



CEYLON ELECTRICITY BOARD

Sri Lanka's Power Generation Past, Present and Future

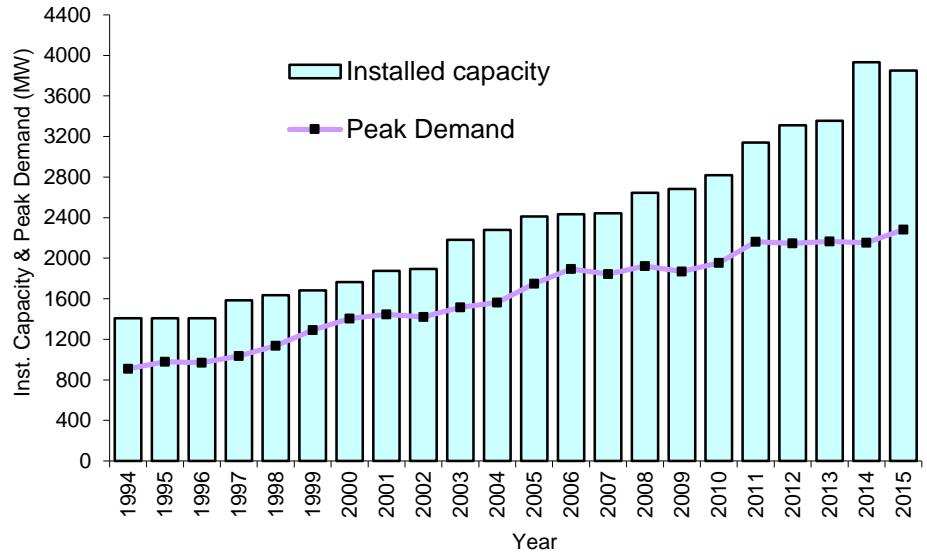
Eng. Noel Priyantha- Chief Engineer (Renewable Energy)

Eng. Buddhika Samarasekara- Chief Engineer (Generation Planning)

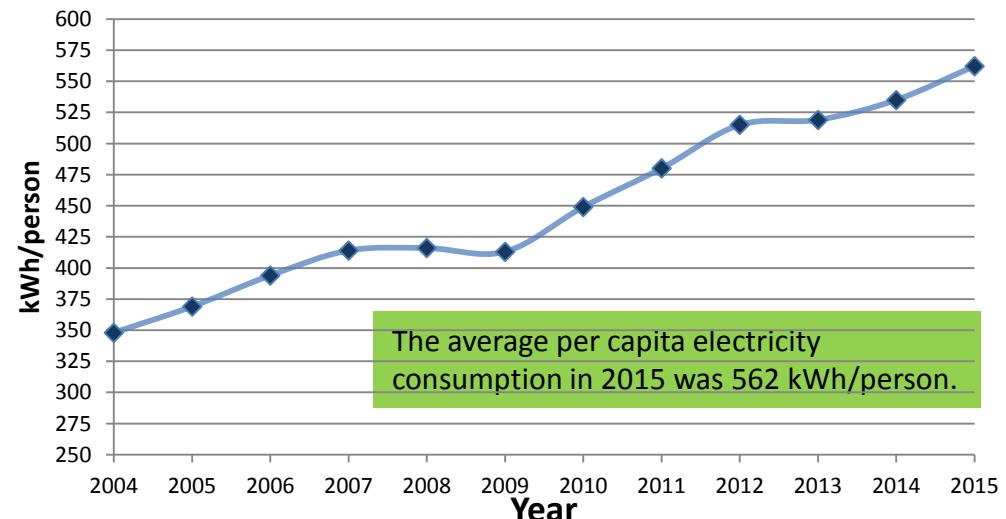
**Transmission Division
Ceylon Electricity Board
Sri Lanka
May 2016**



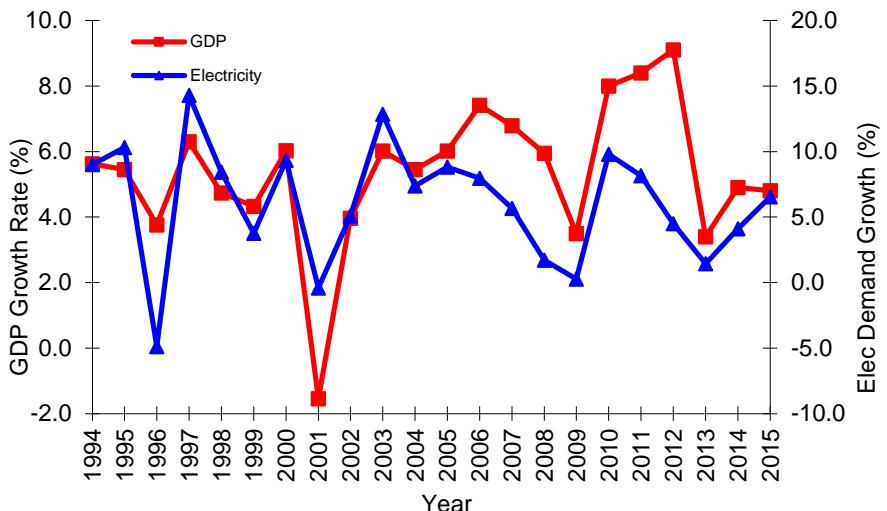
Installed Capacity and Peak Demand



Per Capita Electricity Consumption (2004-2015)



