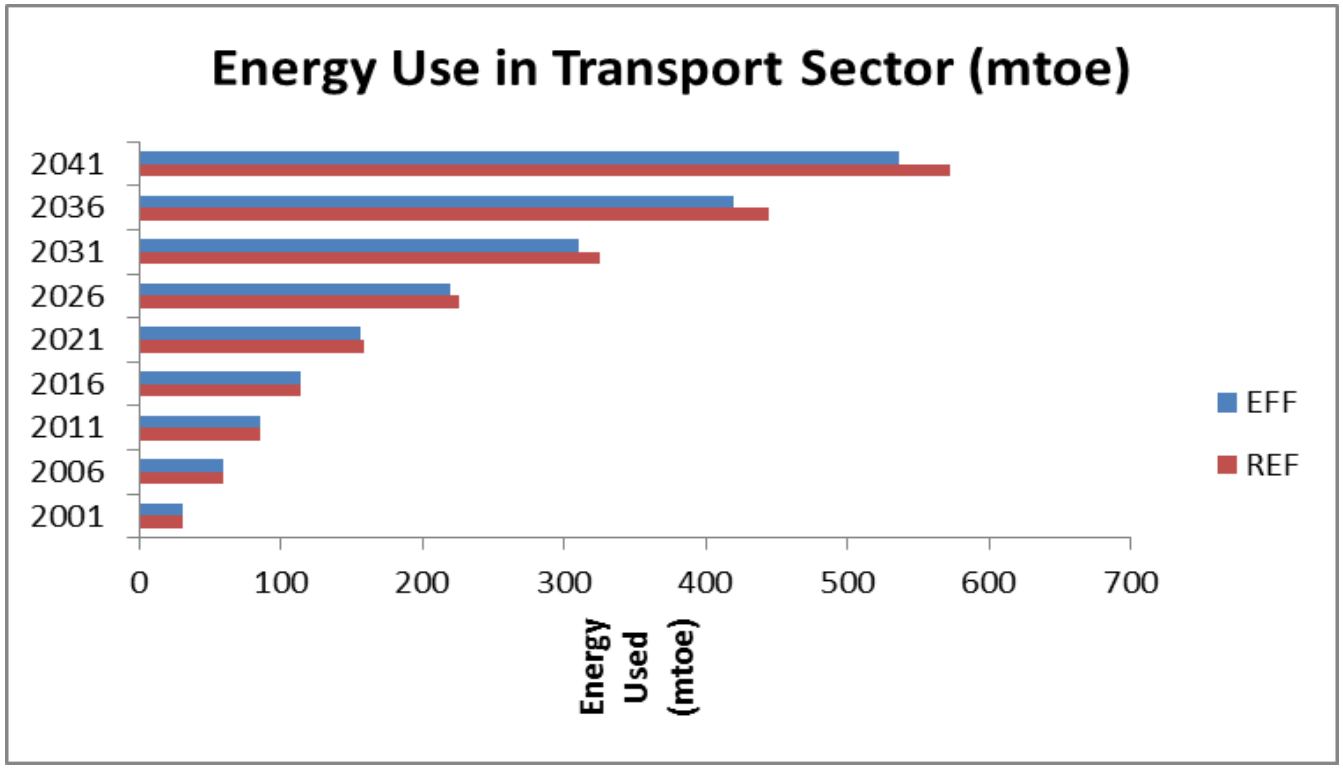
Potential in Commercial buildings



The commercial sector indicates a significant potential for energy efficiency, ranging from about 7% in 2021, 15% in 2031 and 18% by 2041 in the EFF scenario as compared to the REF scenario.

