GHG Mitigation Interventions- How Far Feasible in India

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Increase in India's commercial energy needs – an imperative to meet MDGs and National Devpt Goals

- India is 5th largest in terms of total commercial energy, but low per capita commercial energy consumption
- Only 55% of households have access to electricity
- Target of high economic growth geared towards
  - poverty reduction & provision of basic services towards attaining development goals, as well as imperatives of developing adaptive capacity for climate change

    →Rapid increase in energy needs inevitable

Energy Programmes and policies

Improving energy efficiency

Promoting renewable energy including hydro

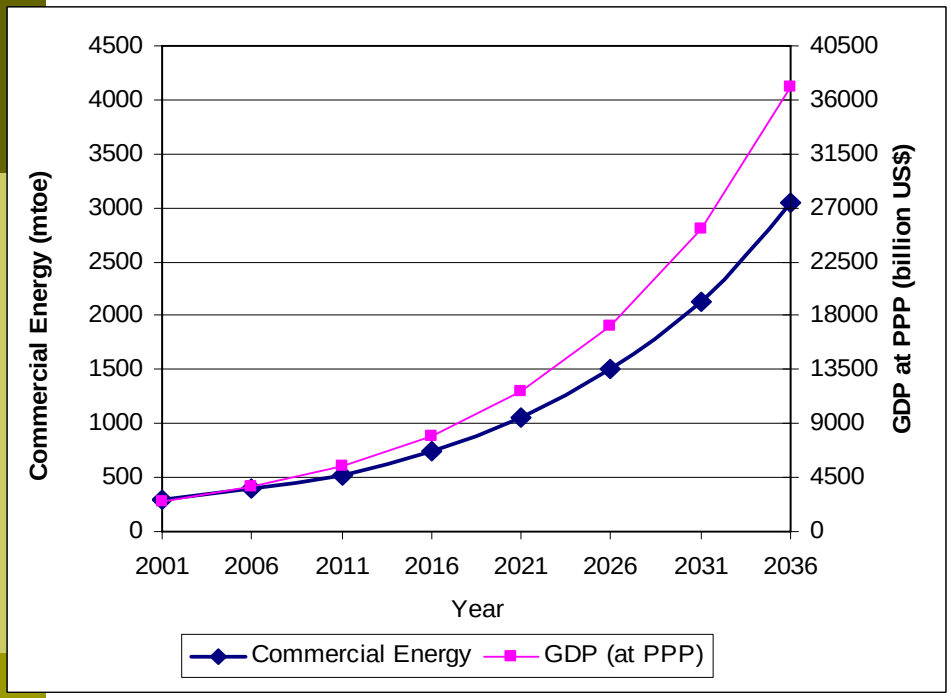
Power sector reforms

Energy and infrastructure development

Environmental quality management

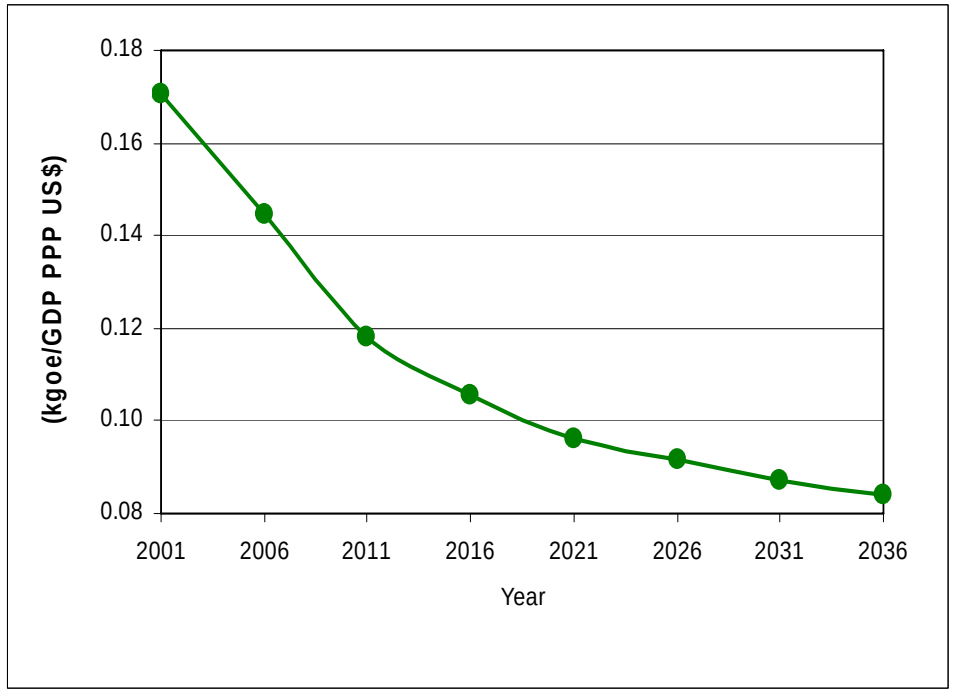
Indian government already has several policies and programmes in place directed at reducing energy intensity

Commercial Energy and GDP (2001-36)



