"Energy Scenarios: Harnessing Renewable Energy for Sustainable Development and Energy Security in Nepal

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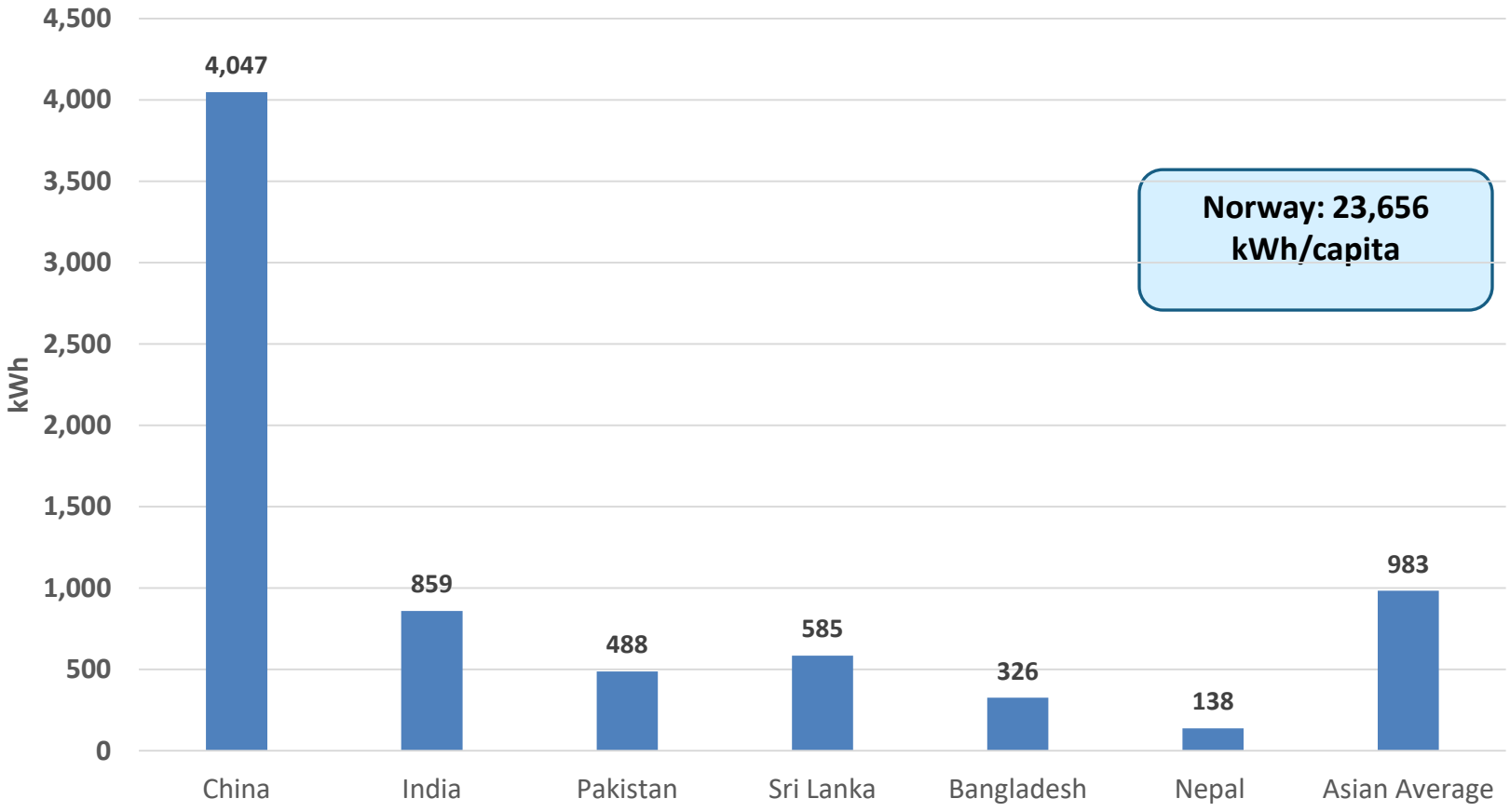
Contents

- Overview of energy sector
- Sectoral Interventions/Assumptions
- Scenario Results and Impacts
- Economic Evaluation
- Conclusions