By 2021, 2031 and 2041 around 3 mtoe, 13 mtoe and 34 mtoe respectively could be saved between the two scenarios

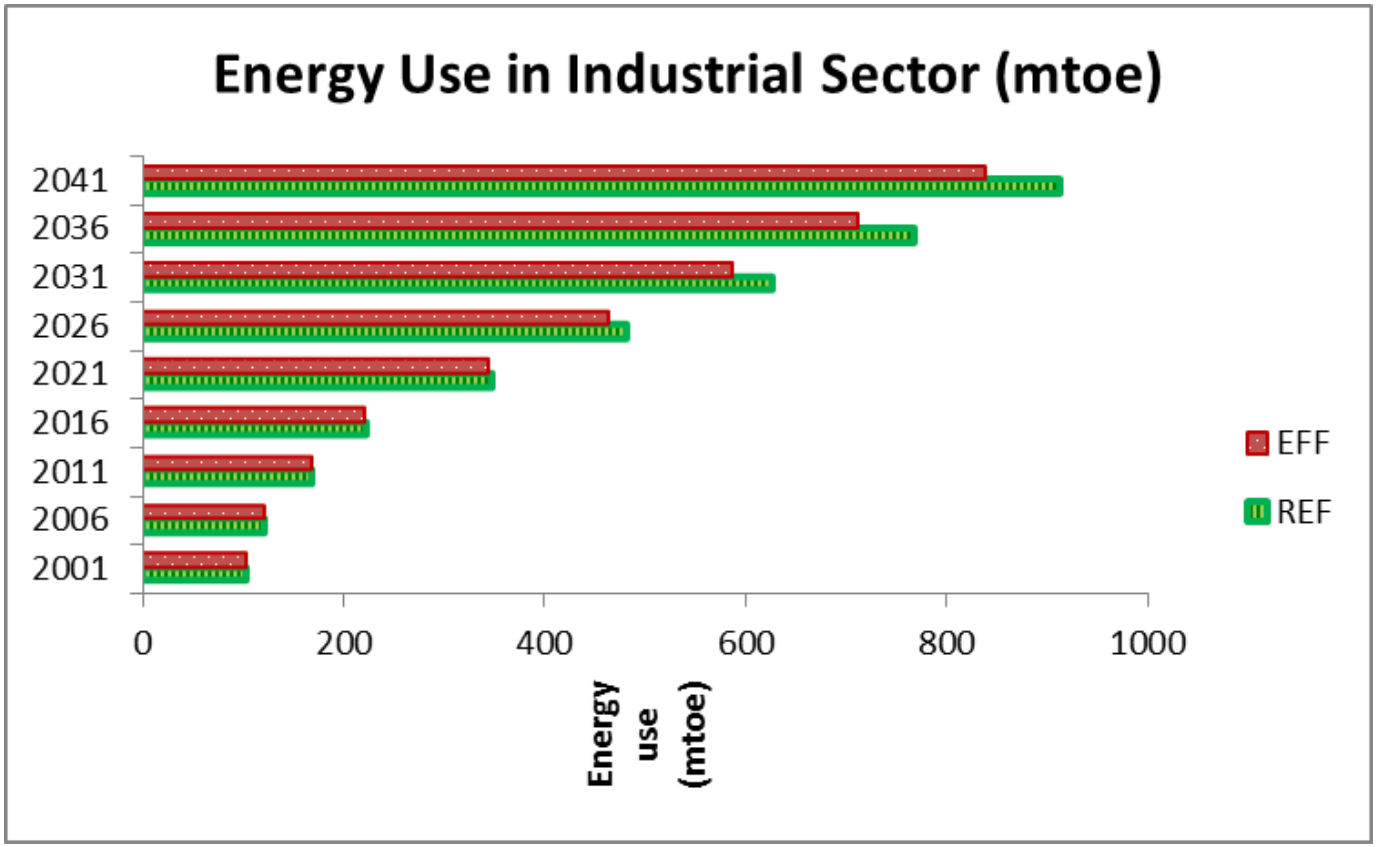
Potential in Transport Sector



Transport sector shows potential saving of 3, 15 and 37 Mtoe in 2021, 2031 and 2041.