GDP Growth % & Elec. Demand Growth %

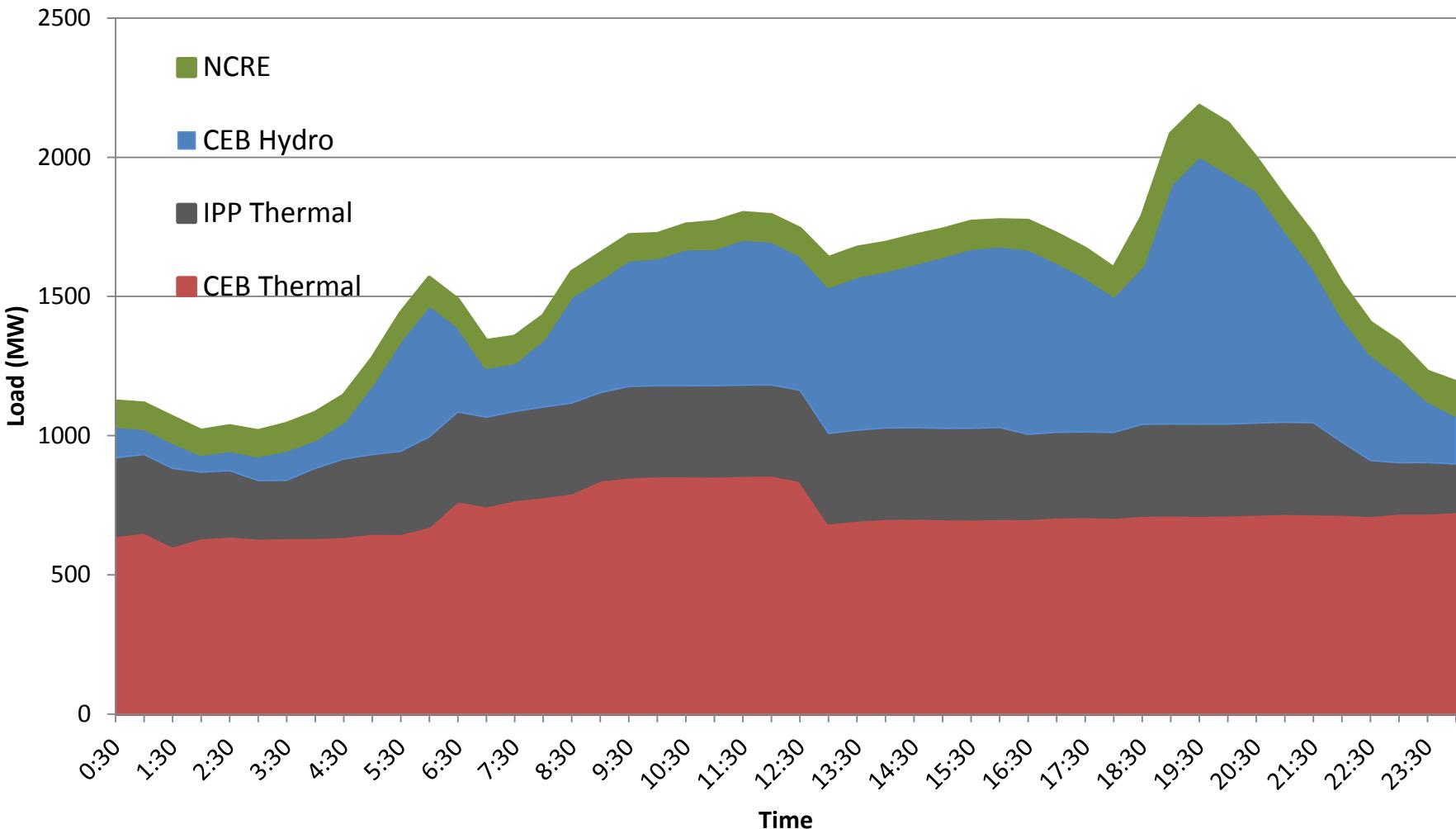


Less significant relationship between GDP growth and Electricity demand growth in recent years

Comparison with Regional Countries(kWh/person)

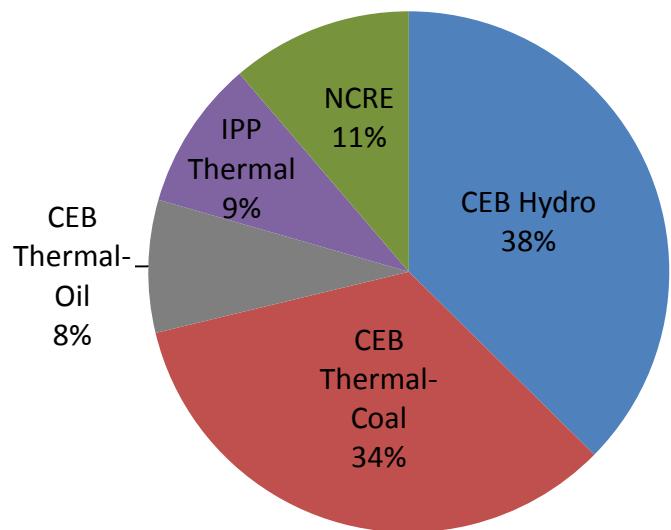
Country	2009	2010	2011	2012
Bangladesh	221	247	259	278
India	605	641	684	753
Japan	7838	8378	7848	5190
Malaysia	3934	4136	4246	3405
Pakistan	450	458	449	649
Singapore	7896	8438	8404	8595
Vietnam	917	1035	1073	907