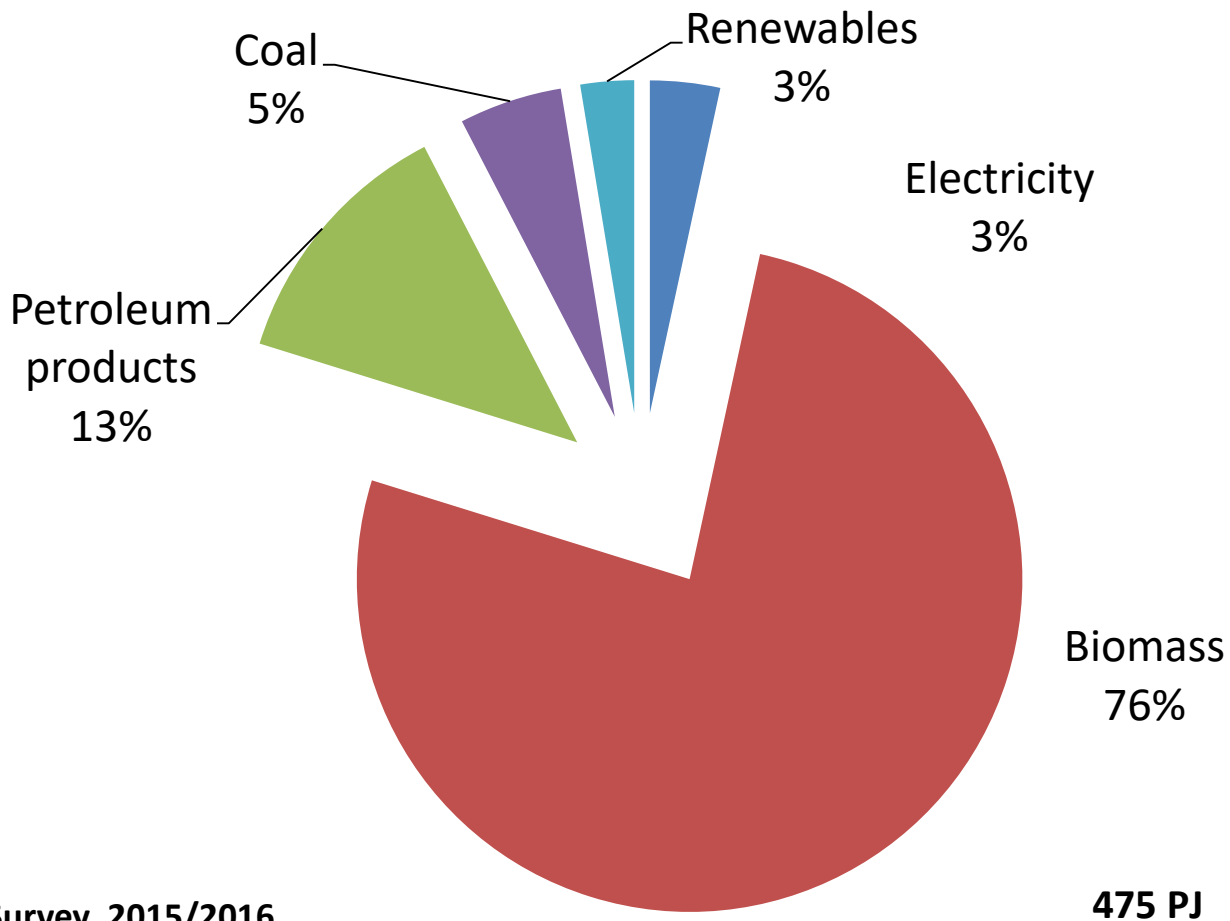
Overview of energy sector

Per Capita Electricity Consumption in 2015



Key World Energy Statistics, IEA, 2017

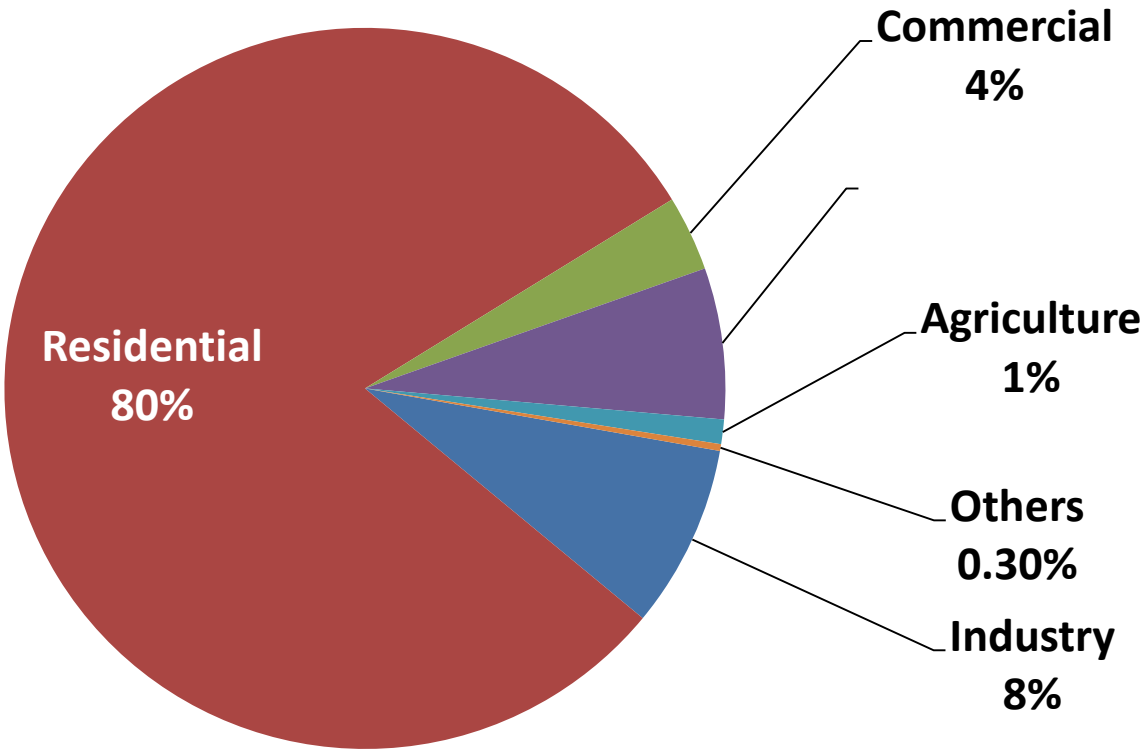
Fuel mix 2015



Economic Survey, 2015/2016

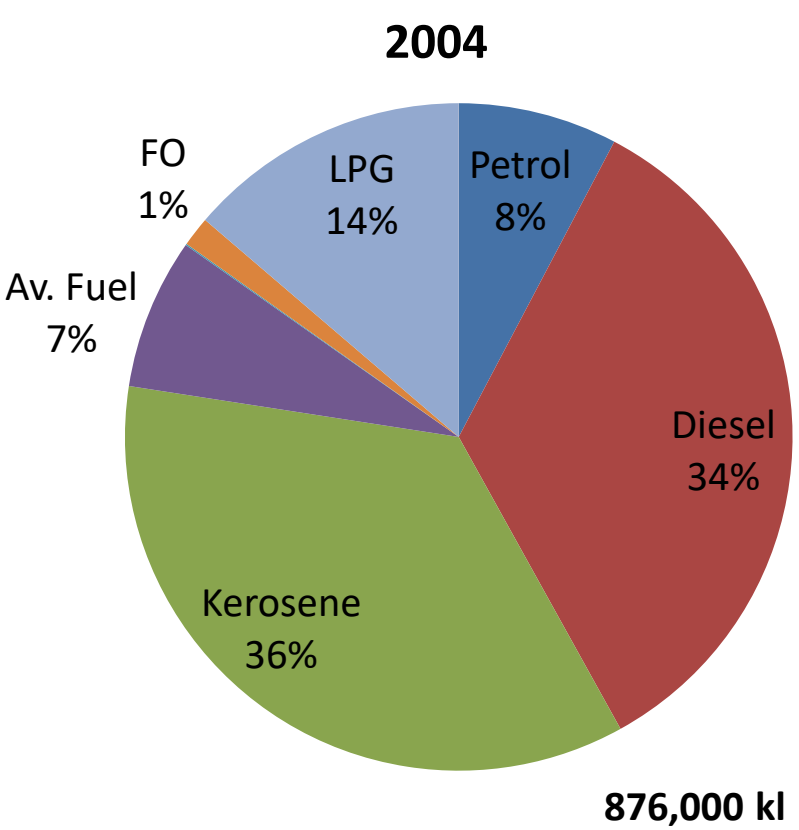
475 PJ

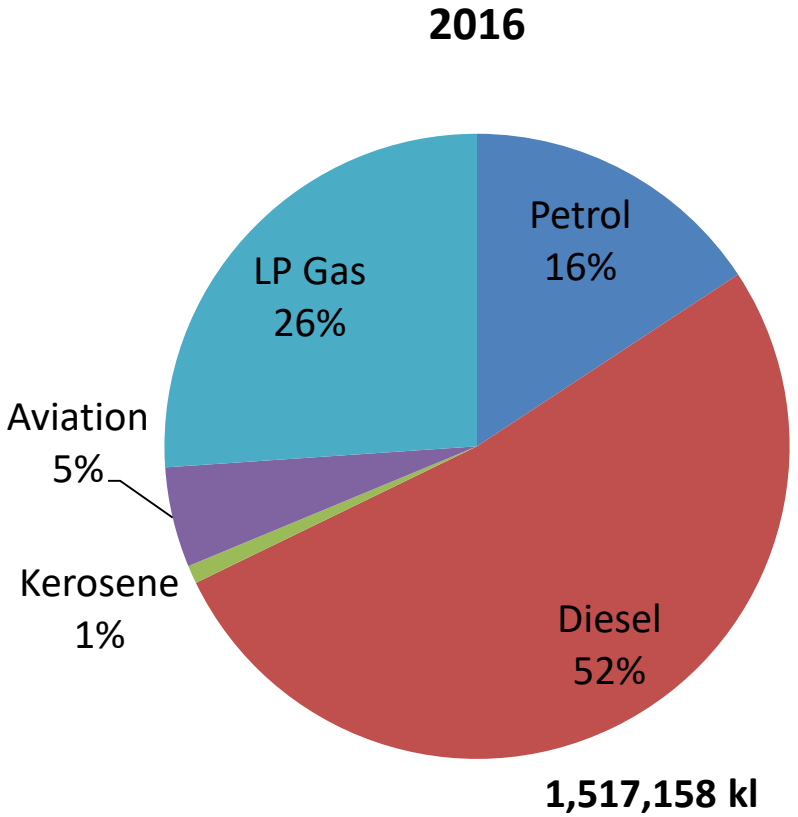
Sectoral Energy 2015



Economic Survey, 2015/2016

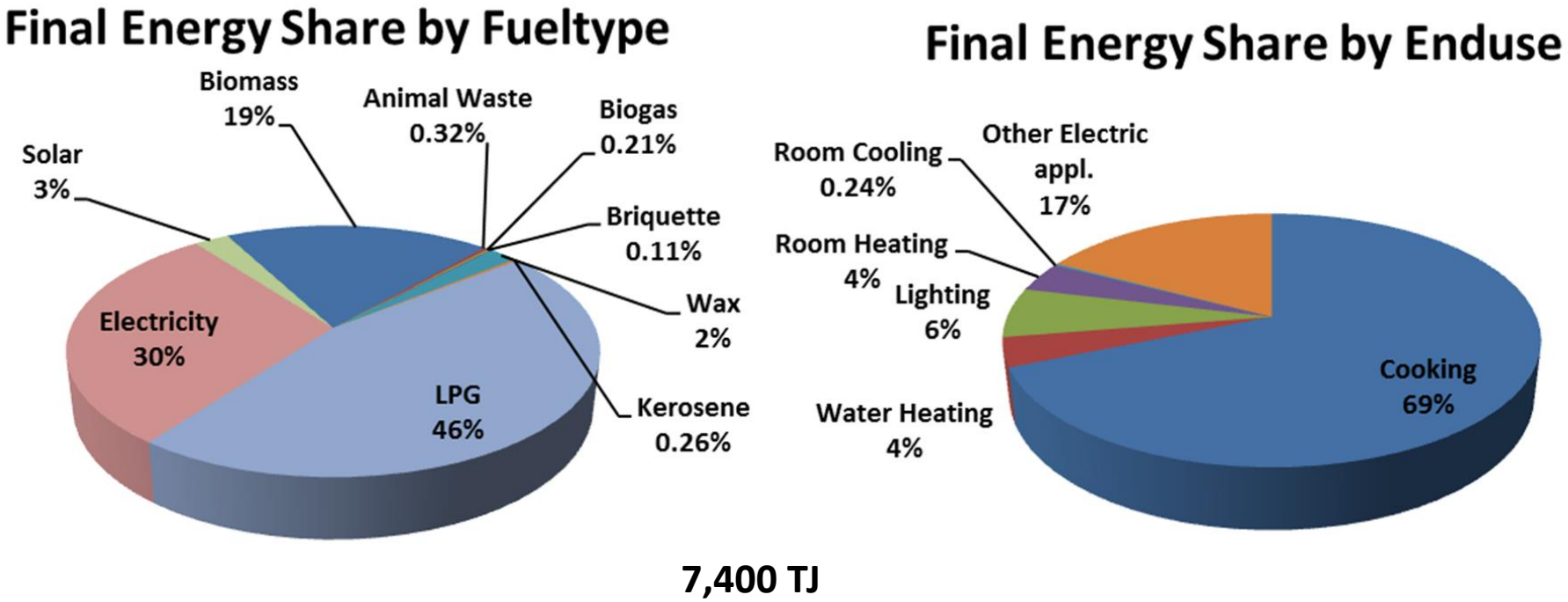