At 2000 prices

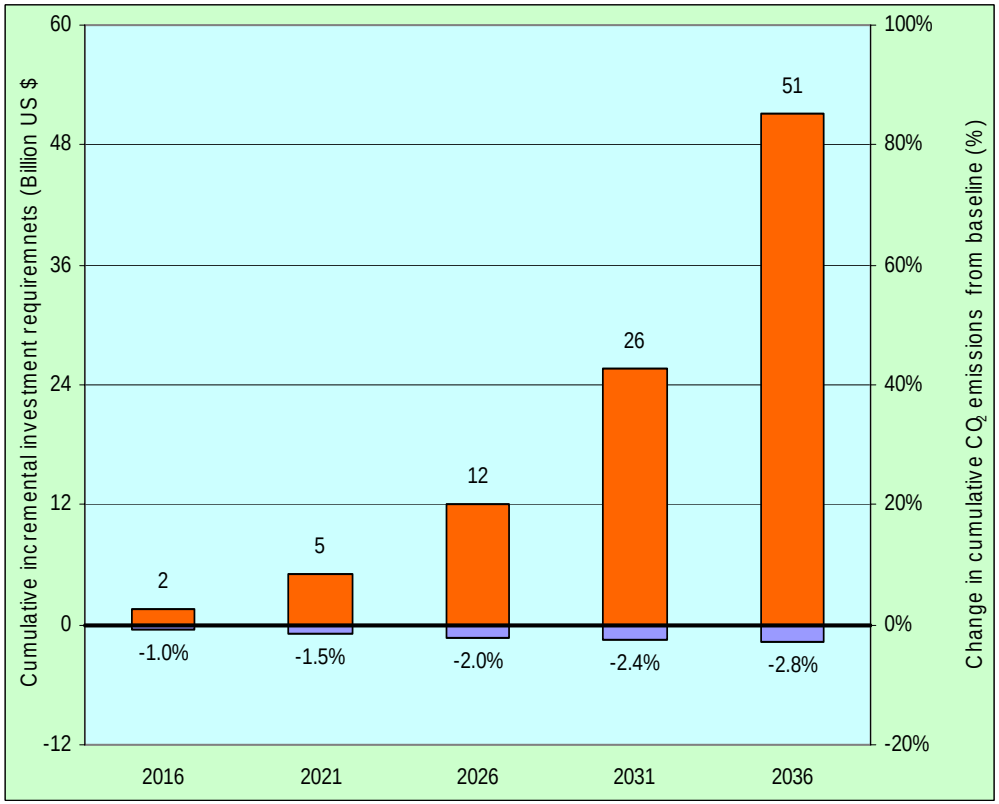
Commercial energy intensity (2001-2036)



At 2000 prices

- 8% GDP growth during 2001-2036 (Planning Commission)
- Total commercial energy consumption would inevitably increase
- Government policies directed towards sustainable development would lead to reduction in energy intensity

Incremental investment requirements for reducing CO_2 emissions from residential and commercial sector from baseline (2001-36)

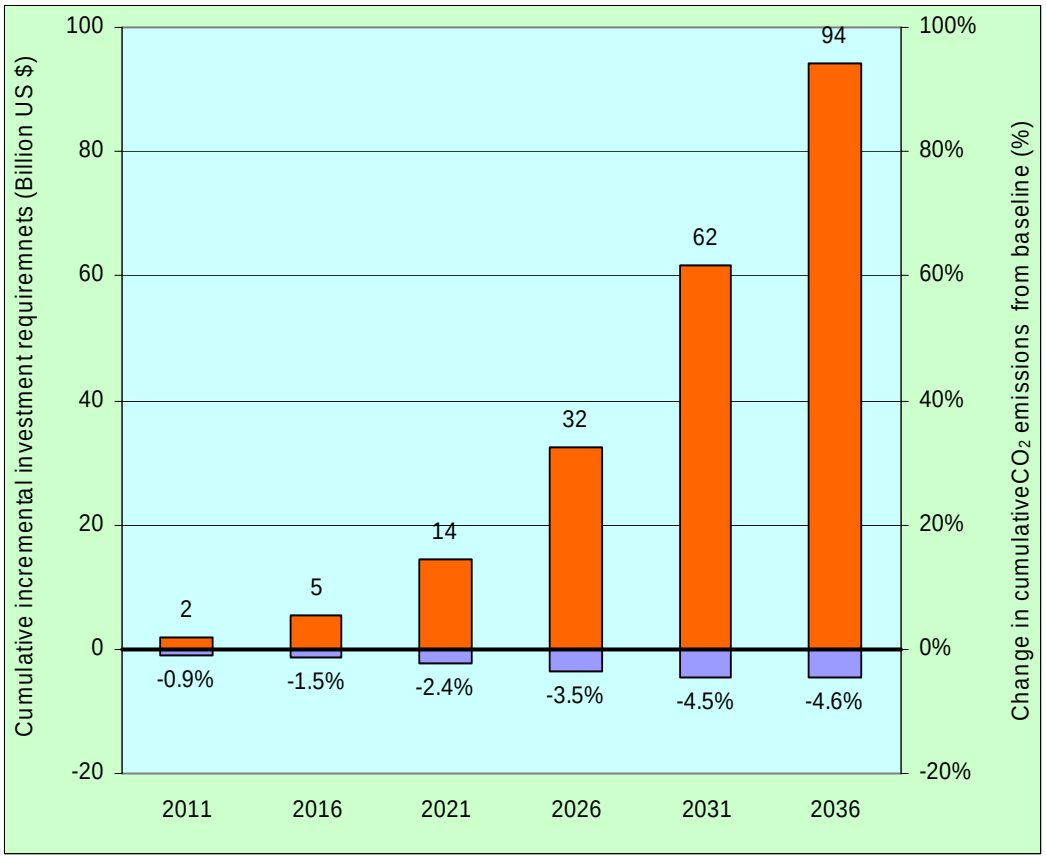


Options included in residential and commercial sector

CFLs, Fluorescent tube lights (FTL), Efficient AC, Efficient refrigerator

- Faster penetration of CFL & FTL
- Share of efficient refrigerators increasing from 17% in 2001 to 30% in 2036
- Share of efficient AC increasing from 25% in 2001 to 45% in 2036
- All above options are negative cost options
- Together can achieve
  - ~0.5% reduction in overall CO_2 emissions
  - ~ 2.8% CO_2 emission reduction in residential and commercial sector