TYPICAL LOAD CURVE OF SRI LANKA

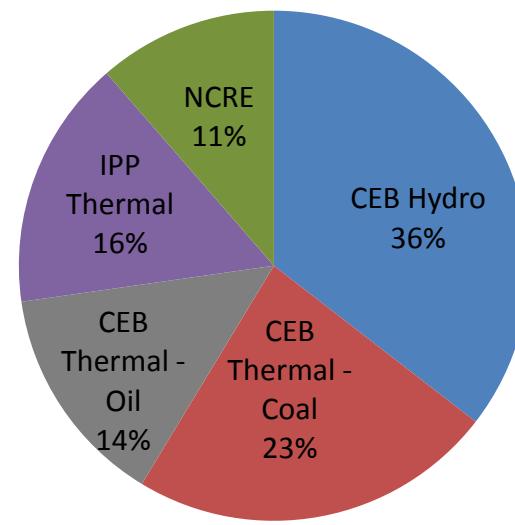


PRESENT CAPACITY MIX AS AT DECEMBER 2015

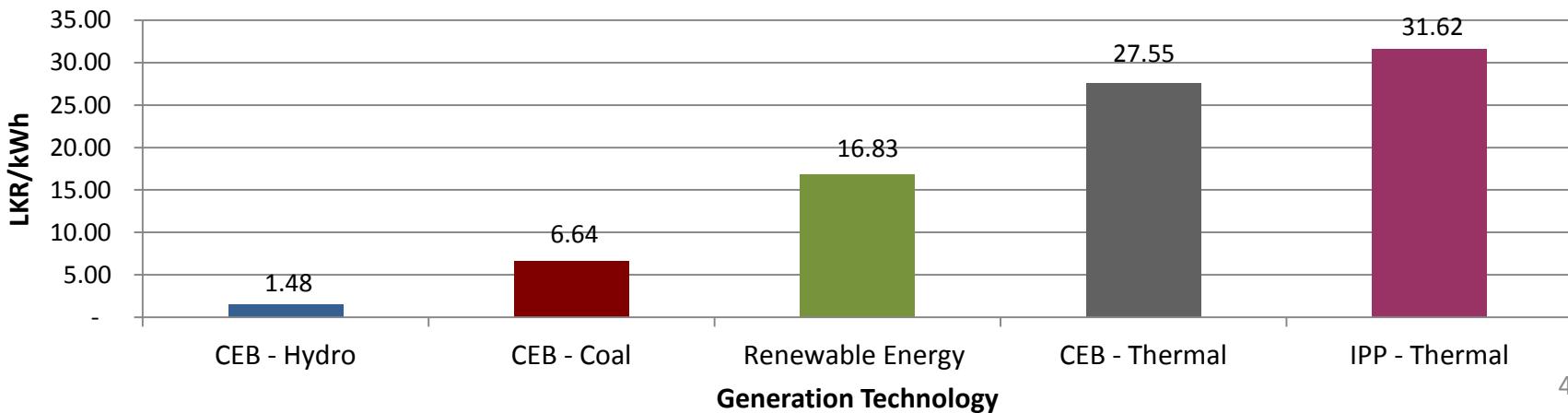
Energy Share in GWh- 2015



Capacity Share in MW - 2015



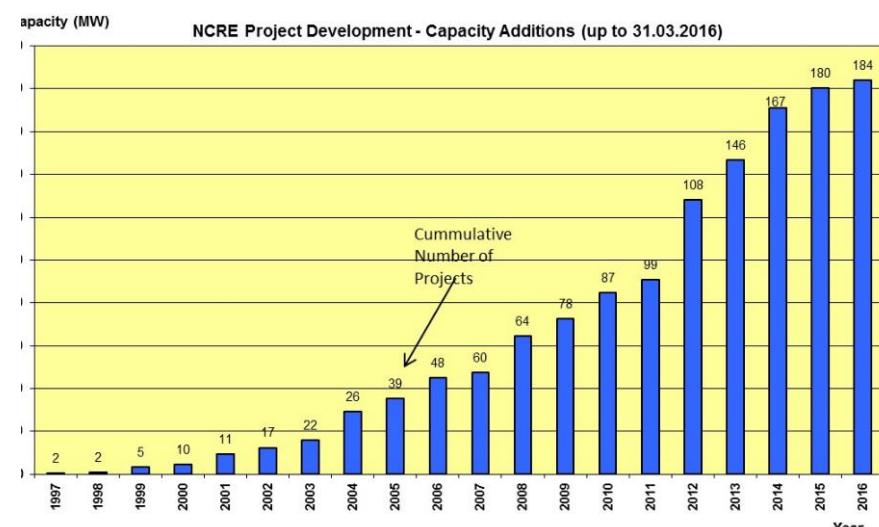
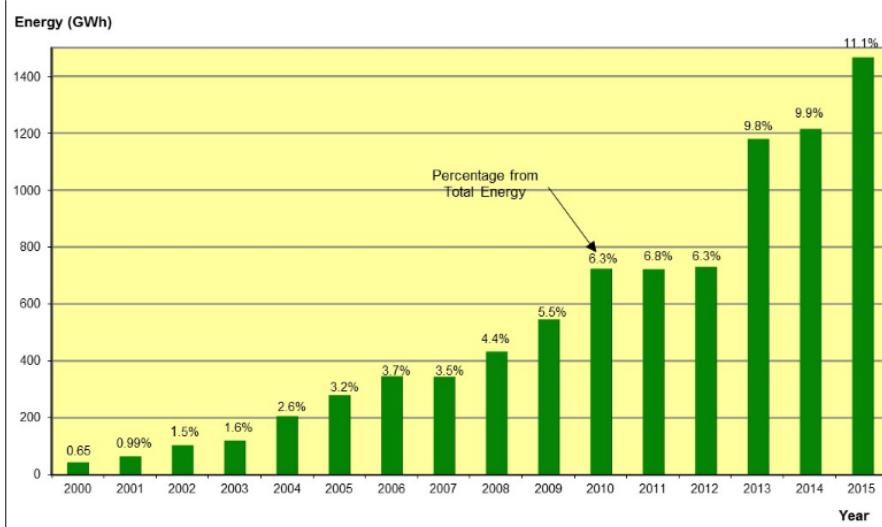
Average Cost per Unit for Generation Technologies (For Year 2015)