Fuel Mix in the petroleum products





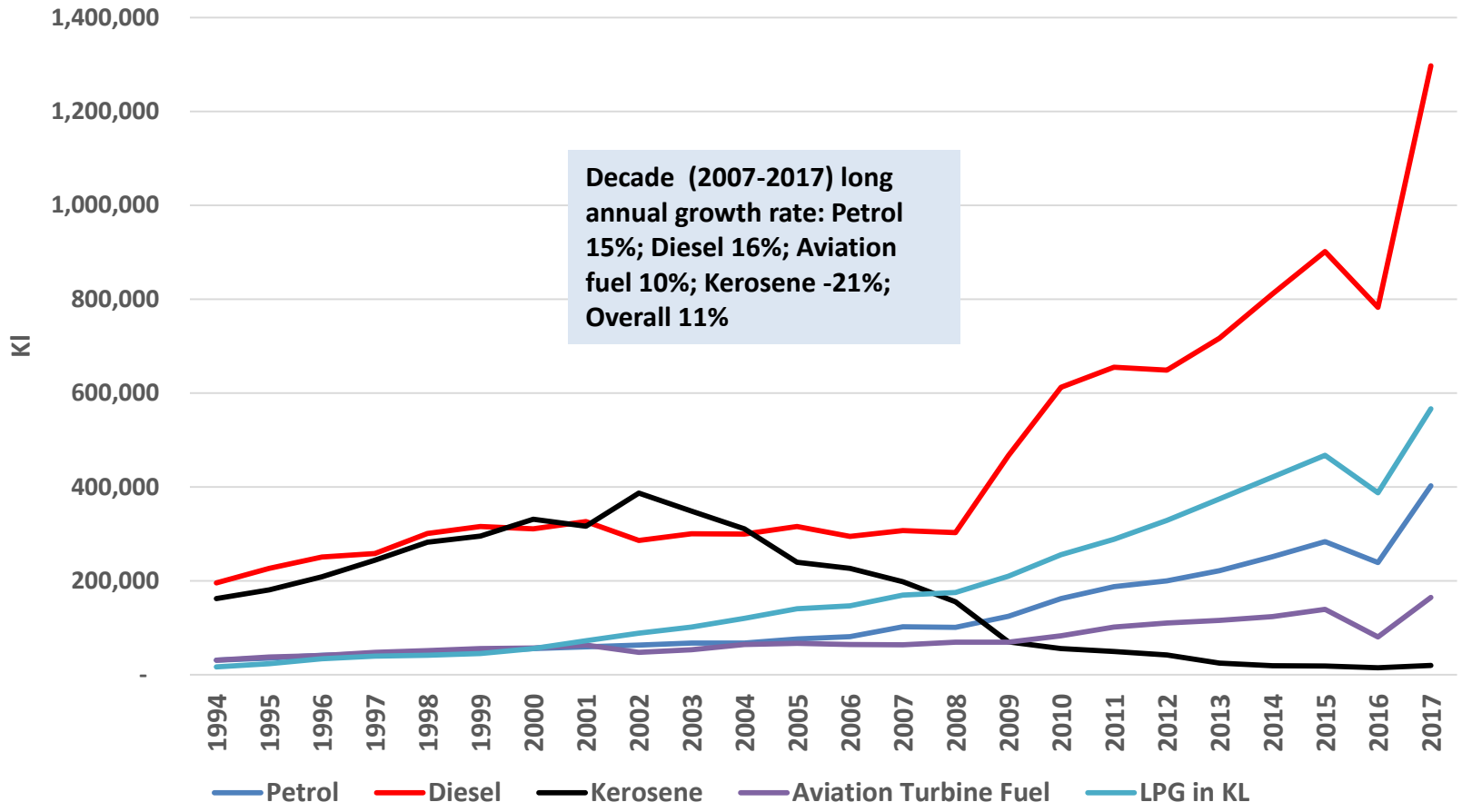
Source: MOF, 2017

Primary data results in Kathmandu Households in 2014



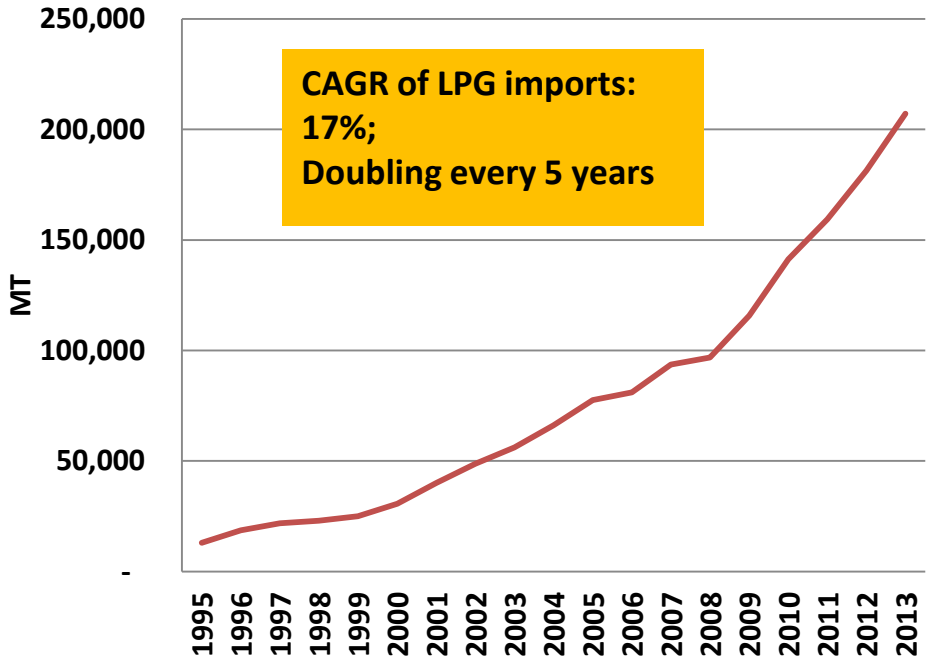
(Nakarmi and Rajbhandari, 2015)

Sales of Petroleum Products (kL)



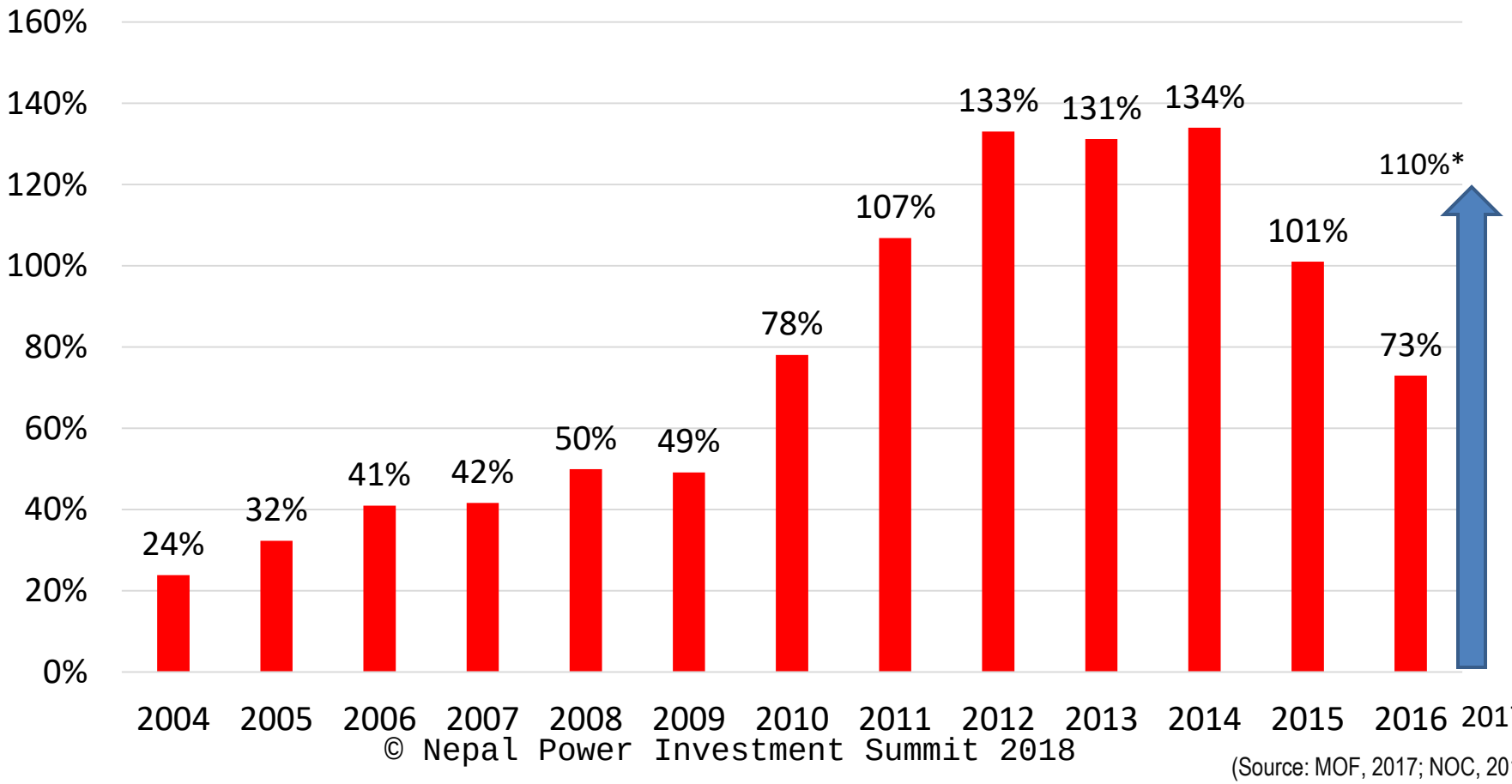
NOC, 2017

Penetration and Sales of LPG



Penetration of LPG in remote rural areas as well.