Incremental investment requirements for reducing CO_2 emissions in transport sector using bio diesel (2001-36)

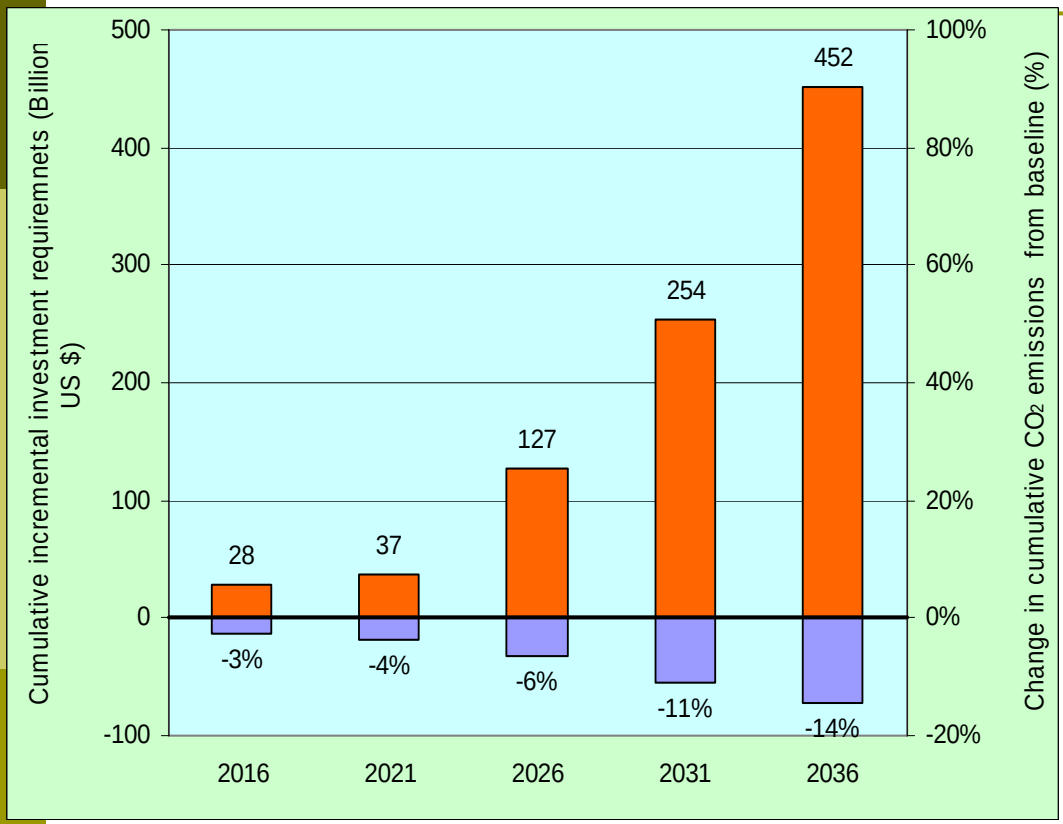


- Use of bio diesel for transport sector
  - ~0.9% reduction in overall CO_2 emissions
  - ~ 5 % CO_2 emission reduction in transport sector (2001-36)

Option considered with higher penetration

Bio diesel for transport sector

Incremental investment requirements for reducing cumulative CO_2 emissions (2001-2036) from power sector w.r.t. baseline

