



# Hydroelectricity within the scope of the NREAP

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# History of Energy Planning in Lebanon

- ❖ Policy Paper for the Electric Sector 2010
  - ❖ First National Energy Efficiency Action Plan (NEEAP 2011-2015)
  - ❖ Second National Energy Efficiency Action Plan (NEEAP 2016-2020)
- ❖ National Renewable Action Plan (NREAP 2016-2020)



The National Renewable Energy Action  
Plan for the Republic of Lebanon  
2016 - 2020



[www.lcec.org.lb](http://www.lcec.org.lb)



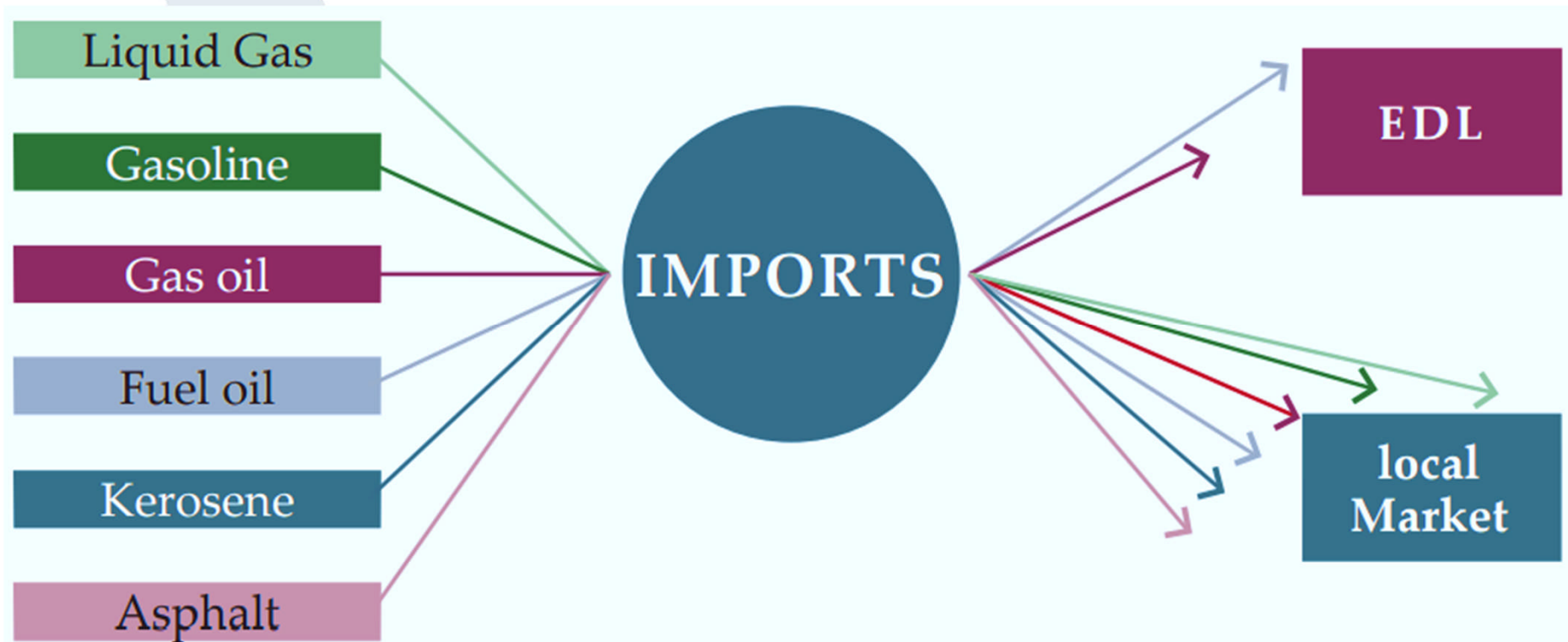
\*All documents are available on <http://www.lcec.org.lb/>