Historical trend of Petro Imports vs. Goods Exports



(Source: MOF, 2017; NOC, 2017)

Fuel economics in urban/rural areas (cost of cooking/month for a household of 5 members) ***with electricity tariff increased by 20% since Aug 2016***

Year	Kerosene stoves	LPG stoves	Electric hotplates	Biogas cook stoves*	Traditional fuel-wood stoves/ rural	Traditional fuel stoves/KTM
2000	270	430	680	320		
2003	340	535	790	320	400	
2014	1,760	1,082	960	1,120	630	
2018	1,354	1,212**	1,114	1,120	780	1,530

For induction heater NPR 990

*: the cost is without subsidy for biogas plant of capacity 6 cu m

**: Household has 2 cylinders in use and it includes capital cost of them (loss of NR 208/cyl: 18/01/2018, NOC)

Sectoral Policy Intervention

Based on Low Carbon Economic Development Strategy and INDC of Nepal, SE4ALL, SDGs and World Energy Outlook, IEA, 2017 in the Long Range Energy Alternatives Planning System (LEAP) modeling framework

Policy Intervention in Energy Sector

Agriculture

-Electrification

Commercial

-Electrification

-Efficient Technology

Industrial

-Electrification

-Efficiency Improvement

Residential

-Electrification

-Efficiency Improvement

Transportation

-Mass Transportation

-Electrification

-Biofuels

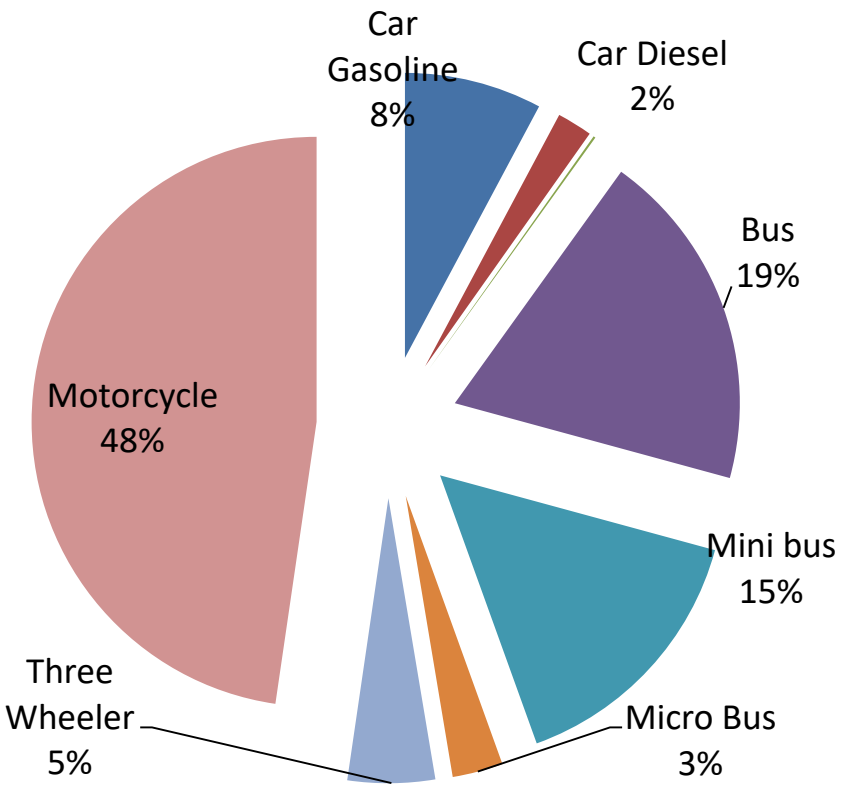
Strategy Matrix

Agricultural Sector		
Strategic Options	**2015 status**	**Target by 2030**
Non emissive devices for agricultural activities	• 20% water pumping by electricity • 1% electricity operated farm machineries	• 50% water pumping by electricity • 25% electricity operated farm machineries
Commercial Sector		
Complete penetration of electric devices, and	• 5% electricity penetration	• 100% penetration of electrical technologies in all end-uses.
Industrial Sector		
Replace non-electric devices with electric devices	• 50% electrification in other uses in mechanical engineering and manufacturing industries. • 0% Electric boilers • 100% electric lighting. .	• 100% electric motive power devices. • 50% electrification in other uses in mechanical engineering and manufacturing industries. • 50% Electric boilers • 100% electric lighting by CFL and LED
Efficiency		• 35-40% efficiency improvement of current efficiency in process heat technology

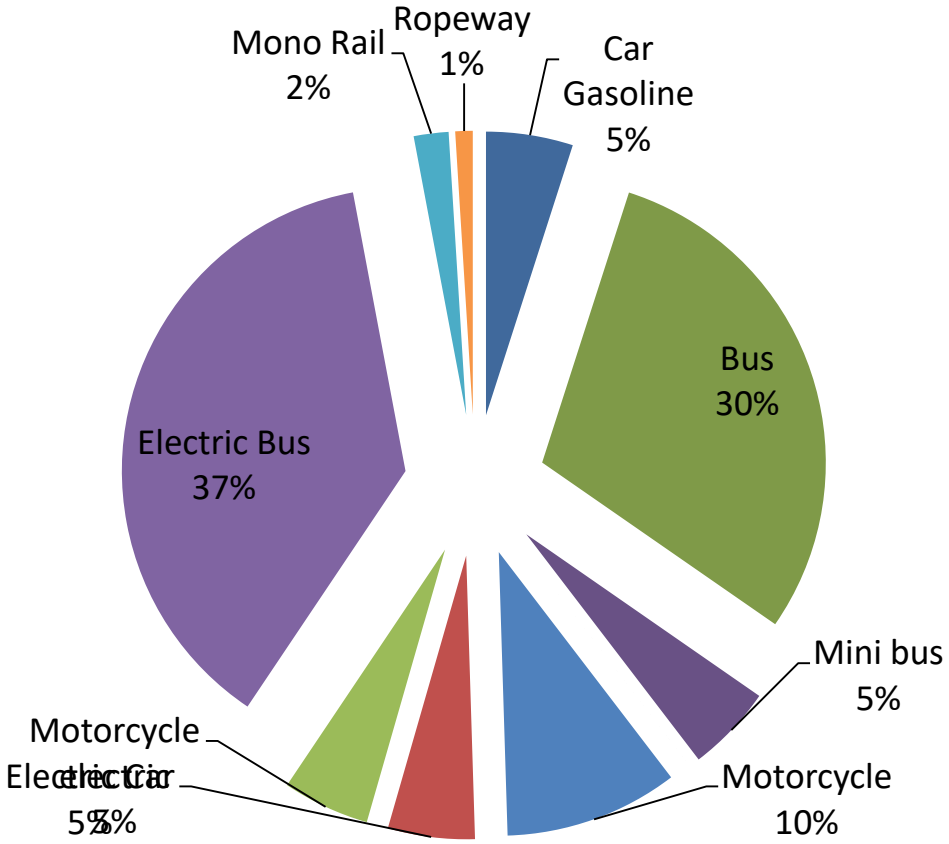
Residential Sector		
Strategic Options	**2015 status**	**Target by 2030**
• Electrification in urban Area • Increase access to modern fuel cooking technology in rural area • Phase out non-electric lighting sources.	• 12.8% cooking by electricity in urban • 18.3% improved cooking stoves and 27% biogas • 3.6% LPG and 1% Electric cooking devices in rural	• 100% electrical cooking technology • 70% improved cooking stoves in rural area, 15% electric cooking devices, 5% LPG stoves, 10% biogas source for cooking purpose • 100% lighting by electricity (LED)
Transport Sector		
• Efficient means of transportation • Electrify transport sector. • Introduce bio-fuels (Ethanol and Bio-diesel) .	Intracity • 19% transportation share by bus • 48% share by motorcycle • 9% share by car/jeep/Van • 15% Mini-bus • 3% micro bus	• 30% intracity share by bus • 39% intracity electric bus • 5% share of electric car • 20% share of Ethanol mix in gasoline. 10% share of Bio-diesel in total diesel mix.

Transport Modal Mix (Intracity Passenger-km)