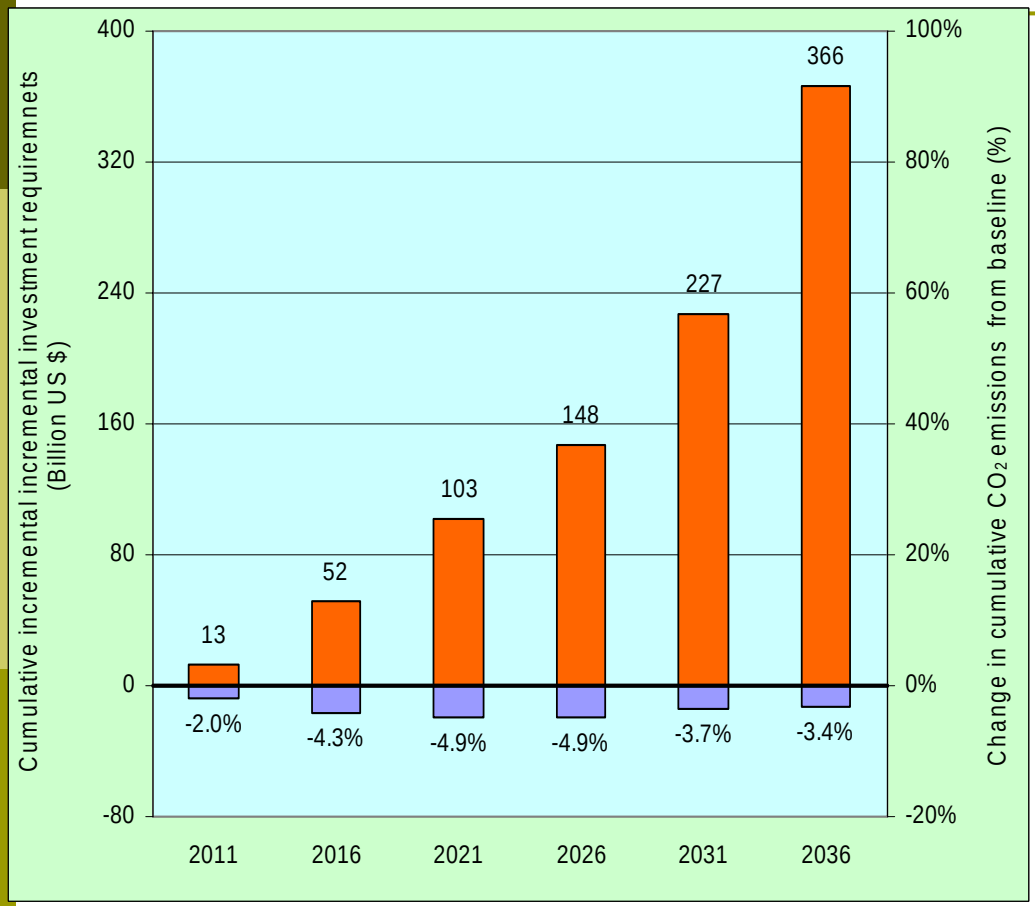


- Increased penetration of Clean coal technologies as compared to baseline
- All clean coal technologies are positive cost options for CO_2 emissions reductions
- Clean coal technologies can achieve
  - ~6.0% reduction in overall CO_2 emissions
  - ~ 14.4% CO_2 emission reduction in power sector (2001-36)

Power Sector options

Super critical, Ultra supercritical , IGCC based on imported coal, IGCC based on domestic coal

Incremental investment requirements for reducing CO_2 emissions from renewables in power sector (2001-36)

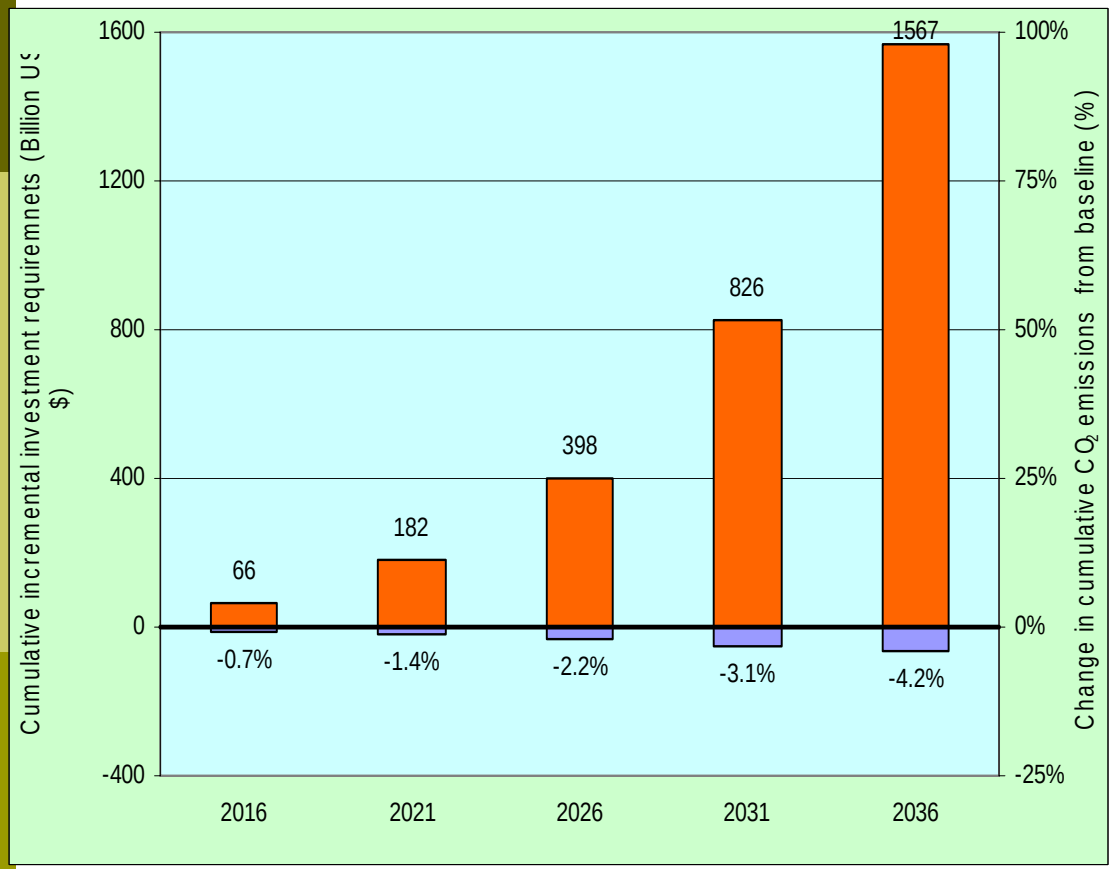


- Higher level of renewable for power generation as compared to baseline
- Renewable energy technology for power generation can achieve
  - ~1.5% reduction in overall CO_2 emissions
  - ~ 3.4% CO_2 emission reduction in power sector (2001-36)