# The New Era 2016-2020

NREAP 2016-2020  
RE

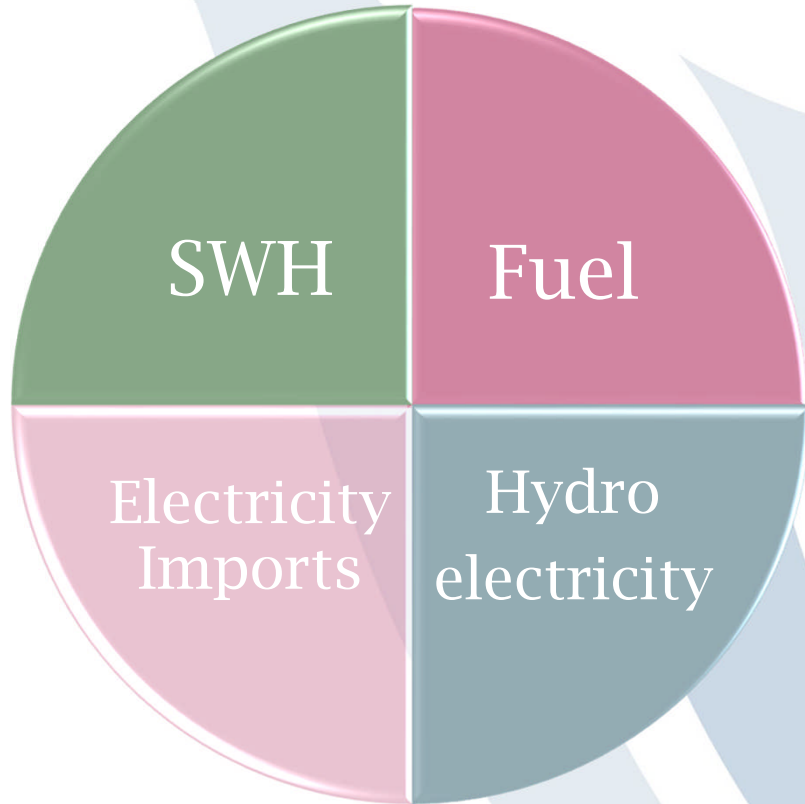
NEEAP 2016-2020  
EE

# Baseline -Year 2010 (1)

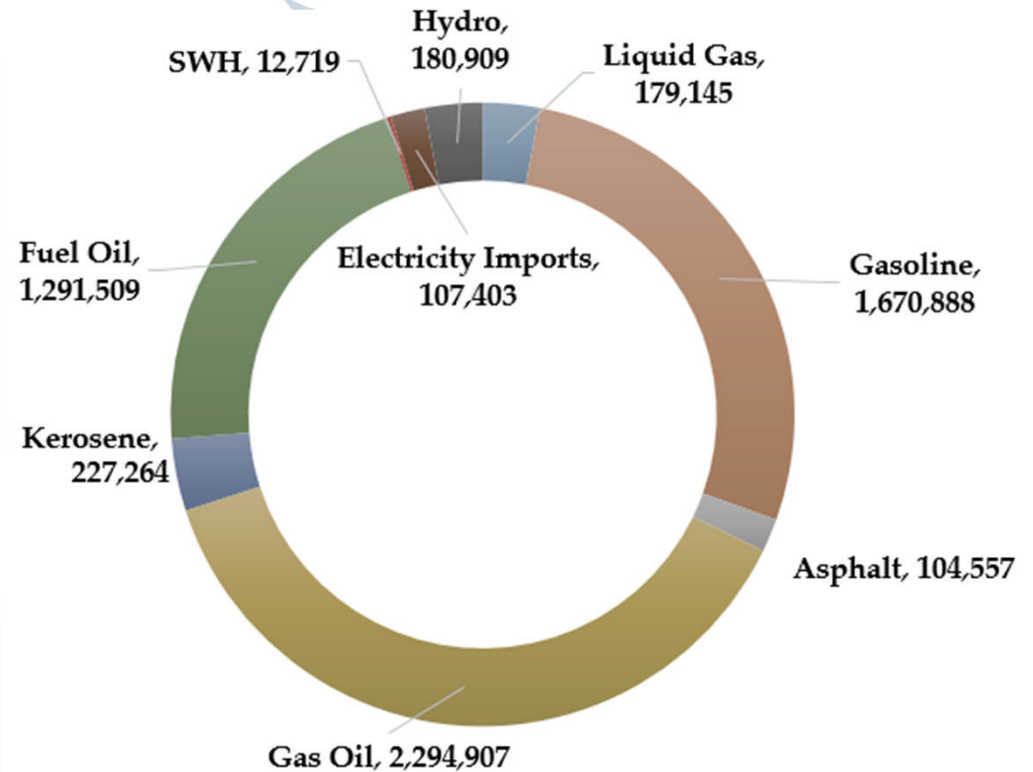


During the base year, the total fuel imports amount to 5,768,269.94 toe consumed in the different sectors in Lebanon.