Historical NCRE Contribution

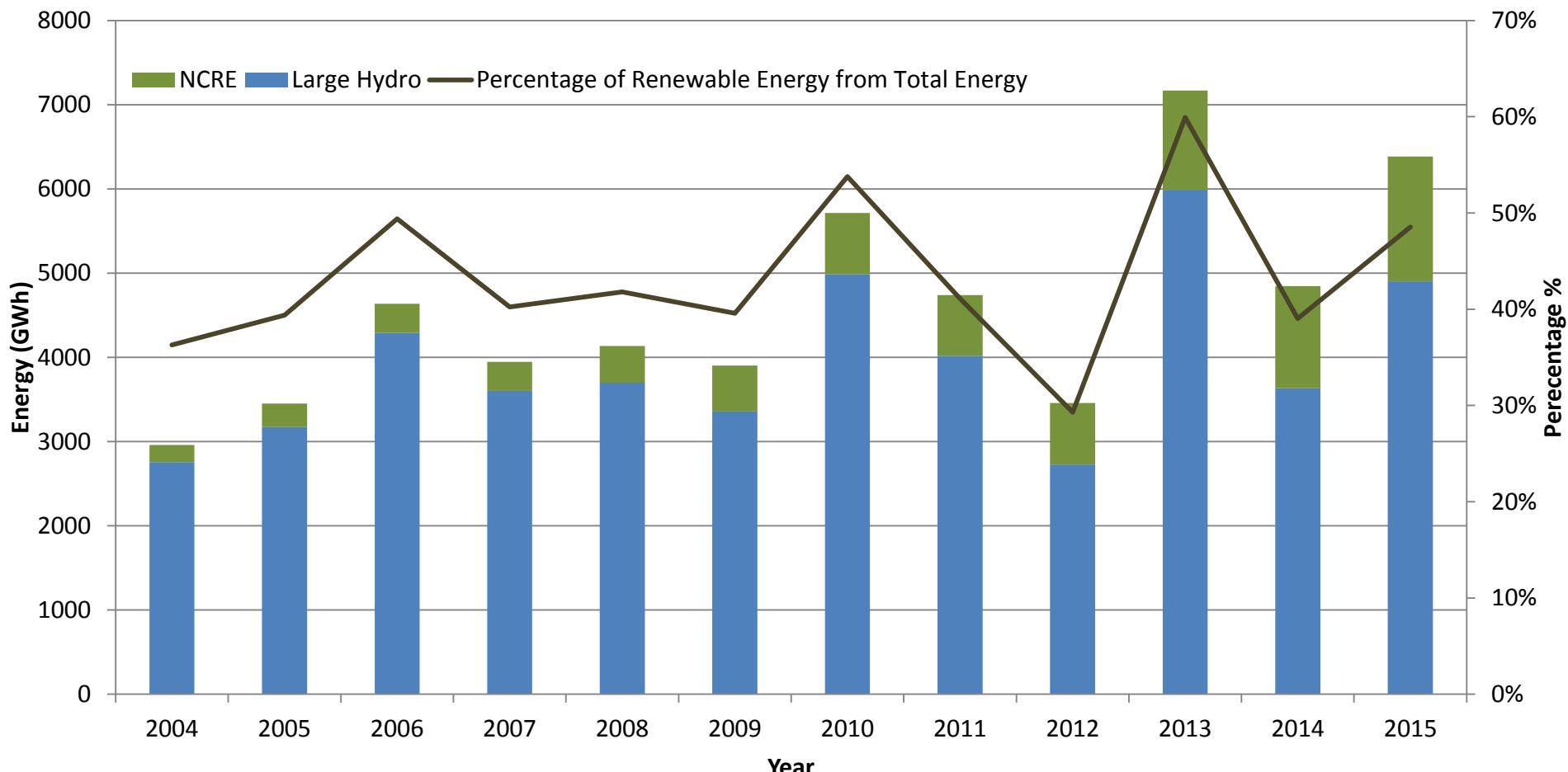
Year	Energy Generation (GWh)		Capacity (MW)	
	NCRE	System Total	NCRE	Total System Installed Capacity
2003	120	7612	39	2483
2004	206	8043	73	2499
2005	280	8769	88	2411
2006	346	9389	112	2434
2007	344	9814	119	2444
2008	433	9901	161	2645
2009	546	9882	181	2684
2010	724	10714	212	2818
2011	722	11528	227	3141
2012	730	11801	320	3312
2013	1178	11962	367	3355
2014	1215	12418	442	3932