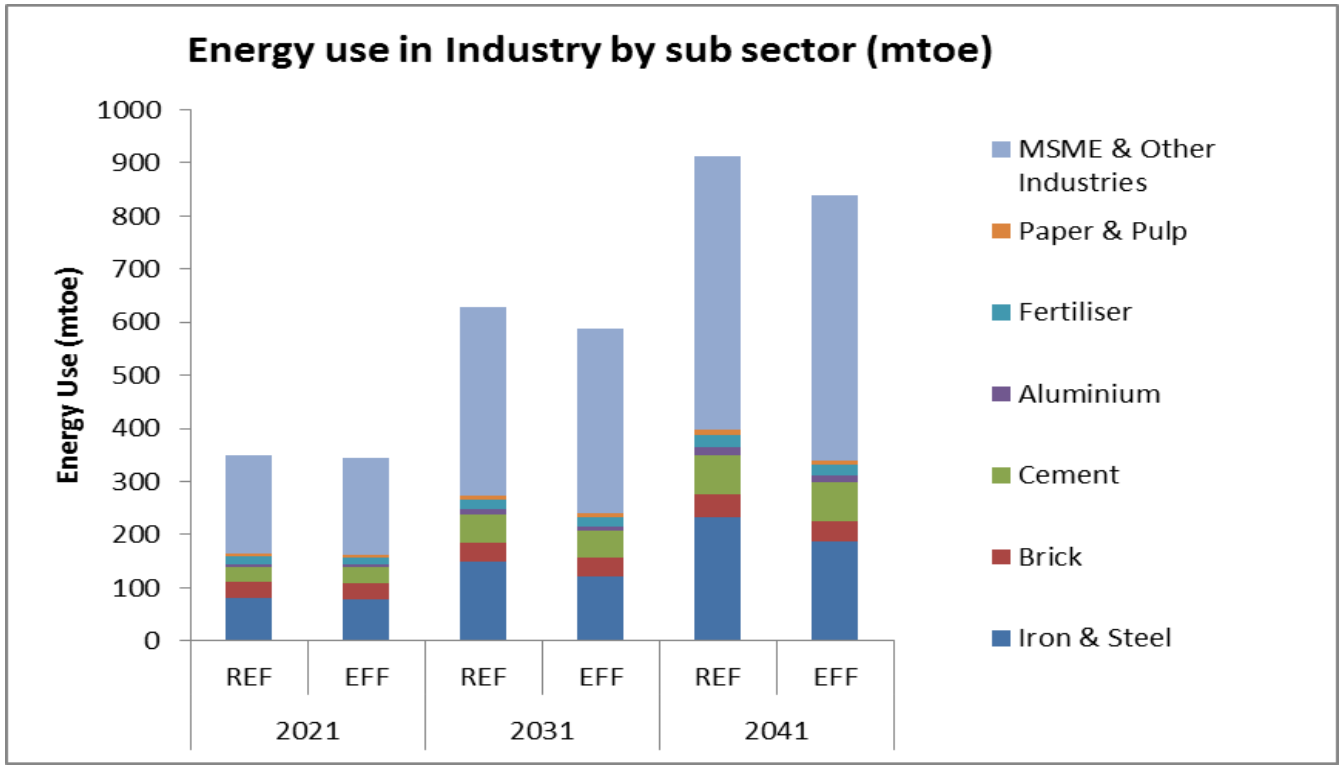
This accounts for 2%, 5% and 6% savings with respect to REF scenario.

Potential in industry sector



By 2021, 2031 and 2041, savings of 1%, 6% and 8% can be achieved in the industry sector in the EFF scenario as compared to the REF scenario