Options considered with higher penetration

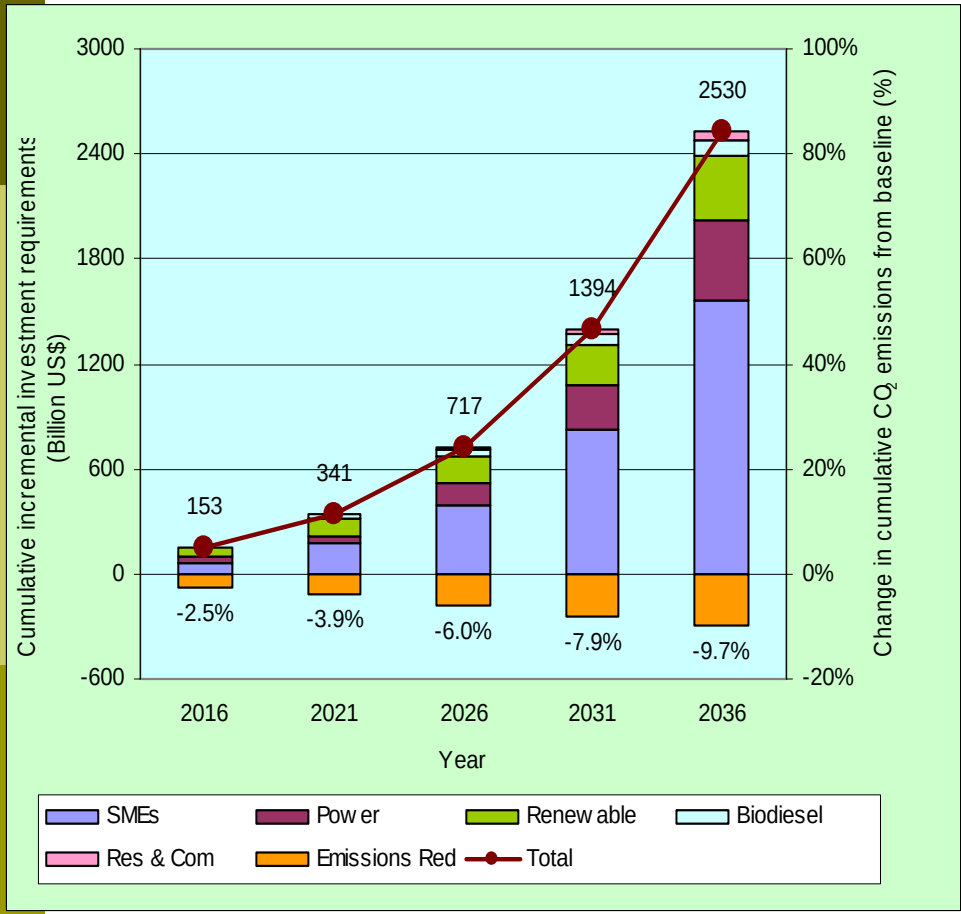
Wind, solar PV, small hydro, biomass gasifier

Incremental investment requirements for reducing CO_2 emissions from industry sector from efficiency improvement in small and medium scale industries (2001-36)



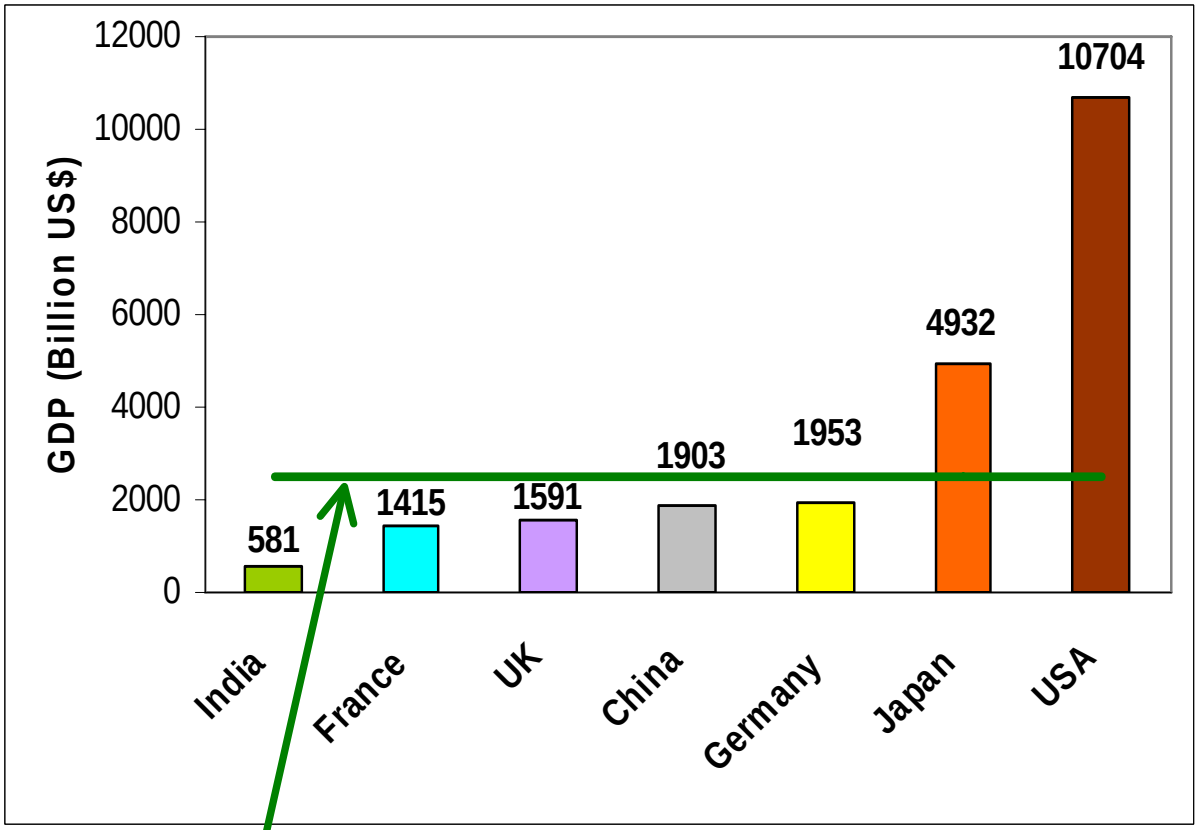
- Efficiency improvement in small scale industries compared to baseline
  - ~1.3% reduction in overall CO_2 emissions
  - ~ 4.2 % CO_2 emission reduction in industry sector (2001-36)