Annual Energy Contribution from NCRE Projects

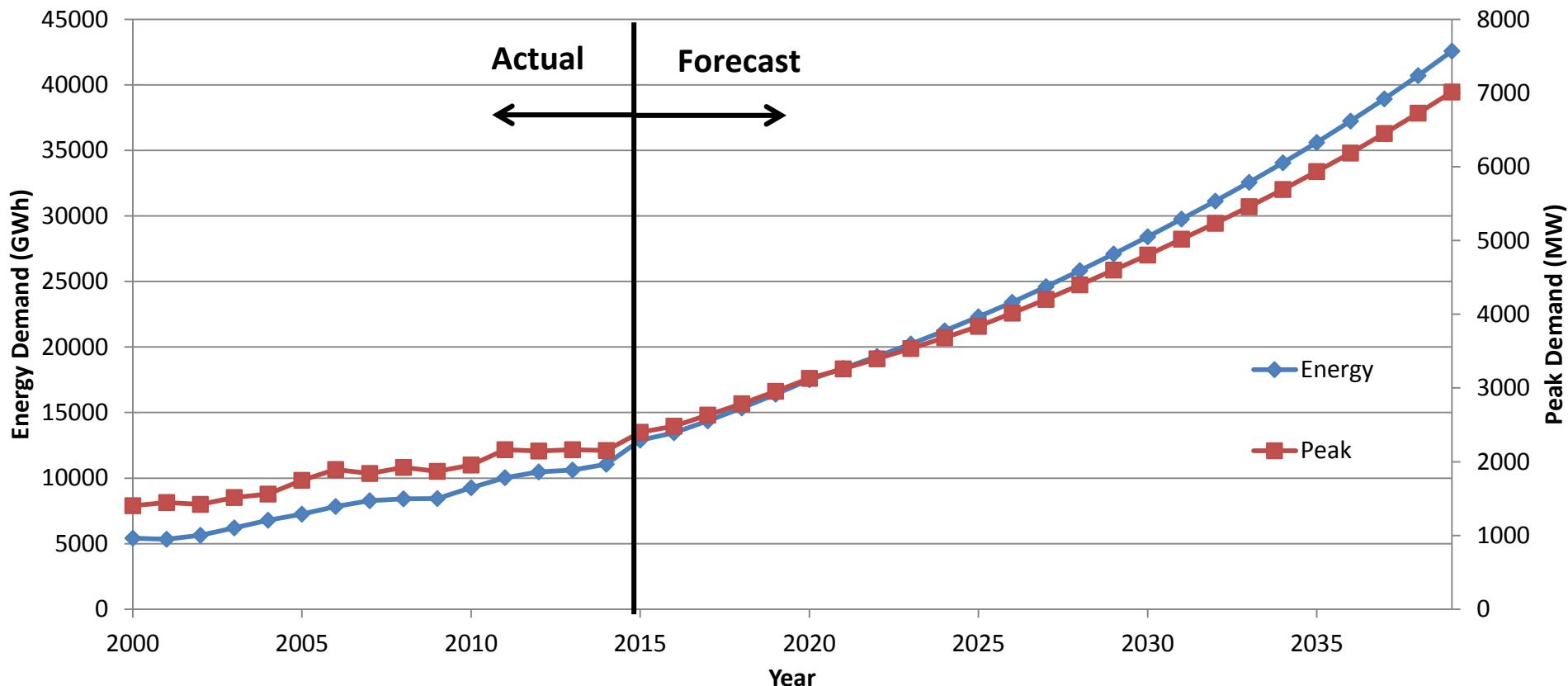


RENEWABLE ENERGY- PRESENT STATUS

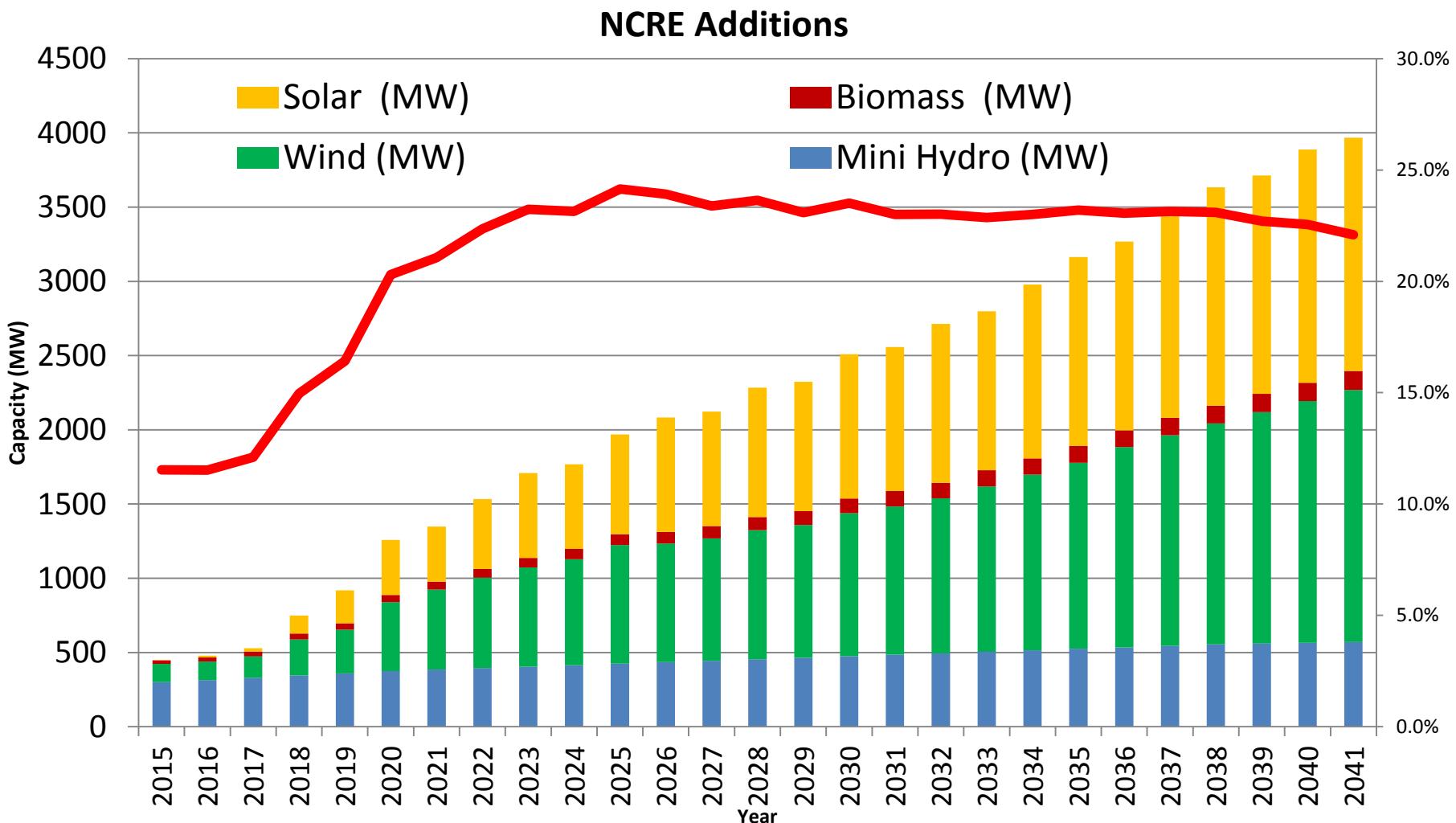
Renewable Energy Contribution



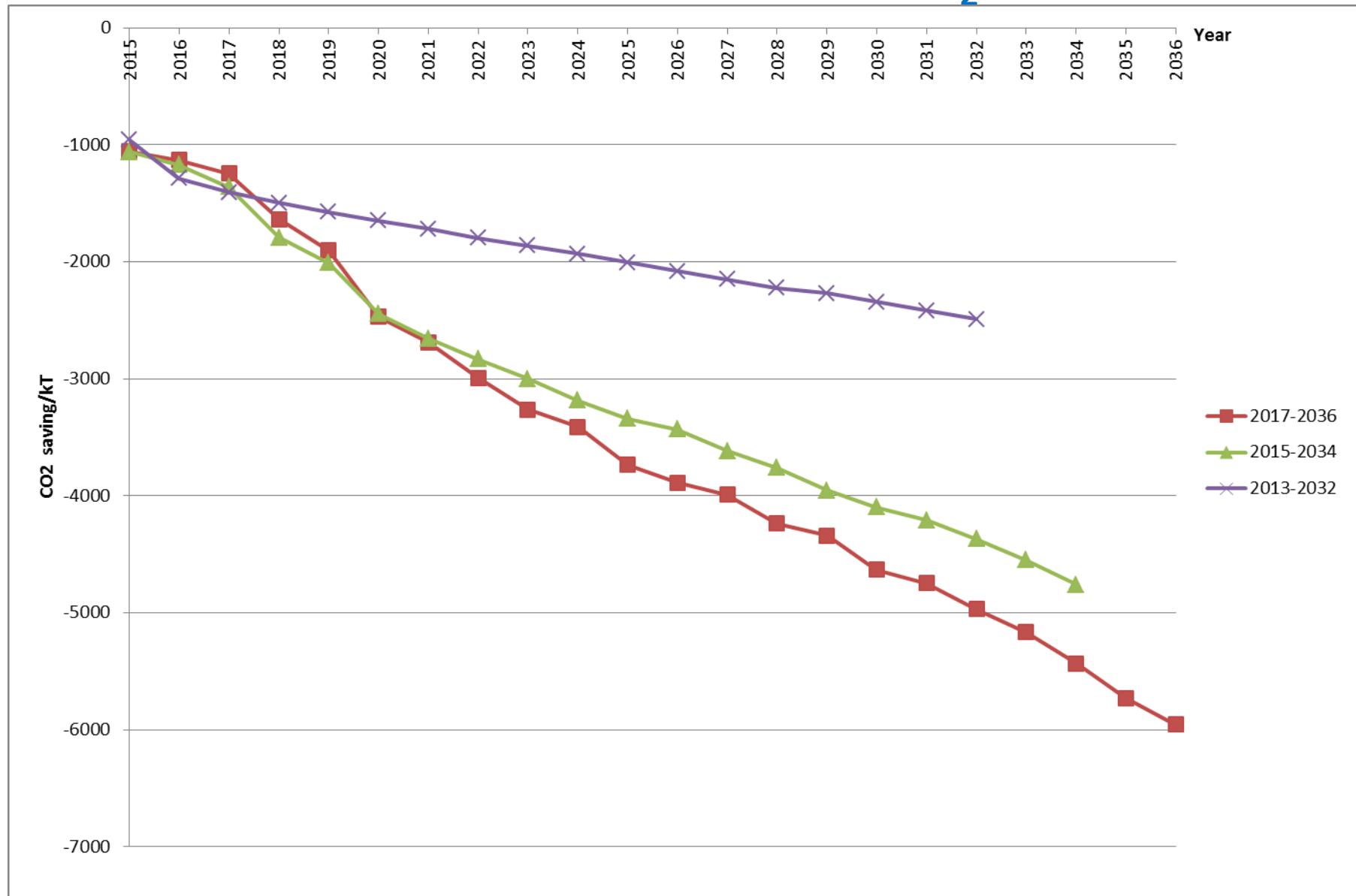
ACTUAL AND FORECAST ENERGY/PEAK DEMAND (AS PER DRAFT LTGEP 2015-2034)