Reference Case in 2015



Policy case 2030



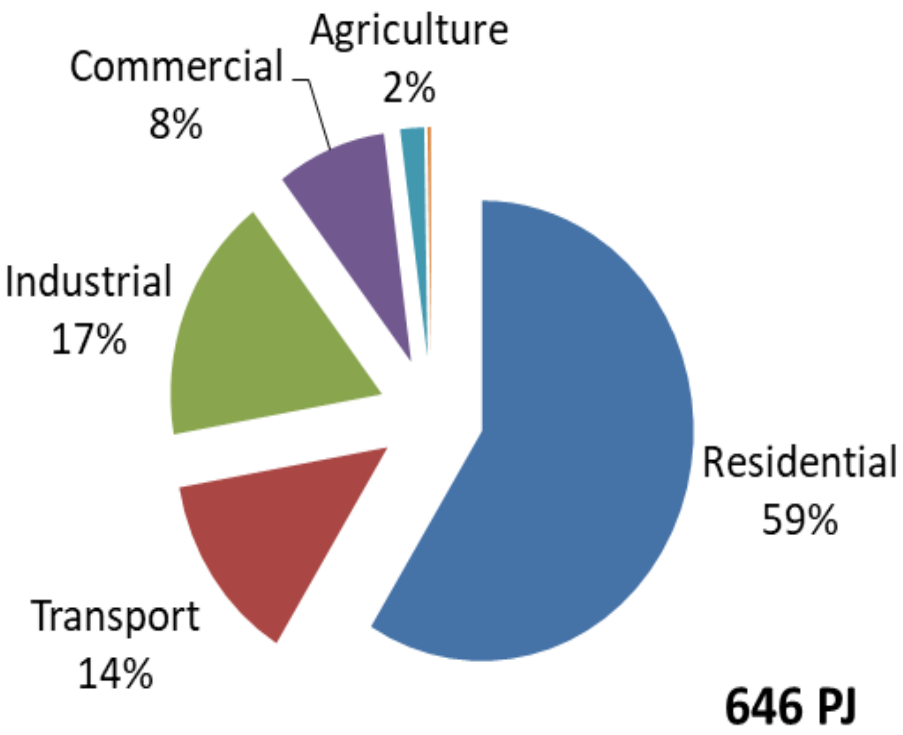
Overall Scenario Result

Energy Mix

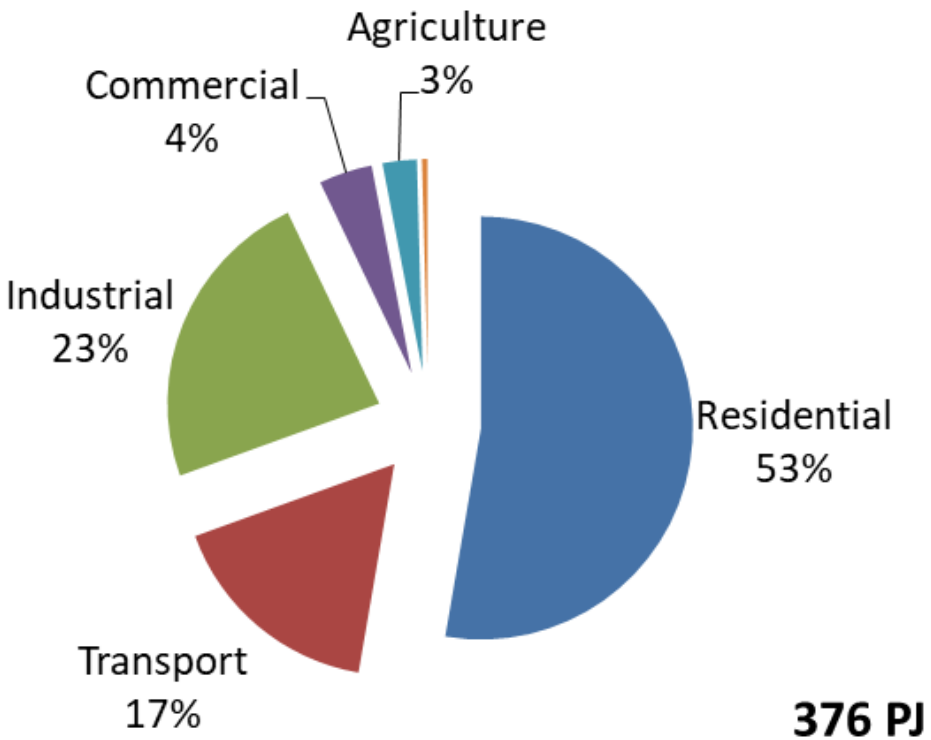
GHG emissions

Power Plant Requirements

Sectoral Energy Mix in 2030



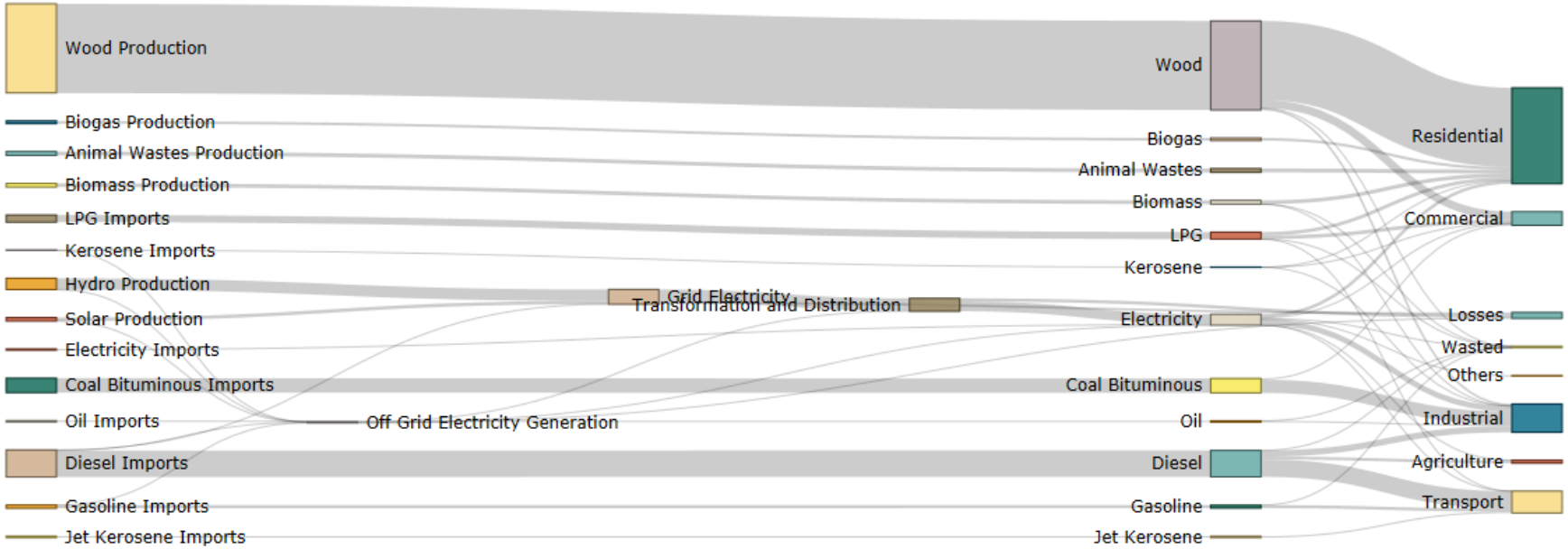
Reference scenario



Policy scenario

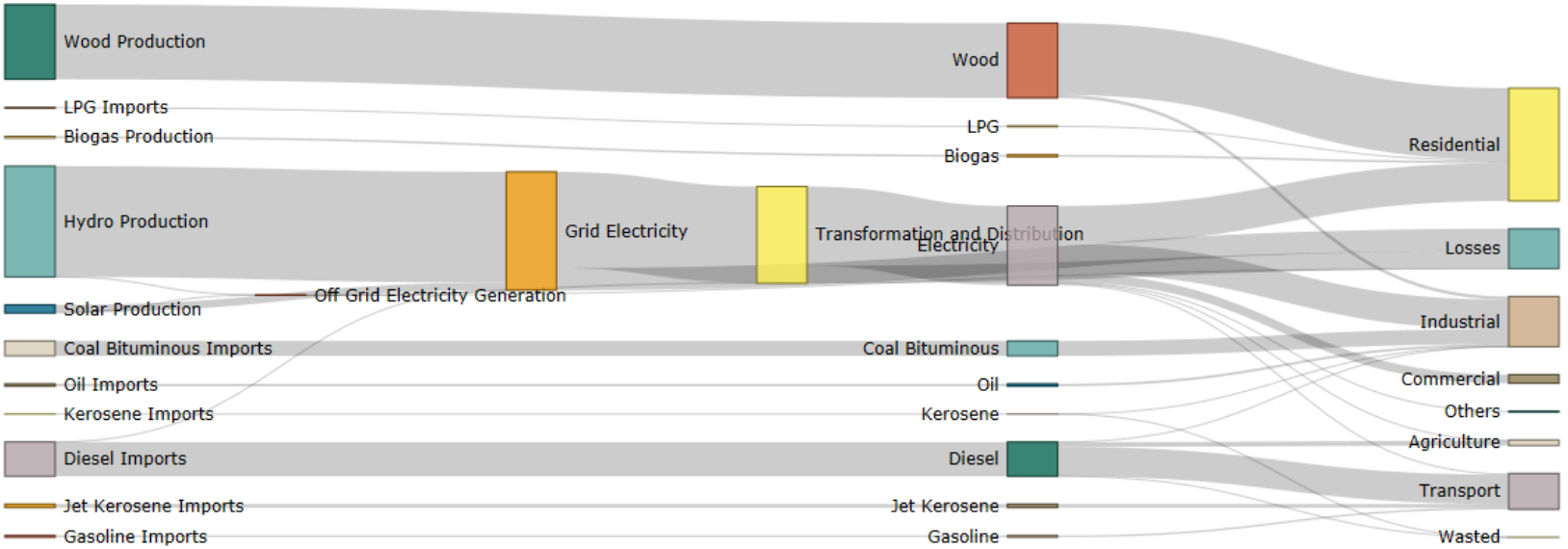
- 42% reduction of energy consumption in policy scenario

Energy Balance in Reference Scenario in 2030 (E- Sankey Diagram)