Cumulative incremental investment requirements

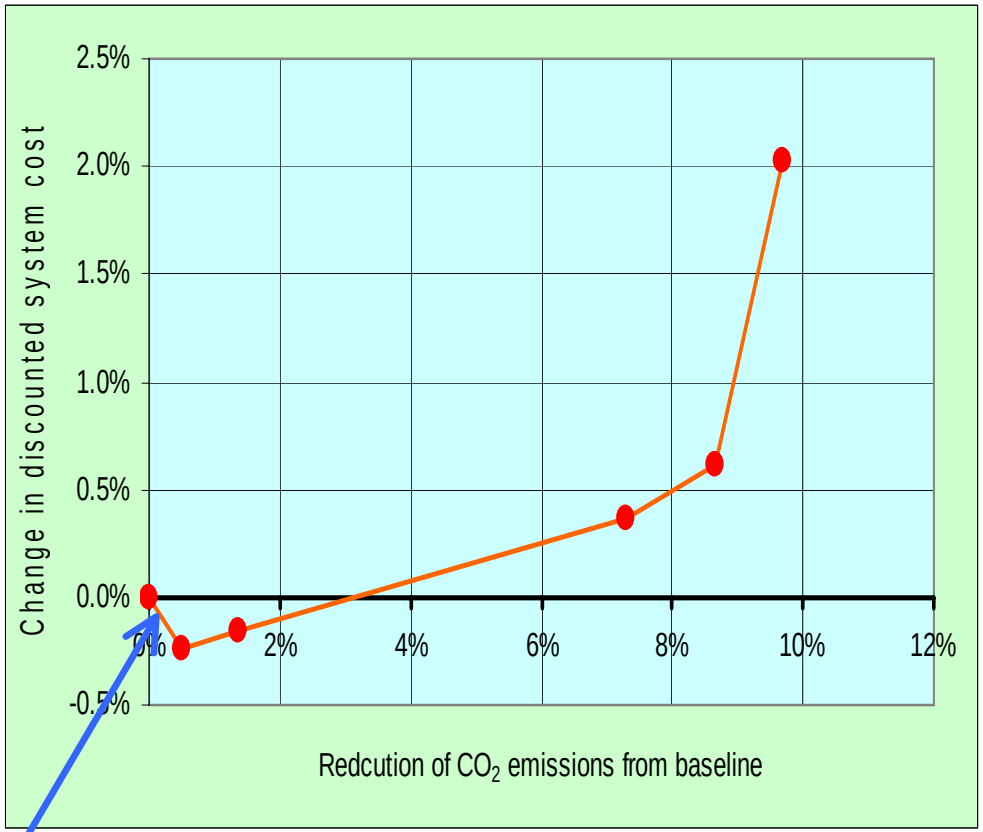


Year	Cumulative incremental investments (Billion US$)	Cumulative CO_2 emissions reduction from baseline (%)
2016	153	2.5%
2021	341	3.9%
2026	717	6.0%
2031	1394	7.9%
2036	2530	9.7%

Cumulative incremental investment requirements and GDP of different countries in 2004



Change in discounted energy system cost with successively increasing CO_2 emission reductions (2001-36)



% Reduction in CO_2 emissions from baseline	% Change in total discounted system cost
0.5%	-0.24%
1.4%	-0.15%
7.3%	0.36%
8.7%	0.61%
9.7%	2.03%