# Baseline - Year 2010 (2)

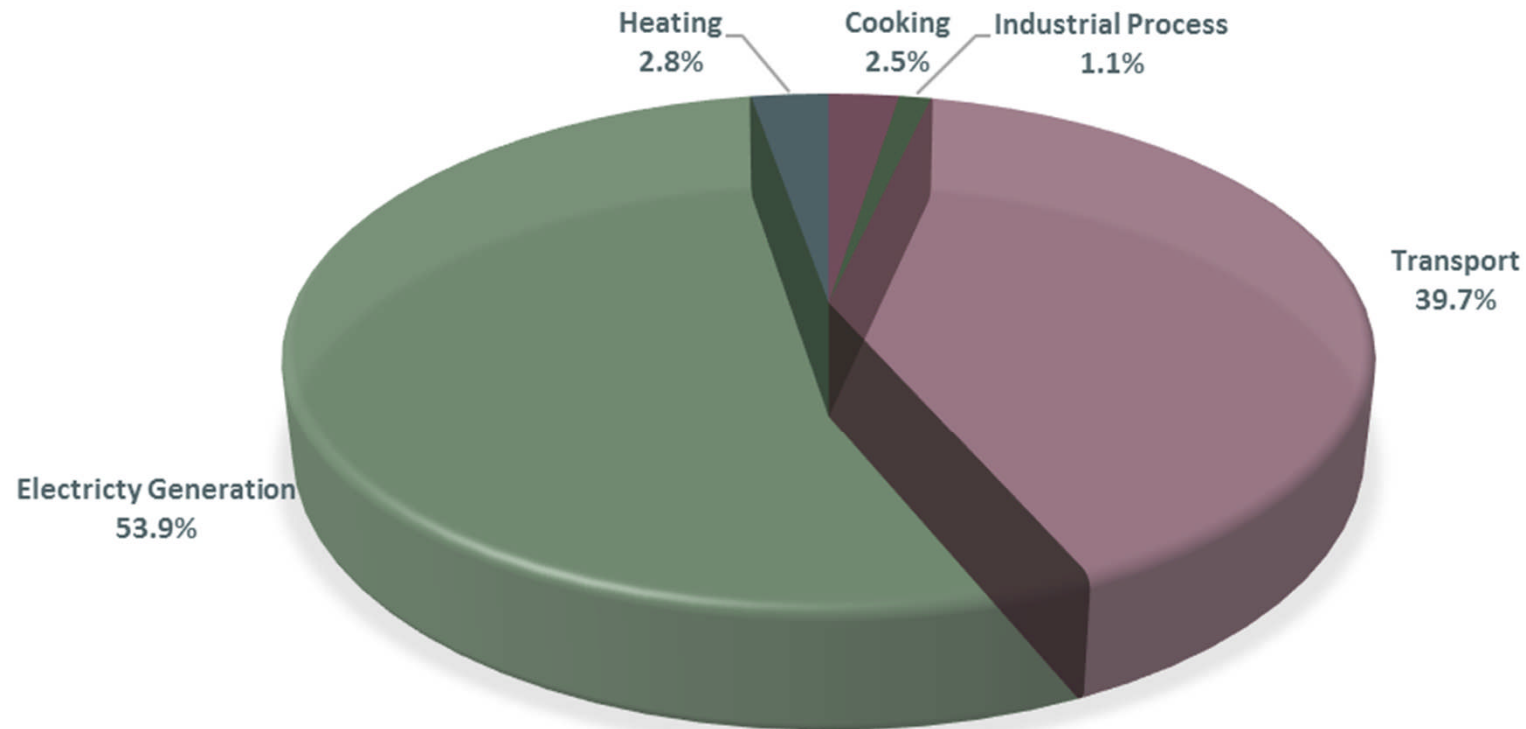


Primary Energy Components



Total consumption in 2010 amounts to 6,069,301 toe, out of which 96.8% were imported from outside Lebanon and the remaining (3.2%) was locally produced.