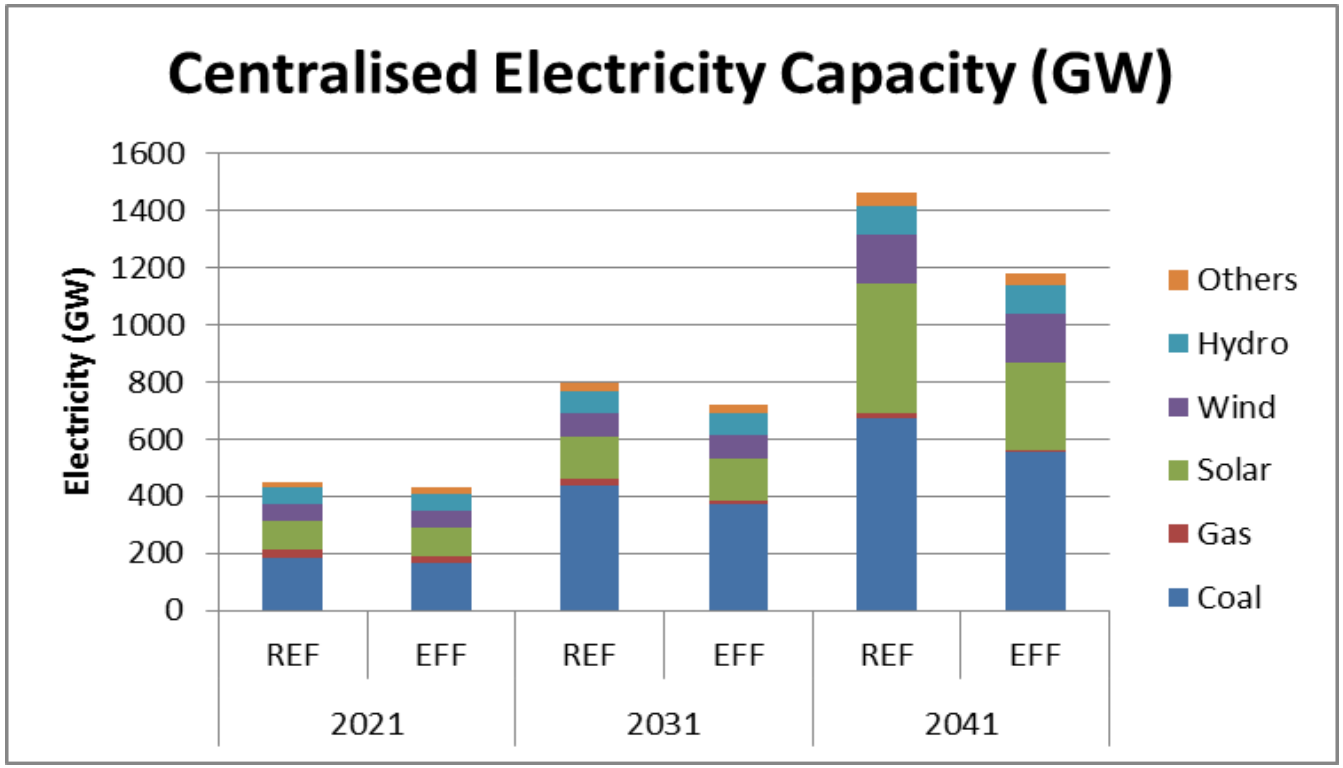
Sub-sector choices in industry



Major Savings across industries in 2041:

Iron & Steel-45Mtoe
MSMEs- 15Mtoe
Bricks- 4Mtoe
Fertilisers- 3Mtoe

Power Sector: Capacity

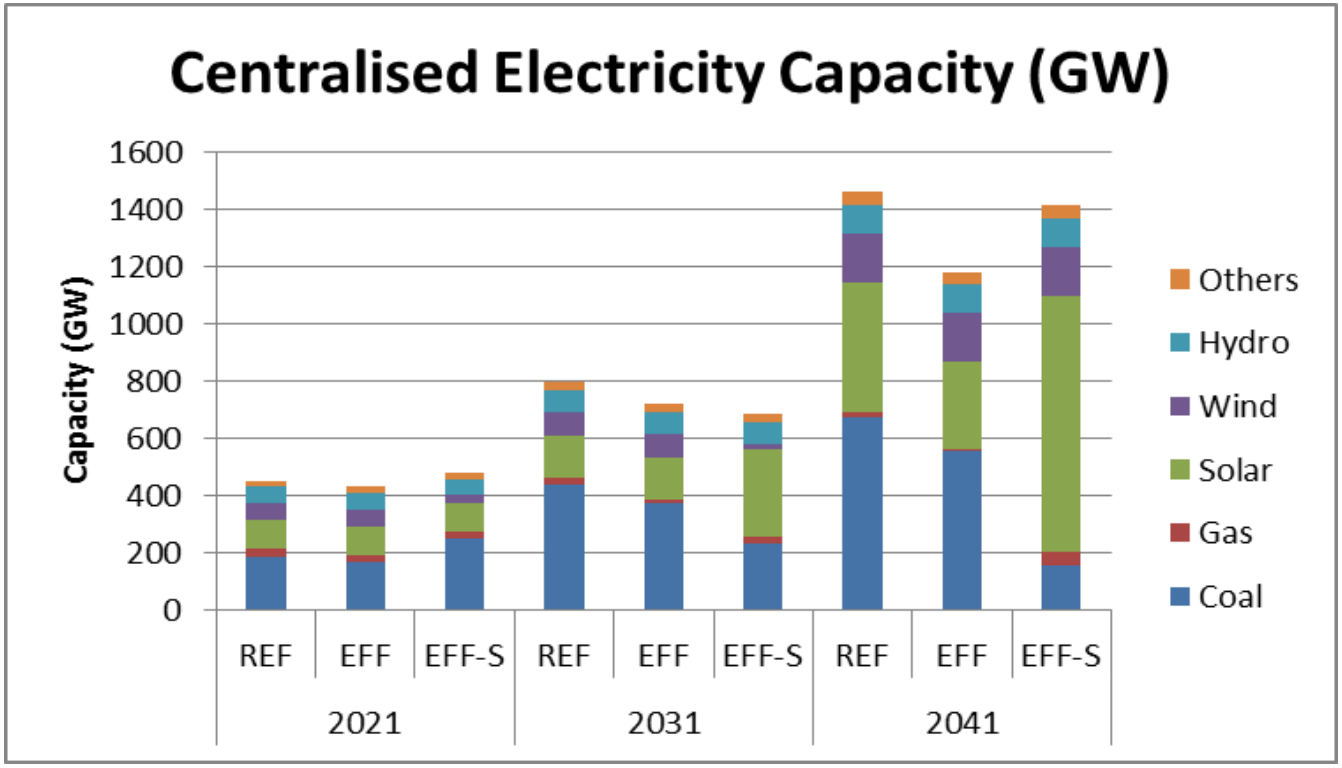


Phase out of old thermal plants

R&M of existing plants

Shift to more efficient thermal plants

Electric Capacity- Sensitivity Analysis

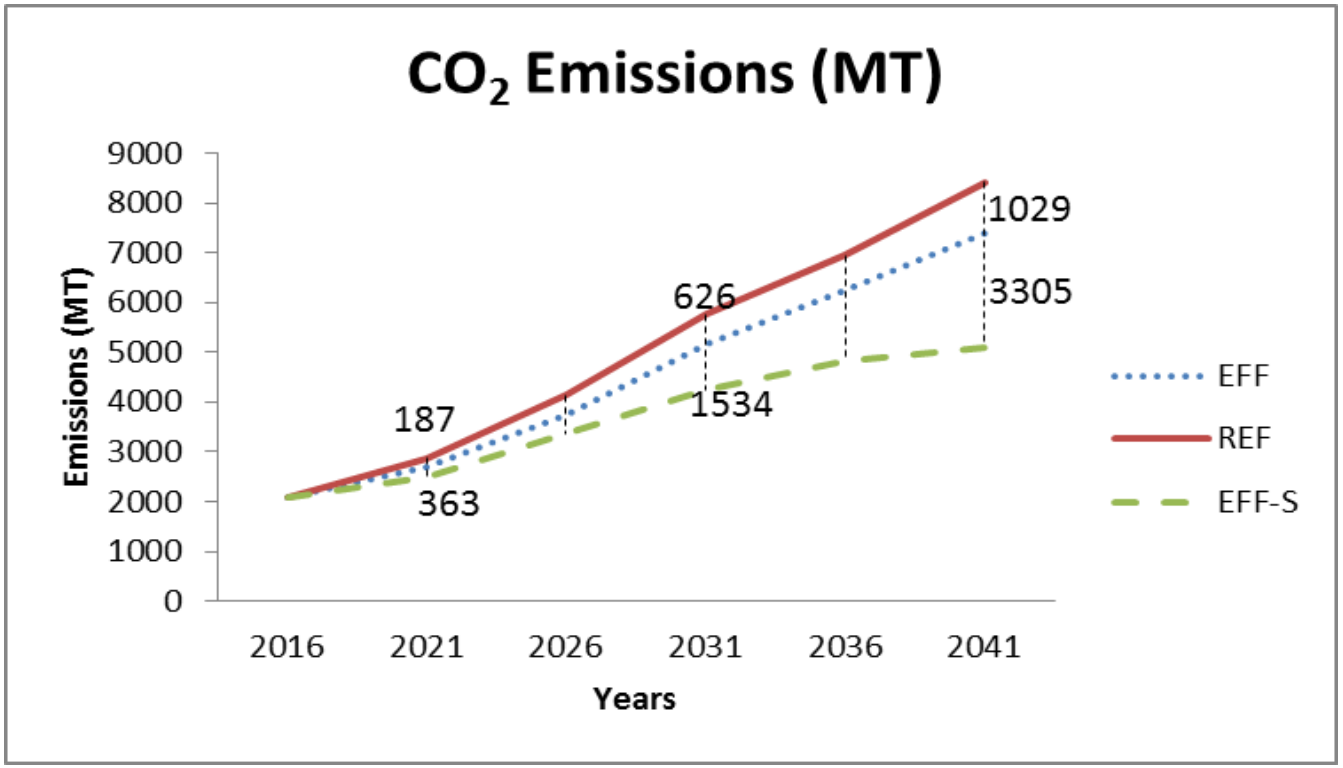


Very large share of renewables

Storage should be commercially viable at scale

Land requirements and feasibility need to be assessed

Emission savings



Emissions intensity of GDP declines by41% in EFF scenario and 43% in EFF-S scenario

EE Potential – A snapshot

Sector	End Use	2021		2031		2041	
		Savings	% Savings	Savings	% Savings	Savings	% Savings
Agriculture	Irrigation	1.18	6%	3.5	16%	6.4	25%
Residential	Space Conditioning	0.20	2%	4.6	13%	17.9	28%
	Lighting	1.11	6%	5.1	17%	10.7	30%
	Refrigeration	0.03	1%	0.4	2%	1.9	5%
Commercial	Educational Buildings	0.02	3%	0.2	12%	0.6	17%
	Hospitals	0.53	34%	1.7	39%	4.1	40%
	Hotels	0.48	15%	2.6	33%	6.6	41%