Residential and commercial sector

CFL bulb, Florescent tube light, Efficient AC, Efficient refrigerator

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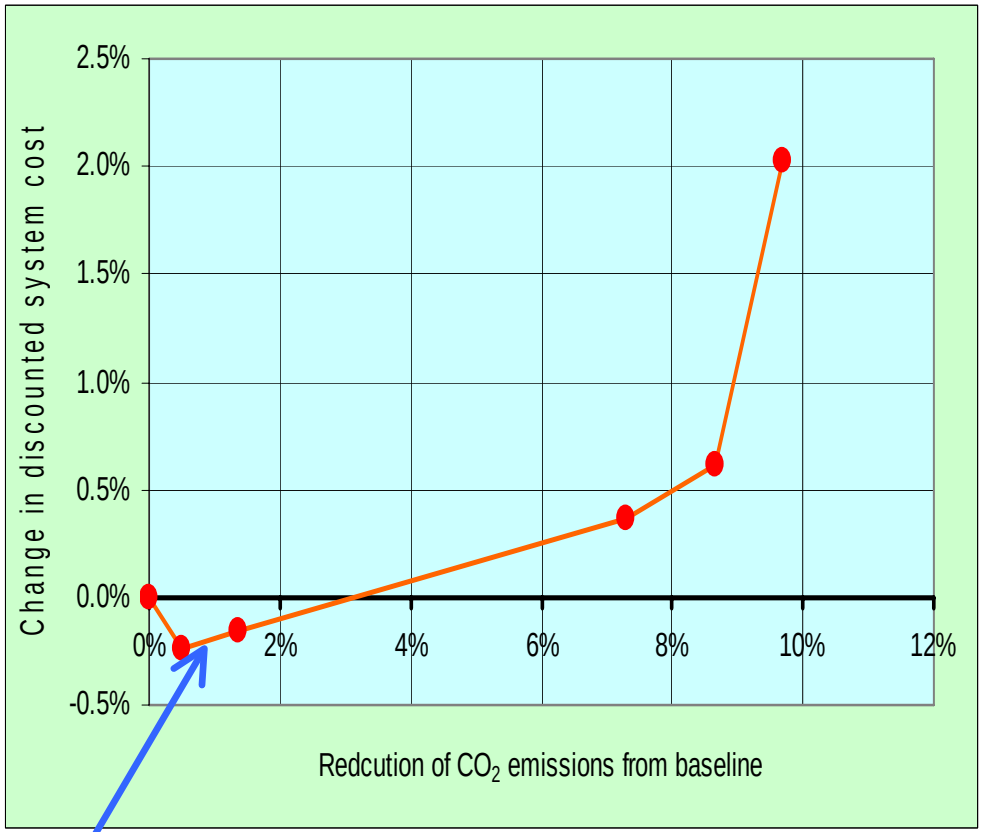

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Transport sector

Use of Biodiesel in transport sectors

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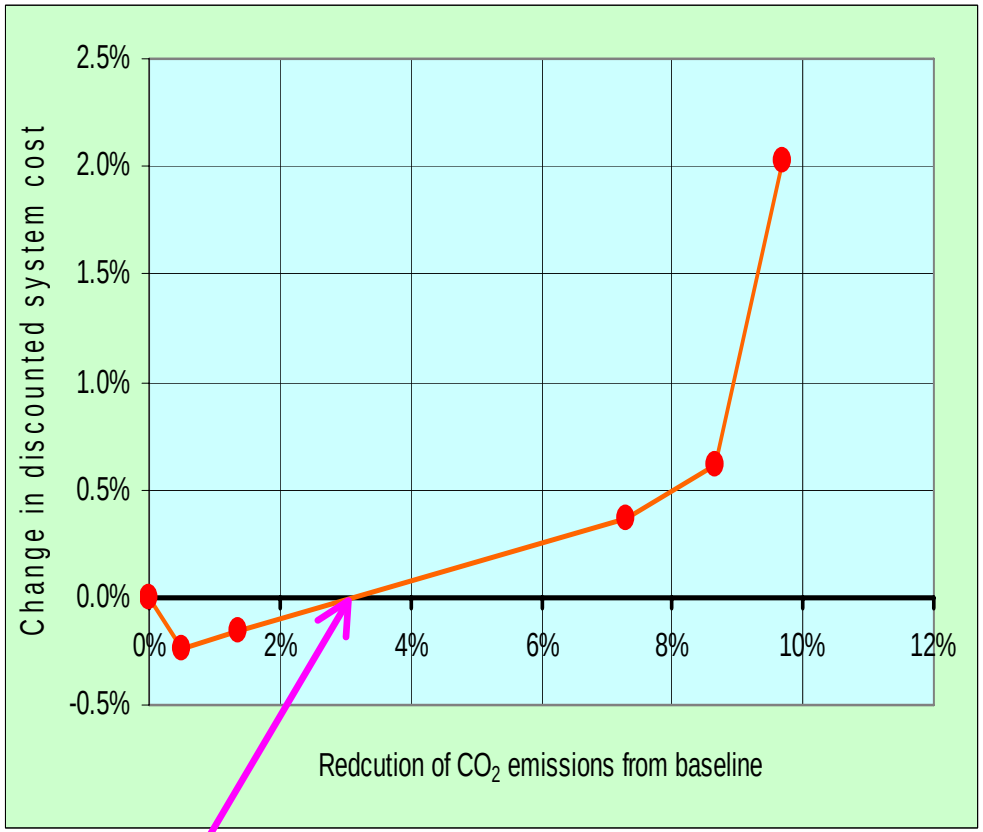