# Baseline - Year 2010 (3)



Total consumption in 2010 amounts to 6,069,301 toe, out of which 96.8% were imported from outside Lebanon and the remaining (3.2%) was locally produced.

# Baseline - Year 2010 (4)

Electricity Demand 15,934 GWh



EDL Generation 12,089 GWh

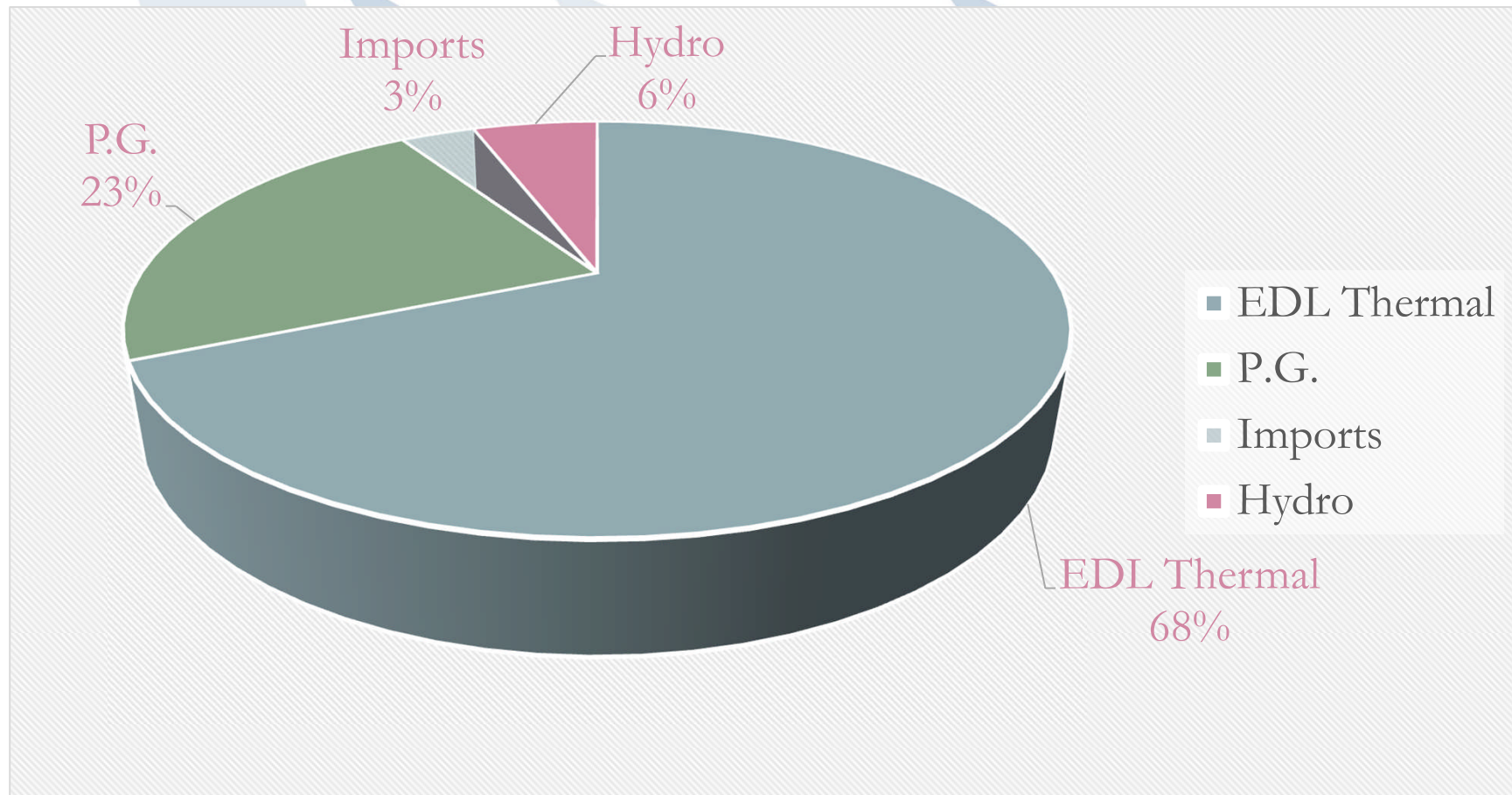


Private Generators 2,950 GWh

Total Generation 15,039 GWh

Deficit ~ 900 GWh

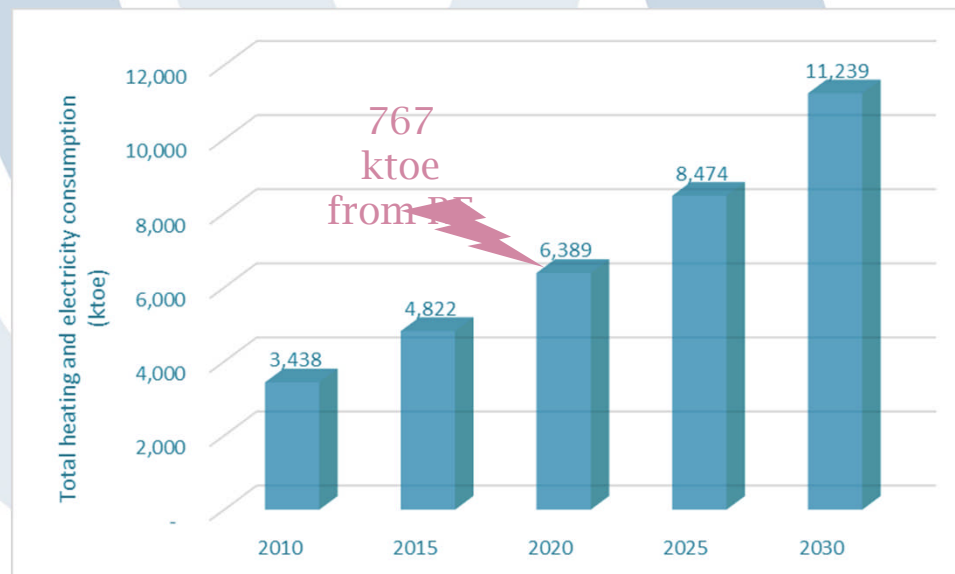
# Baseline - Year 2010 (5)