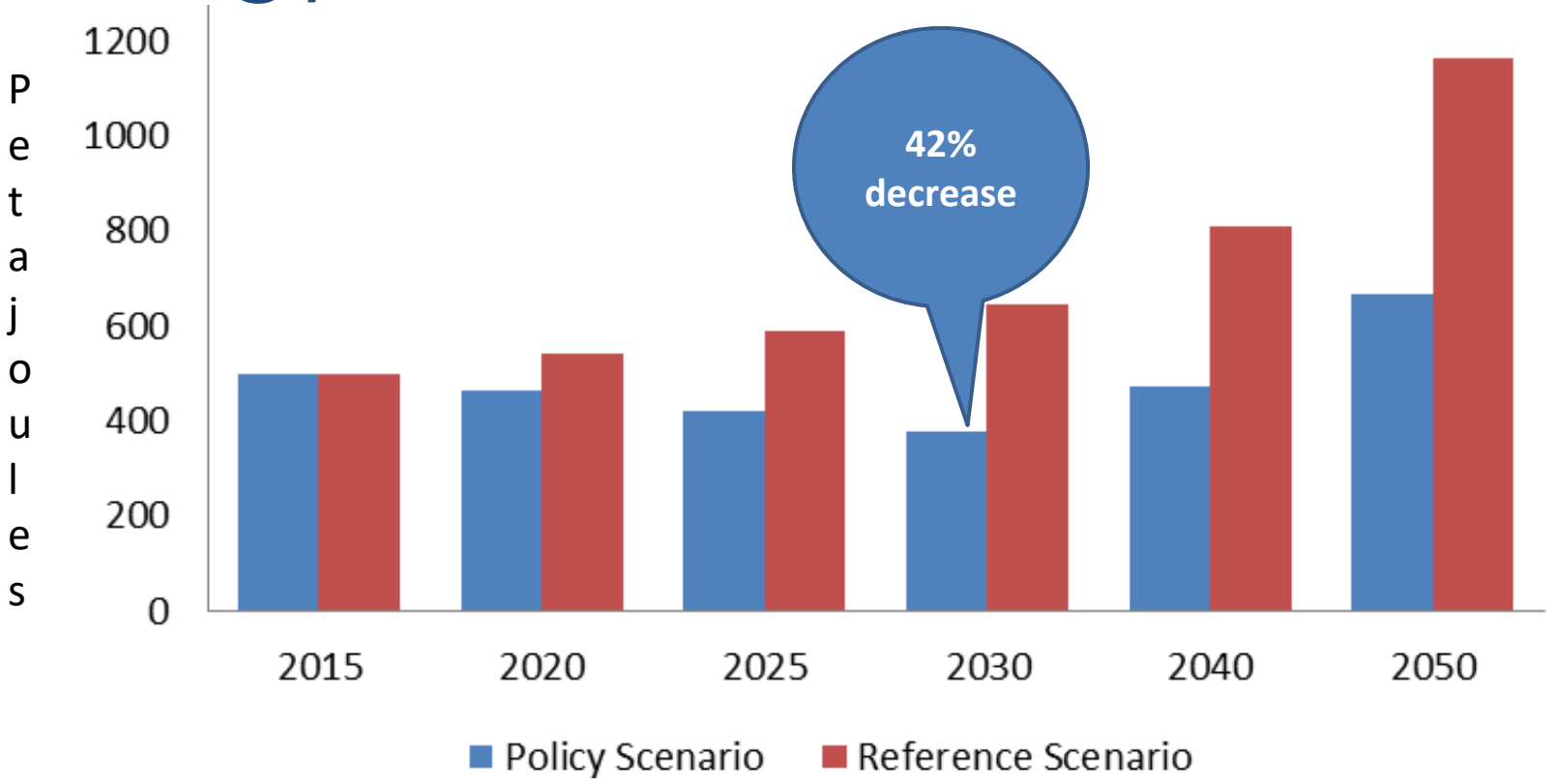
646 PJ

Energy Balance in Policy Scenario in 2030 (E- Sankey Diagram)



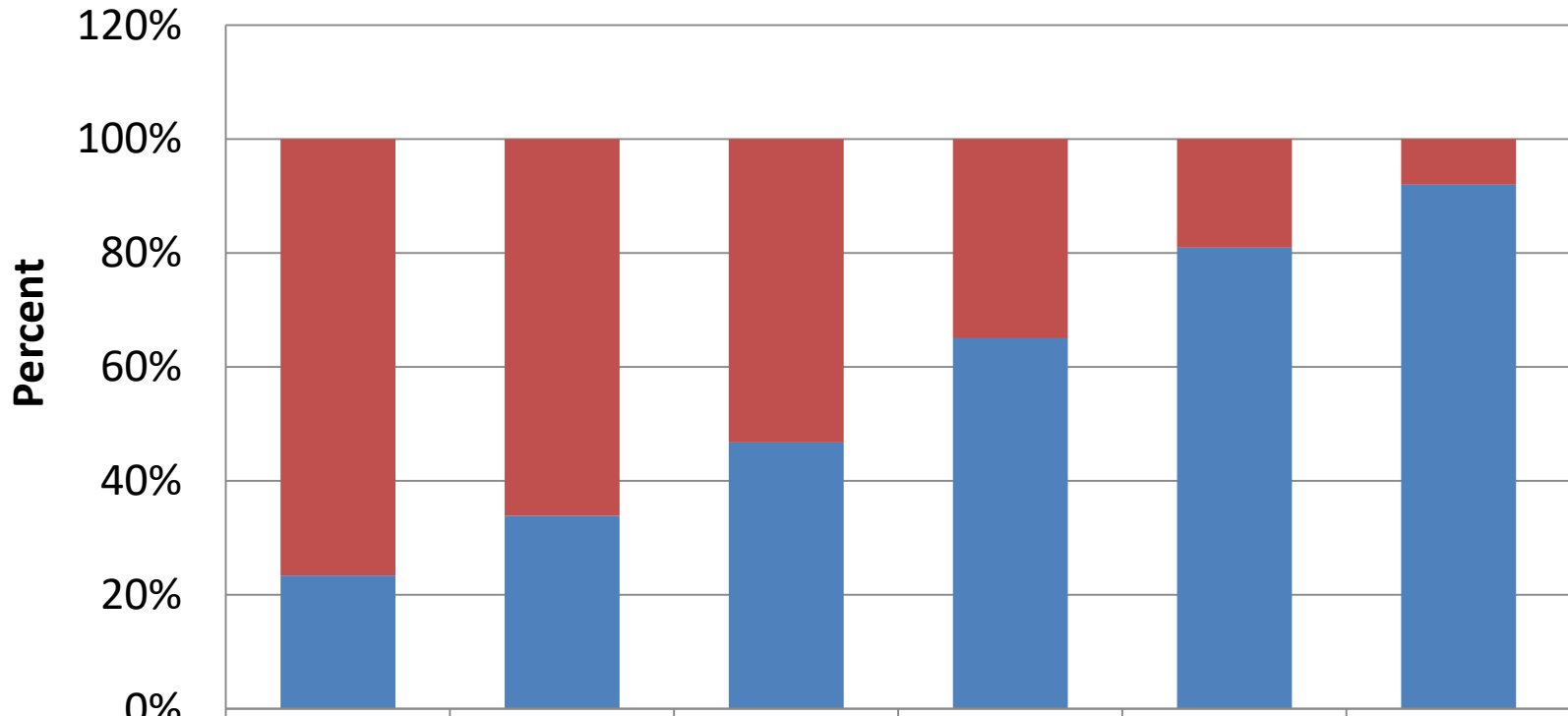
376 PJ

Energy Demand and Fuel Mix



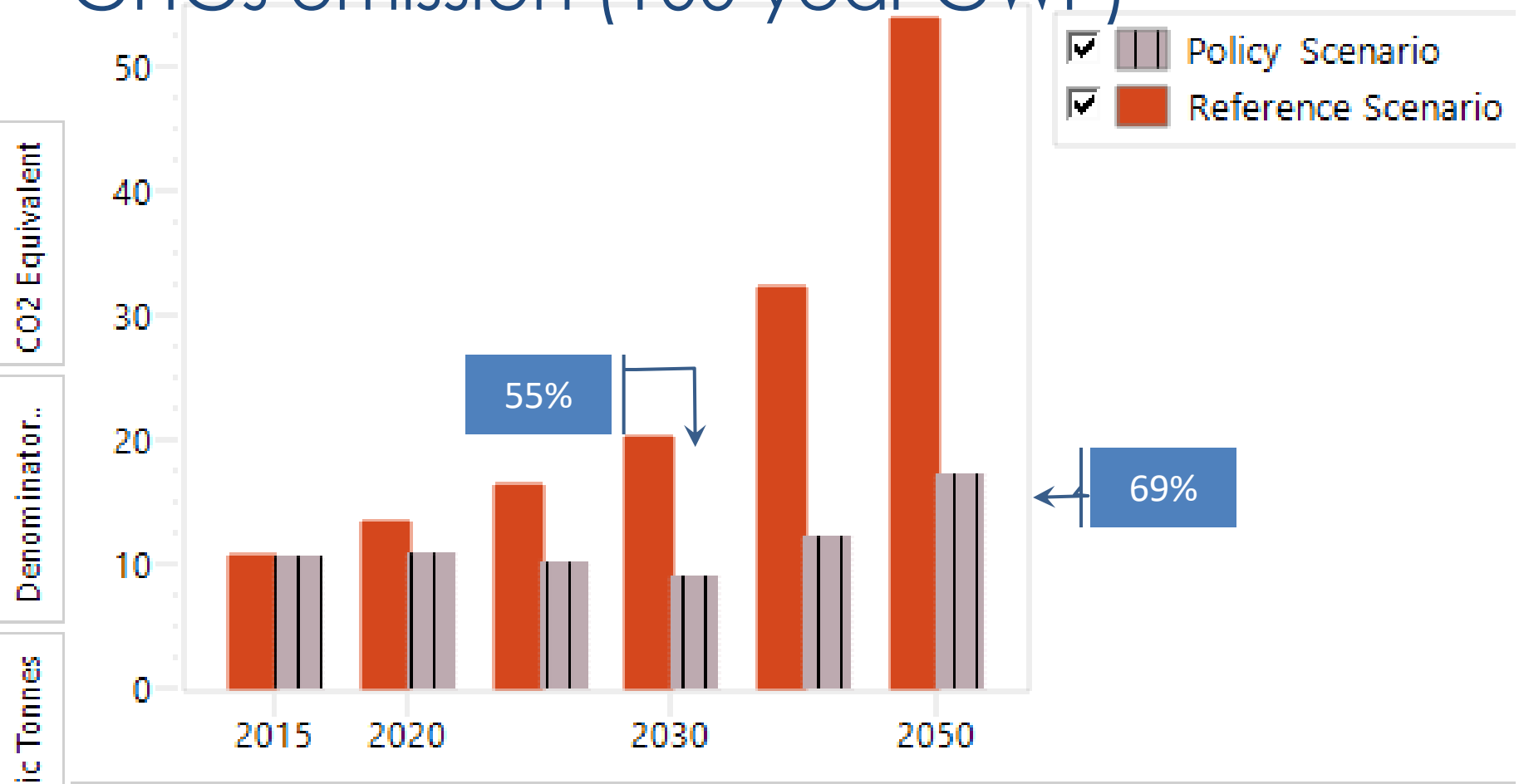
Fuels mix in policy scenario	2015	2020	2025	2030	2040	2050
Electricity	3%	10%	20%	37%	49%	58%
Biomass	76%	66%	53%	35%	19%	8%
Petroleum products	13%	17%	19%	20%	24%	26%
Coal	5%	5%	6%	7%	8%	7%
Renewables	3%	2%	2%	1%	0%	0%