	Shops & Malls	1.18	18%	5.5	34%	15.0	40%
	Offices	0.46	15%	2.8	37%	7.8	47%
Industry	Iron & Steel	0.74	1%	26.9	18%	45.3	19%
	Brick	0.88	3%	2.5	7%	4.3	10%
	Cement	0.03	0%	0.9	2%	1.9	3%
	Aluminium	0.14	2%	0.7	7%	1.7	12%
	Fertiliser	0.07	1%	1.1	6%	3.3	14%
	Paper & Pulp	0.78	14%	1.4	18%	2.0	22%
	MSME & Other Industries	1.21	1%	6.7	2%	15.2	3%
Transport		2.65	2%	15.0	5%	36.6	6%
Power (TWh)	Thermal Power Plants	484	15%	1273	17%	1899	20%

Key options & sub-sectors for EE

- Iron & Steel, Cement, Bricks, and other industries including MSMEs
- Energy efficiency in transport through improvements in the aviation sector, switch towards rail based movement and electric vehicles and improvement in vehicle efficiencies
- Efficient buildings for shops/malls, hotels and offices
- Improvement in irrigation efficiencies in agriculture sector
- Lighting and space conditioning appliances in the residential sector.

Thank you !

Contact Person:
Swapnil Shekhar
Research Associate, TERI
swapnil.shekhar@teri.res.in