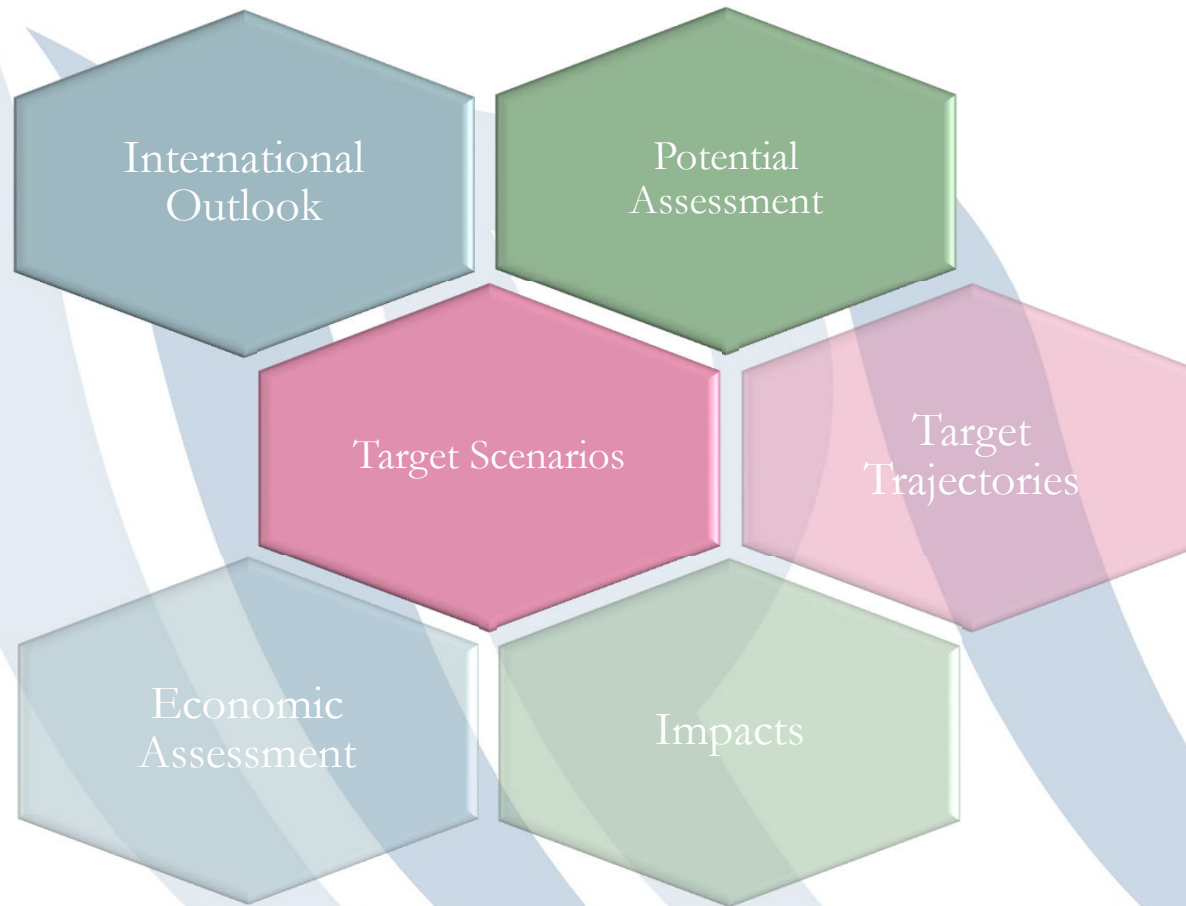


# National RE Target

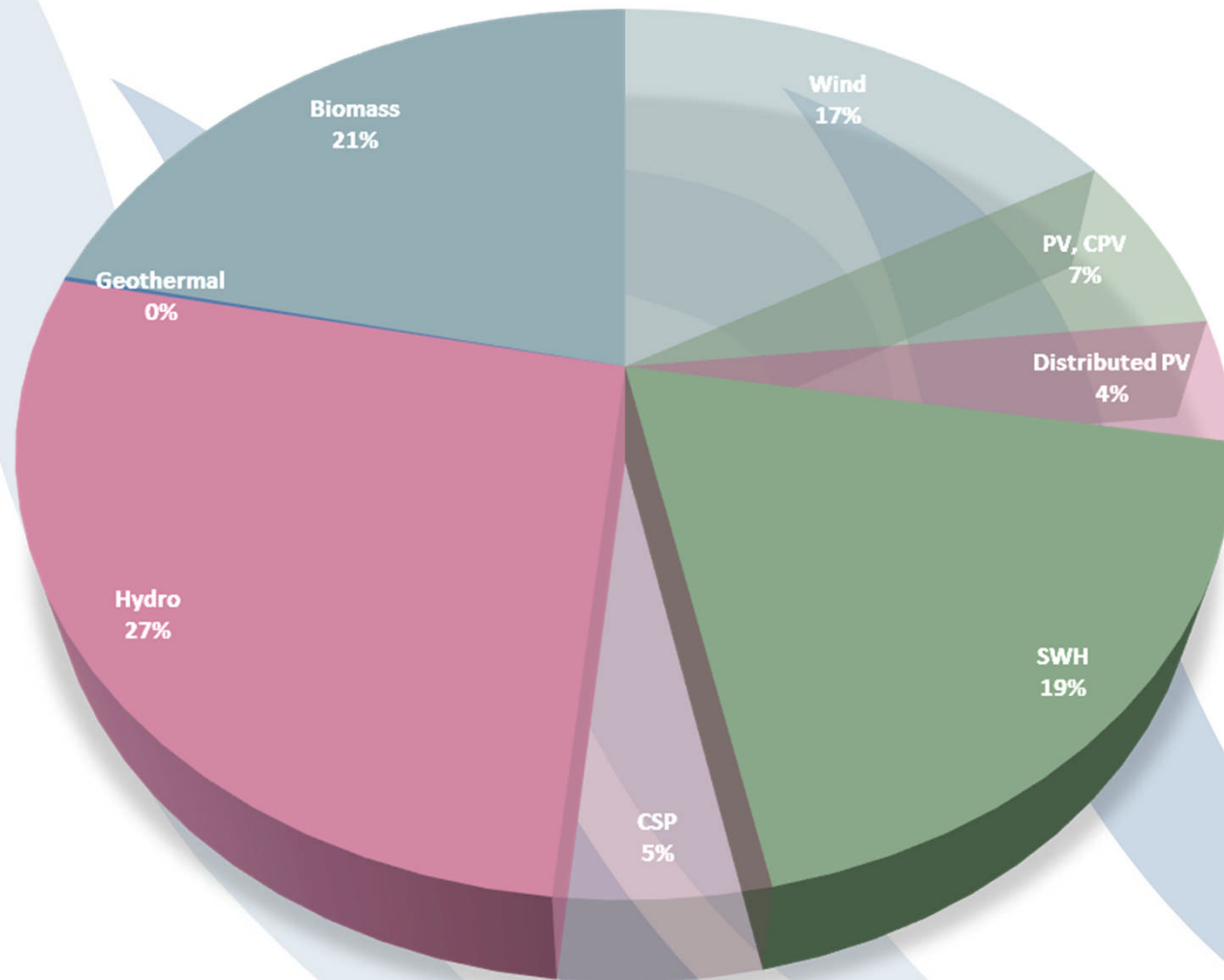
- ❖ 2009 Post Copenhagen announcement 12% in 2020.
- ❖ Definition of 12% out of both heat and electricity demand.
- ❖ Based on primary energy consumption.
- ❖ Adopting 5.82% demand increase since 2016.