FUTURE GENERATION OPTIONS - NON CONVENTIONAL



PROJECTION ON COMPARISON OF CO₂ SAVINGS



PRESENT STATUS OF NCRE TARIFF

PRINCIPLES OF TARIFF FIXING

- Renewable energy, which is a natural resource, belongs to the State.
- Renewable energy should produce electricity in the long term at prices below the cost of thermal power plants, using oil or coal, or even gas.
- Developers are provided with a high tariff to cover their expenses and reasonable profits for an adequately long period (in this case fifteen years.) Cost based , technology specific and three tiered or flat tariff
- Tier 1: Years 1- 8 ;Tier 2: Years 9 – 15; Tier 3: Years 16 – 20
- (SPPA period – 20 years)
- This tariff will be limited to small power producers (Capacity up to 10 MW)
- **This tariff has been designed to eliminate the problems of negative cash flows experienced by many small power producers during the period of loan repayment.**

PROJECTS IN THE PIPELINE - NCRE

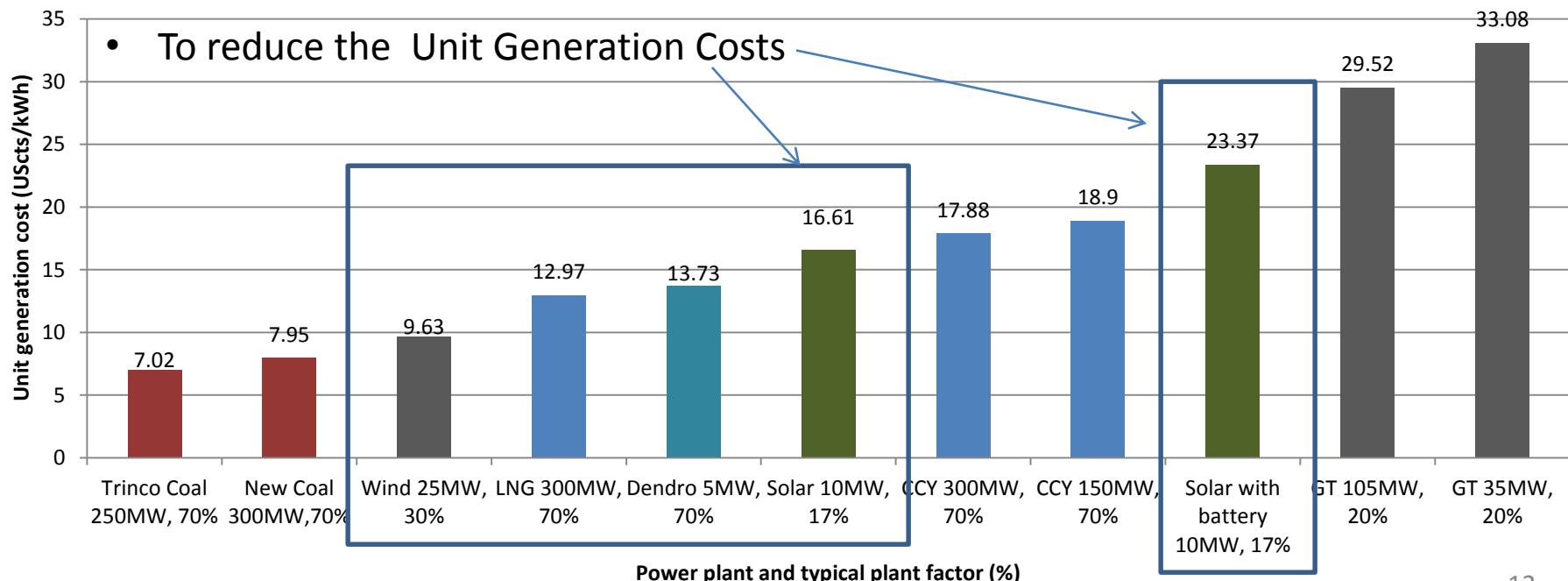
SPPA Signed NCRE Projects – Present Status

NCRE Technology		No of Projects	Capacity (MW)
1	Mini Hydro Power	95	177
2	Biomass - Agricultural & Industrial Waste	2	4.5
3	Biomass - Dendro Power	13	51
4	Biomass – Municipal Waste	1	10
5	Solar Power	4	40
6	Solar Thermal	3	30
7	Wind Power	1	1
Total		119	314