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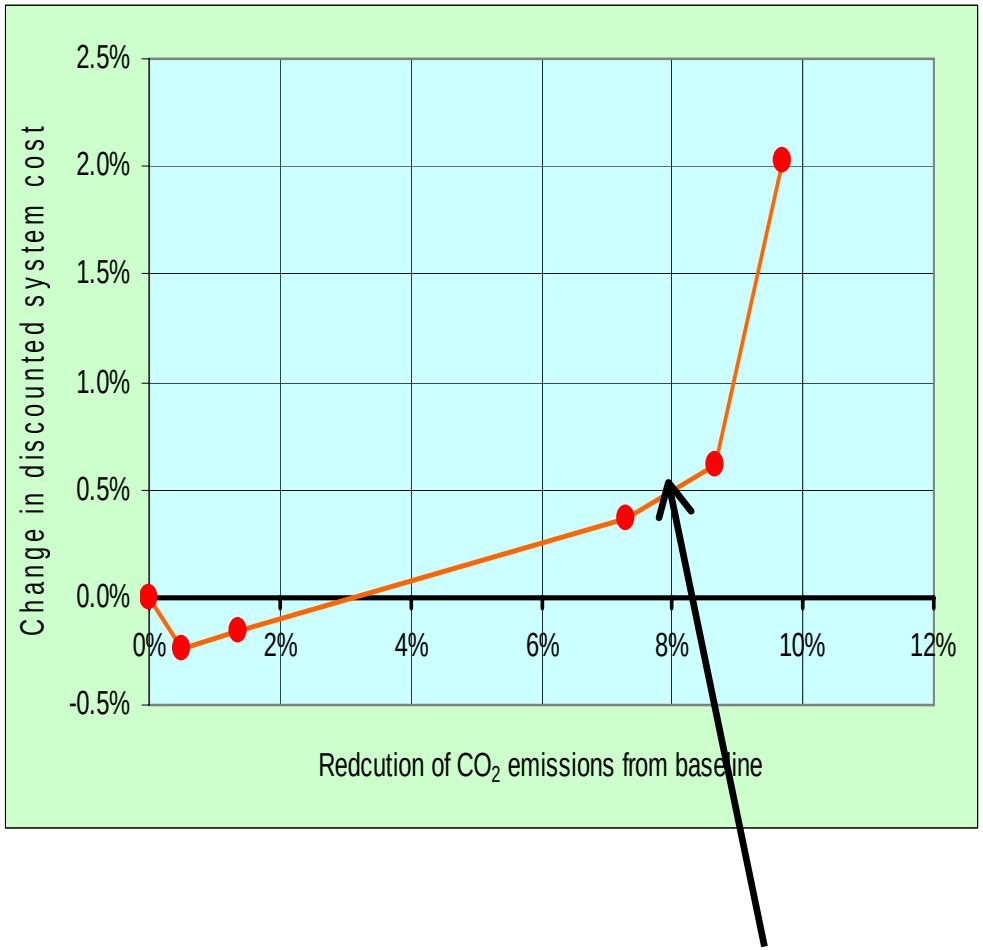

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Higher penetration of renewable

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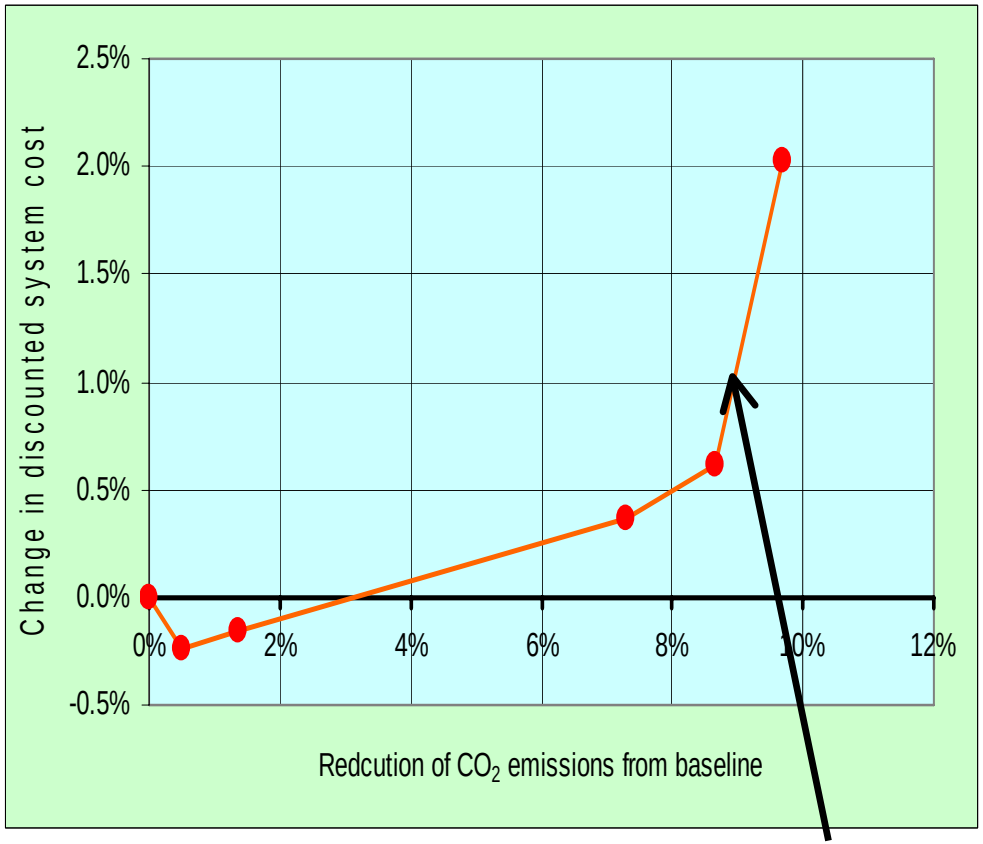

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Conclusion

- Scope of CO_2 emission reduction by no-regret options (zero or negative cost) is no more than ~3.5% of BAU levels by 2036
- Specified GHG mitigation interventions in the residential, commercial, transport and power sectors enable up to 9.7% CO_2 emissions reductions from BAU by 2036
  - ***Incremental investments of around US$2.5 trillion***
  - ***Additional discounted energy systems cost (which can be considered as cumulative GDP loss) is around US$ 180 billion***

Thank You