Fuel Mix in Policy scenario



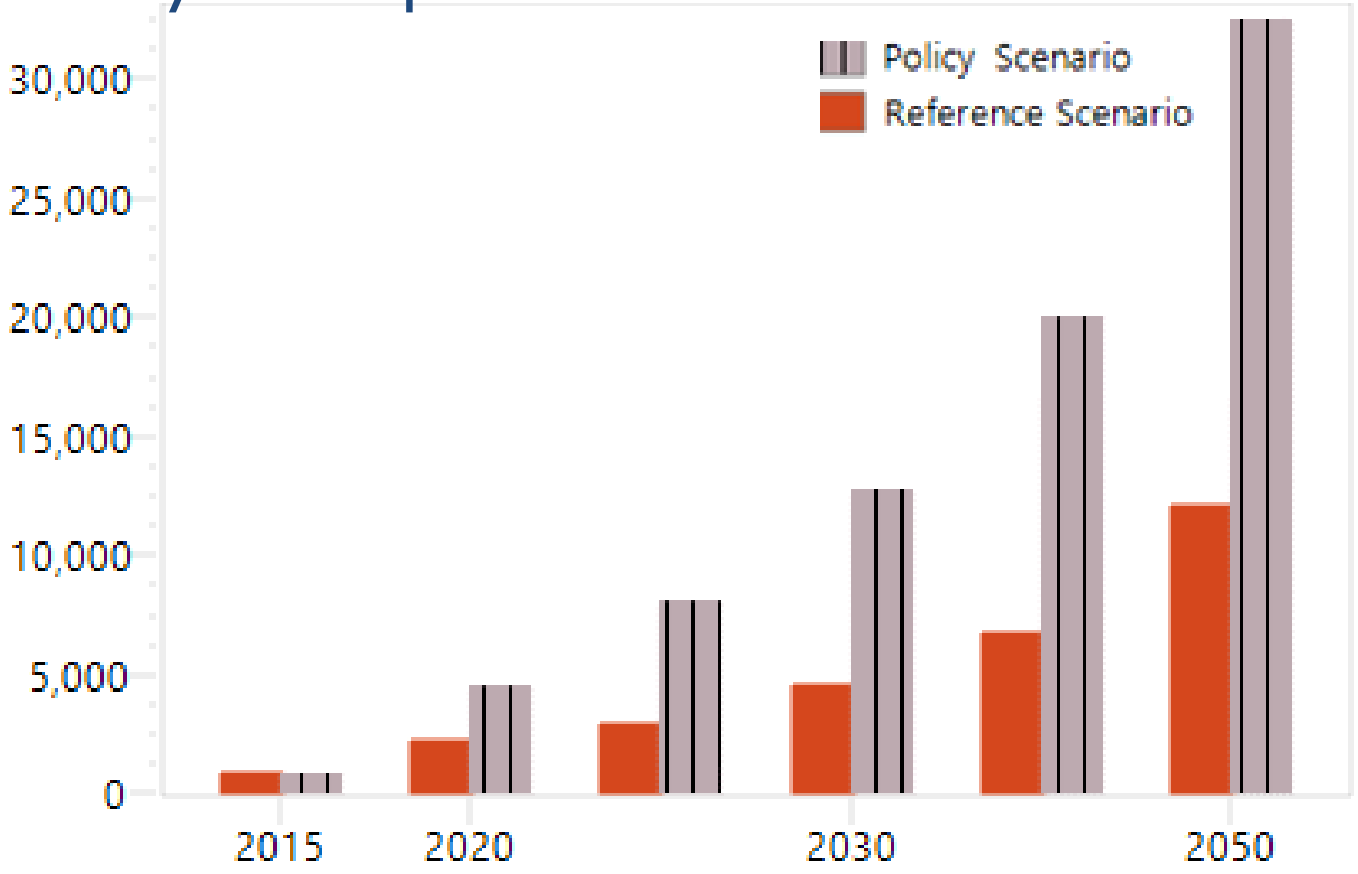
	2015	2020	2025	2030	2040	2050
Traditional solid fuels	77%	66%	53%	35%	19%	8%
Modern enrgy	23%	34%	47%	65%	81%	92%

GHGs emission (100 year GWP)



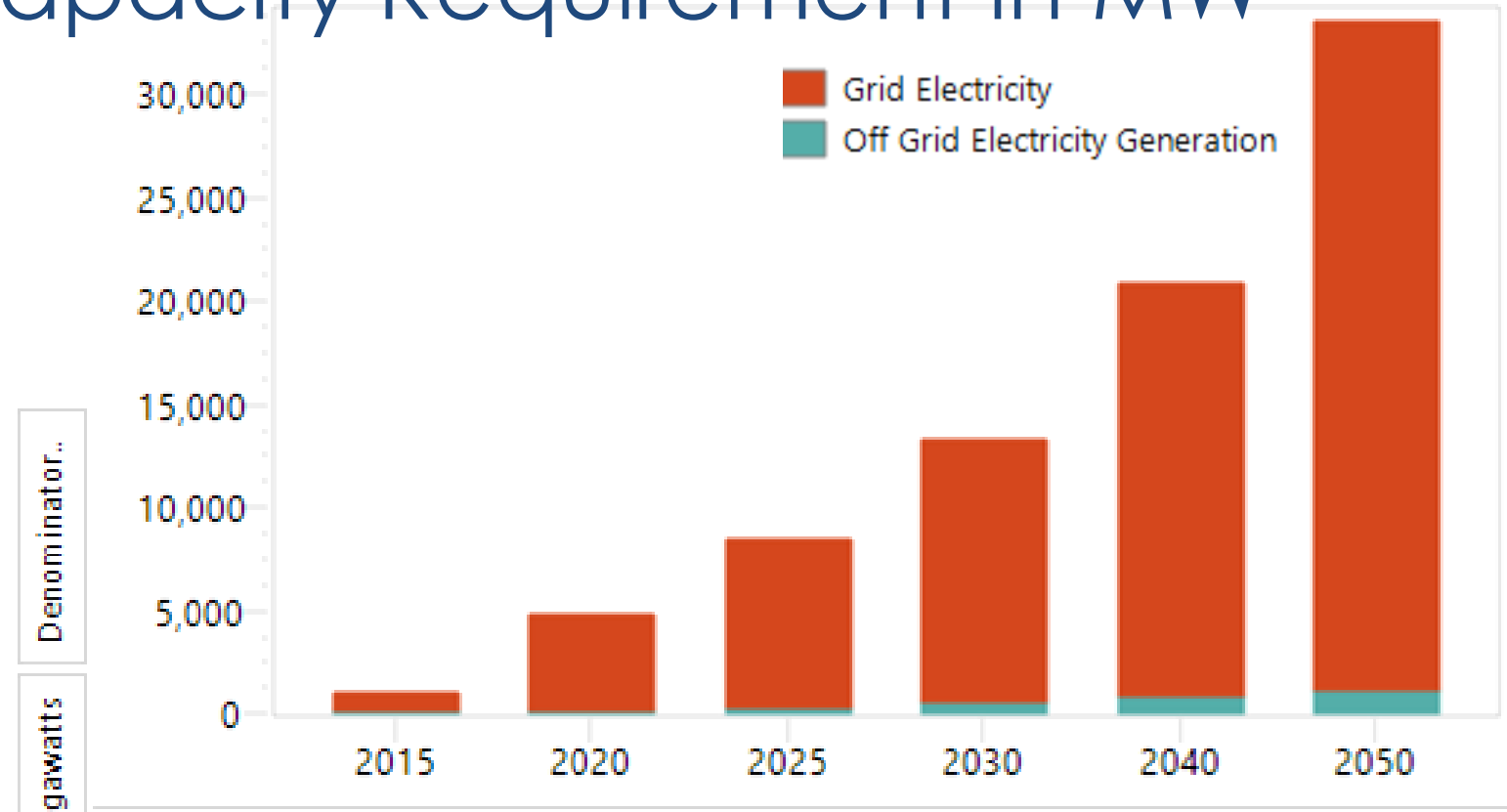
Scenarios	2015	2020	2025	2030	2040	2050
Policy Scenario	11	11	10	9	12	17
Reference Scenario	11	13	16	20	32	54