WHY CLIMATE FINANCE

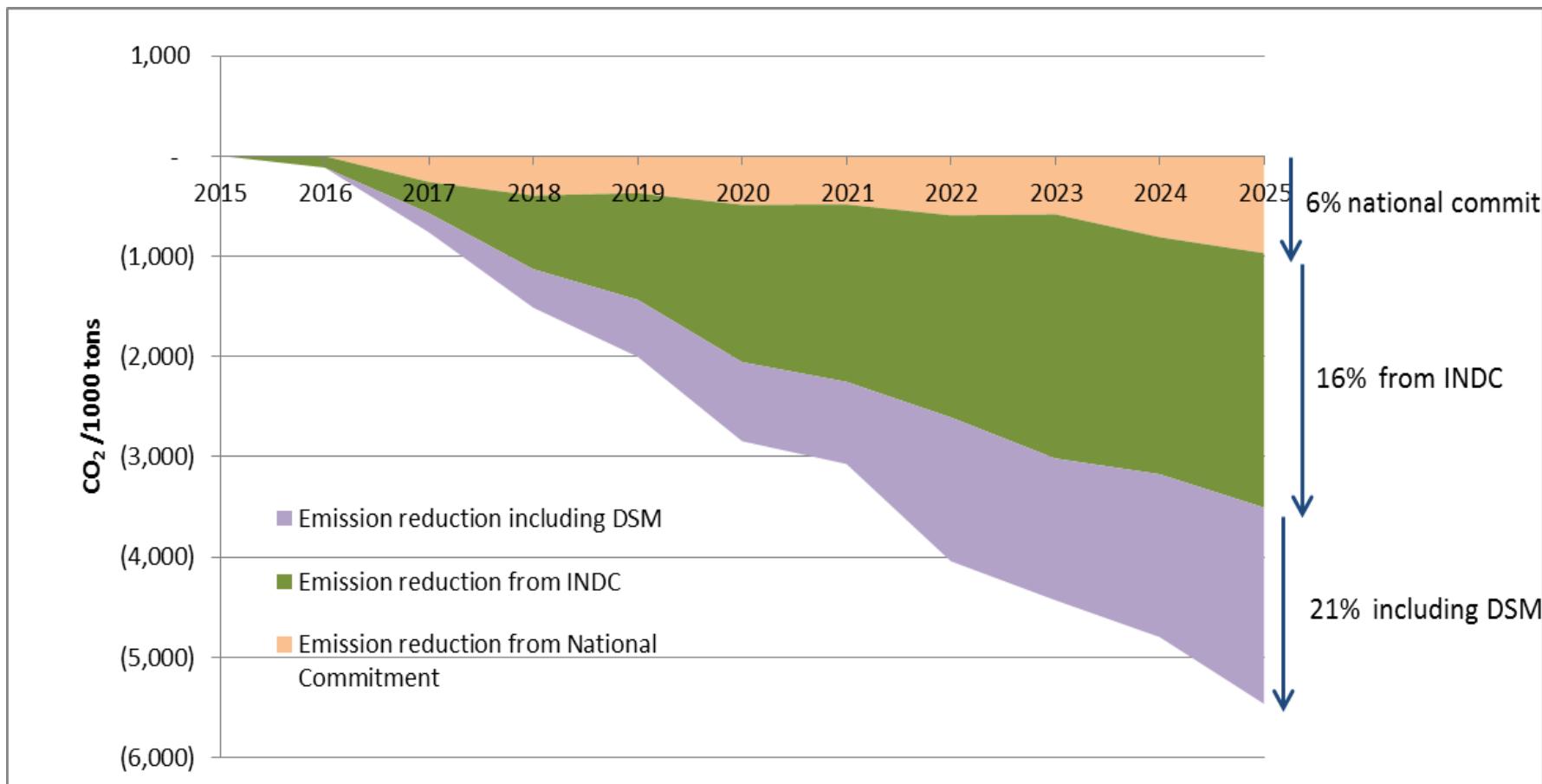
- Sri Lanka seeks Climate Finance to reduce the present high cost of Renewable Energy – CPF support in this regard is highly welcome.
- Possibility of reducing the present feed in tariff payable to NCRE in future, sharing the carbon credits among stake holders including CEB, if appropriate.
- Overall Sector Development through use of carbon credits

Unit Generation Costs for Different Power Plants at Typical Plant Factors



Present Status : INDC

- TO ACHIEVE EMISSION REDUCTION AT LEAST IDENTIFIED FROM INDCs



CHALLENGES TO OVERCOME & SOME SUGGESTIONS TO EXPLORE

- If carbon markets revive, opportunity to get competitive prices for carbon credits may be lost by entering into long term agreements only with the World Bank Group.
 - Inclusion of some provisions in to ERPA to avoid such possibility
- Whether private sector will fully engage in to the CPF program and agree to sell credits to CEB as they may get better credits from competitive market.
 - Directive from the government, a long term proposition
 - Waive off credit rights as part of the SPPA that offers feed-in-tariffs
- According to present practice, all carbon credit programs should be directed by the Climate Change Secretariat (CCS).
 - Engaging CCS from the beginning and seeking their approvals as needed
- Understanding the impact on Intended Nationally Determined Contributions (INDCs), submitted by the Ministry of Mahaweli Development and Environment, Once CEB signs the SPA and ERPA, relevant carbon reduction will be removed from the country and country cannot claim for any reduction of emissions.
 - Inclusion of ‘unconditional’ target in the baseline and credits from ‘conditional target’

THANK YOU

Additional slides

INTRODUCTION

SRI LANKA

- Total Area : 65,610 km²
- Land Area : 62,705 km²
- Population : 20.97 million
 - Urban : 18.3% Rural : 81.7%
- Population Density : 334 per/ sqkm
- Labour Force : 8.973 million
- Unemployment rate : 4.6%
- Literacy rate : 93.3%
- Life expectancy: 72 yrs (M), 78 yrs (F)
- Monetary Unit : Sri Lankan Rupee
(1 USD = 146.19 LKR at 01.01.2016)
- Gross Domestic Product : 11,183 billion LKR (Market Prices)
- GDP per capita : 3,924 US\$ (Market Prices)
- GDP structure 2015
 - Agriculture – 7.85% Industry – 26.20%
 - Services – 56.61% Taxes less subsidies on products – 9.34%



FUTURE GENERATION OPTIONS - NON CONVENTIONAL

Projected NCRE capacity

Year	Mini Hydro (MW)	Wind (MW)	Biomass (MW)	Solar (MW)	Solar Net Metering (MW)	Total NCRE Capacity (MW)	Annual Total NCRE Generation (GWh)	Share of NCRE from Total Generation %
2017	329	144	34	21	20	548	1782	12.1%
2018	344	244	39	121	26	774	2337	15.0%
2019	359	294	44	221	32	950	2720	16.4%
2020	374	464	49	371	39	1297	3530	20.3%
2021	384	539	54	371	44	1392	3840	21.1%
2022	394	609	59	471	50	1583	4277	22.4%
2023	404	669	64	571	55	1763	4663	23.2%
2024	414	714	69	571	60	1828	4875	23.1%
2025	424	799	74	671	64	2032	5339	24.1%
2026	434	799	79	771	69	2152	5553	23.9%
2027	444	824	84	771	74	2197	5702	23.4%
2028	454	869	89	871	79	2362	6051	23.6%
2029	464	894	94	871	83	2406	6200	23.1%
2030	474	964	99	971	88	2597	6619	23.5%
2031	484	999	104	971	93	2651	6785	23.0%
2032	494	1044	104	1071	98	2811	7099	23.0%
2033	504	1114	109	1071	102	2900	7378	22.9%
2034	514	1184	109	1171	107	3086	7763	23.0%
2035	524	1254	114	1271	112	3275	8186	23.2%
2036	534	1349	114	1271	117	3385	8506	23.1%