Capacity Requirement in MW



Scenarios	2015	2020	2025	2030	2040	2050
Policy Scenario	856	4,526	8,056	12,736	20,076	32,516
Reference Scenario	856	2,186	2,876	4,476	6,736	12,056

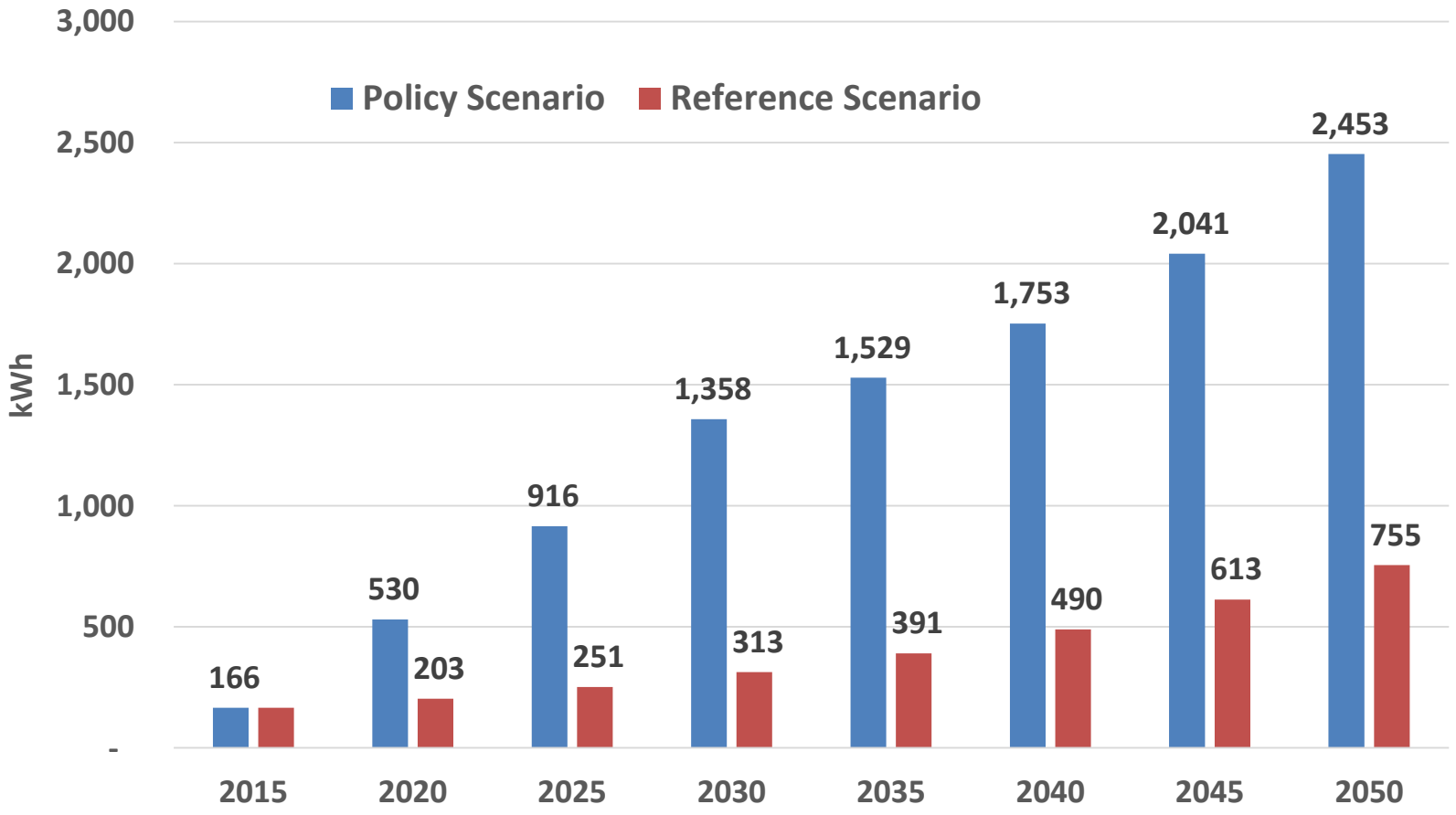
Capacity Requirement in MW



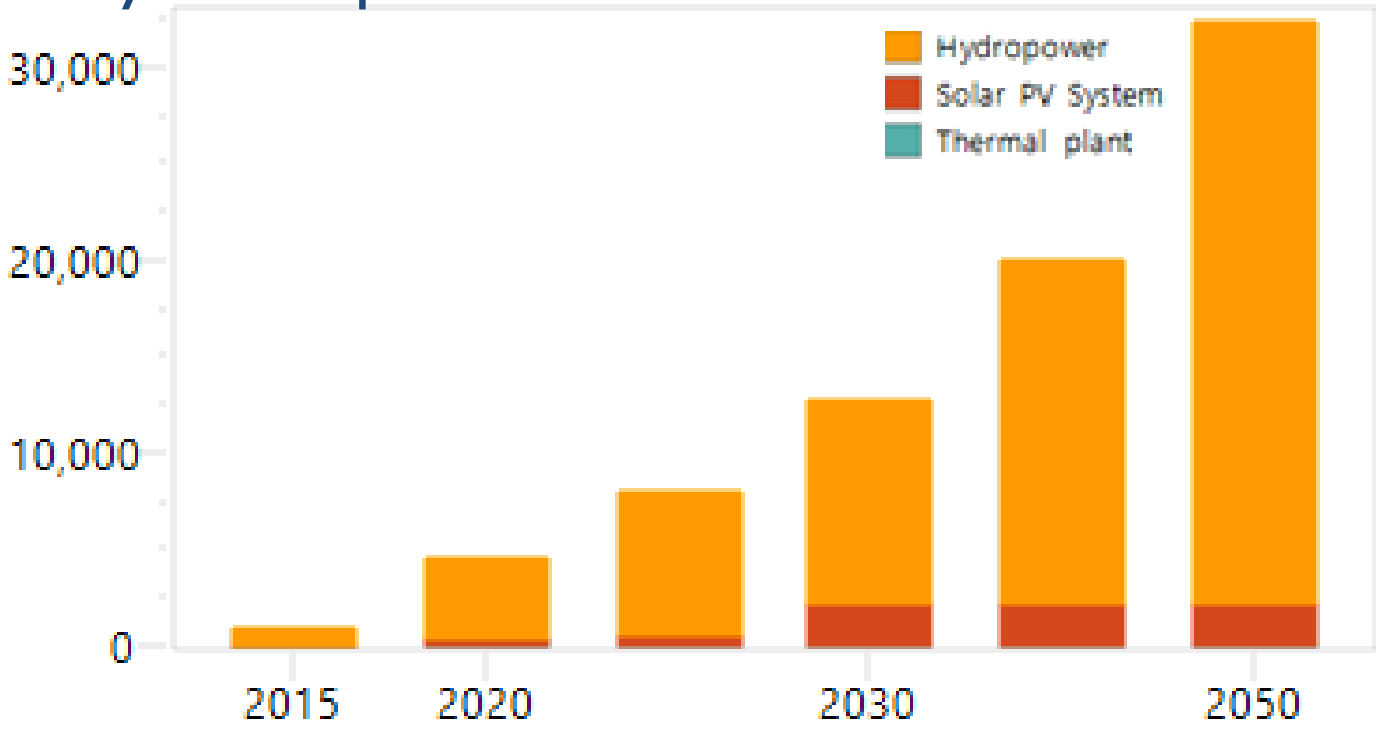
Branches	2015	2020	2025	2030	2040	2050
Grid Electricity	856	4,526	8,056	12,736	20,076	32,516
Off Grid Electricity Generation	200	202	351	501	801	1,100
Total	1,056	4,728	8,407	13,237	20,876	33,616

- Grid electricity includes solar PV system of 2,100 MW from 2030
- Off Grid electricity includes solar home system and micro-hydro

Per capita Electricity Consumption



Capacity Requirement in MW



Denominator..
Megawatts
None

Branches	2015	2020	2025	2030	2040	2050
Hydropower	802	4,222	7,502	10,582	17,922	30,362
Solar PV System	0	250	500	2,100	2,100	2,100
Thermal plant	53	53	53	53	53	53
Total	856	4,526	8,056	12,736	20,076	32,516

Benefit –Cost Analysis

Milllion NRs.

	Benefit	**Cost**
Energy Sector	-	35,540
Electricity Generation	-	973,303
Fuel/resources	2,937,733	-
Carbon Trade	38,955	-
Total	2,976,688	1,008,843

Benefit-Cost		
B-C	1,967,845	million NPR
B/C	2.95	

Conclusion

- Nepal's Energy Policy should focus on
  - Electrification in all economic sectors through harnessing renewable energy
  - Substituting use of fossil fuels by electricity and electricity market development
  - Modern Energy Access to all by 2030
  - Strong institutional set-up for development of renewable energy in an integrated way
  - Development of financial mechanism/incentives for investment in power sector
- ***Nepal's economy will be strengthened only through sustainable energy development and energy security***

https://dipsh.files.wordpress.com/2014/12/scenic-view-of-swyambhu.gif

THANK YOU !!!