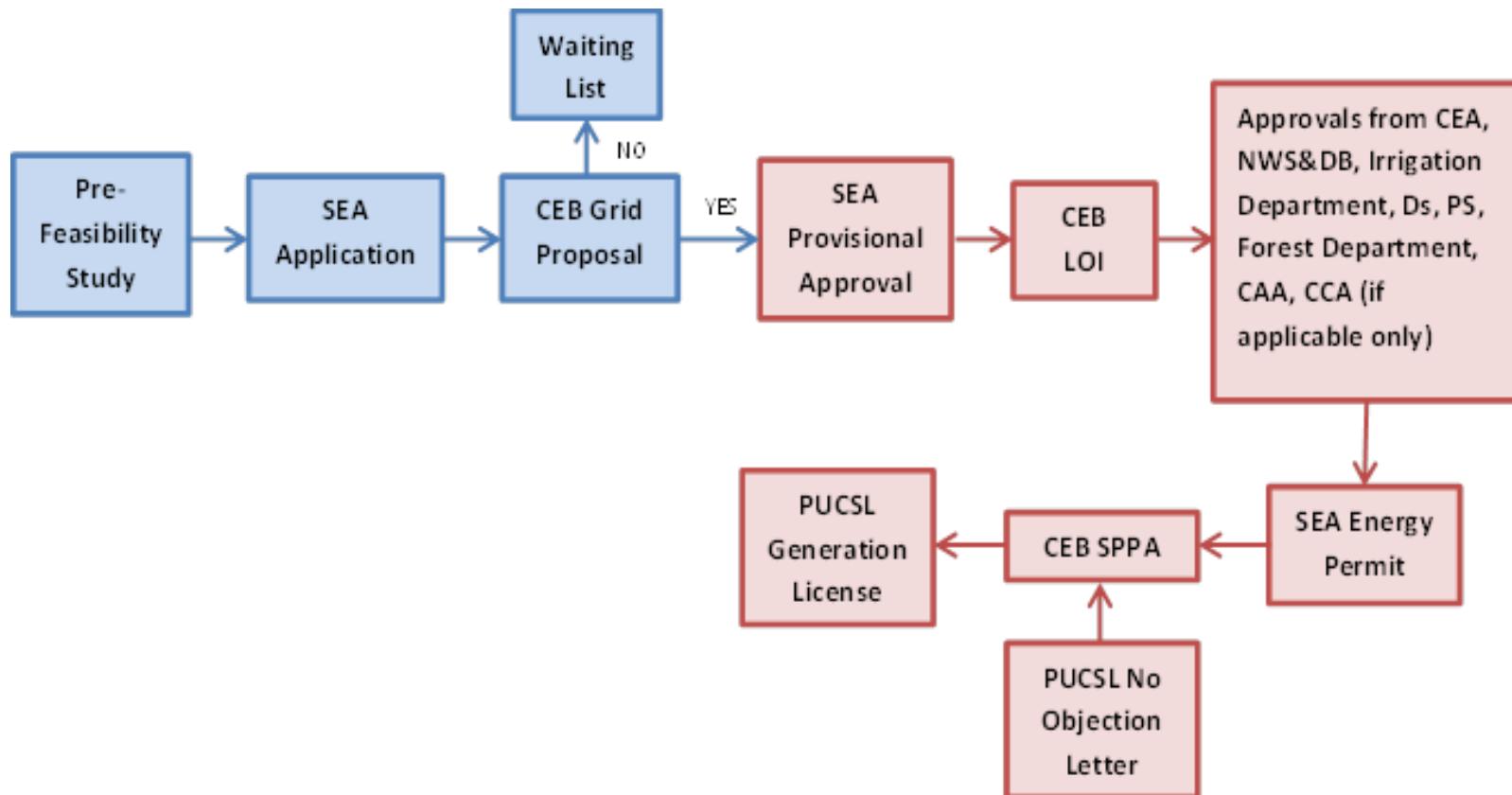
ENVIRONMENTAL ASPECTS

Comparison of CO₂ Emissions from fuel combustion

Country	kg CO ₂ /2005 US\$ of GDP	kg CO ₂ /2005 US\$ of GDP Adjusted to PPP	Tons of CO ₂ per Capita	GDP per capita (current US\$)
Sri Lanka	0.33	0.08	0.67	3,280
Pakistan	0.94	0.19	0.74	1,275
India	1.25	0.32	1.49	1,498
Indonesia	0.94	0.21	1.70	3,475
Thailand	1.07	0.30	3.69	5,779
China	1.85	0.64	6.60	6,807
France	0.13	0.15	4.79	42,560
Japan	0.26	0.30	9.70	38,634
Germany	0.24	0.26	9.25	46,251
USA	0.35	0.35	16.18	53,042
World	0.57	0.37	4.52	

**IEA CO₂ Emissions from Fuel Combustion (2014 Edition)-
2013 data, World Bank website 2013 data**

Present NCRE Projects Approval Process



Main Parameters

- Debt equity ratio - 60:40
- Loan repayment - 8 years
- Construction period - 2 years
- Return on equity (ROE) - 22 %

Plant factor and O & M percentages

Technology	Plant Factor	O & M Percentage (Year 1-15)	O & M Percentage Year (16 -20)
Mini Hydro	42 %	3 %	3 %
Mini Hydro - Local	42 %	3 %	3 %
Wind	32 %	1.5 %	1.5 %
Wind - Local	32 %	1.5 %	1.5 %
Biomass (dendro)	80 %	4 %	5 %
Biomass (agricultural & industrial waste)	80 %	4 %	5 %
Waste Heat Recovery	67 %	1.33 %	1.33 %