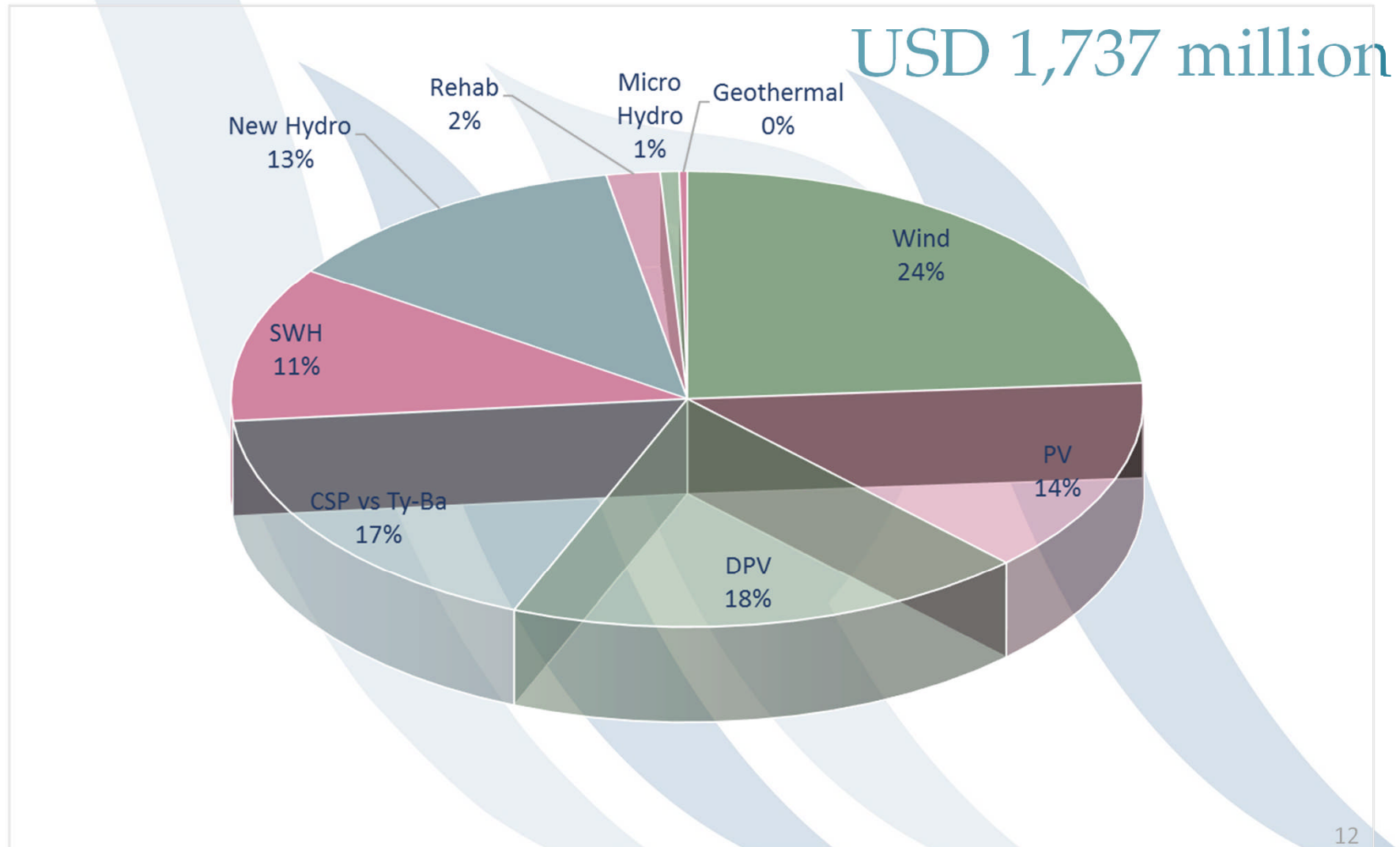
# Methodology



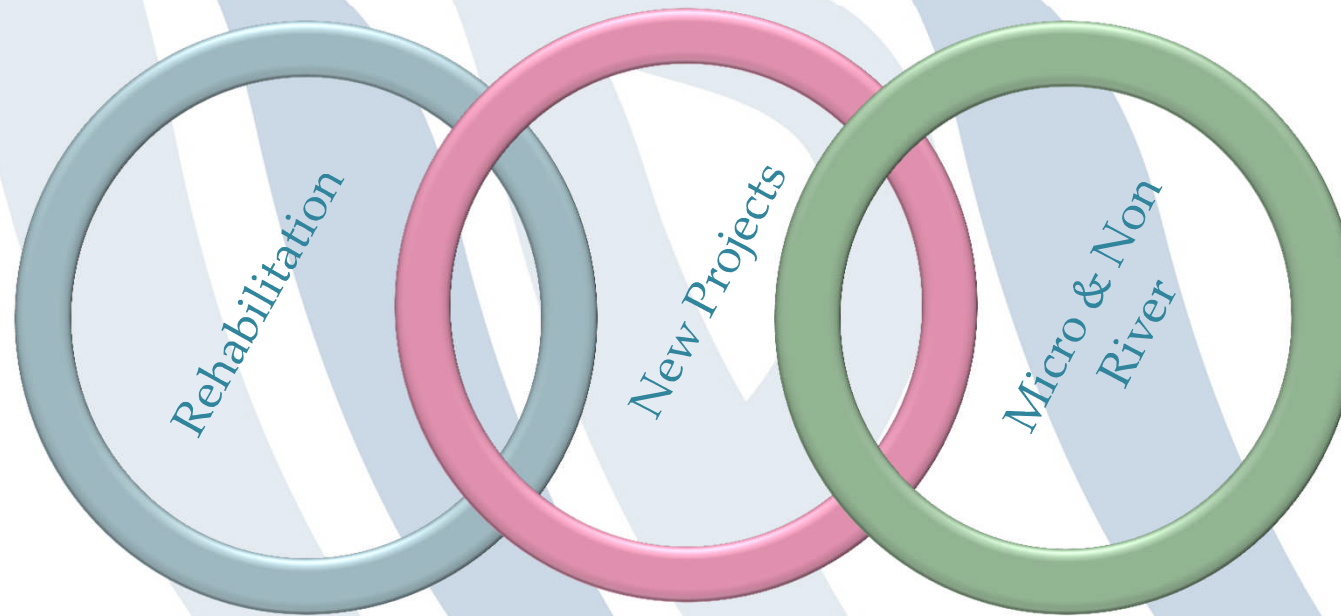
# Resources shares



# Shares of each resource from the total needed investment



# Types of hydro Projects



# Rehabilitation of existing PP

Plant	Rehabilitated Plant Yearly Production (GWh)
Kadisha Hydro	82
Litani	775
Nahr Ibrahim	105
Bared	62
Richmaya	23
Total Hydro	1,047

The rehabilitation of all hydro power plants will allow to increase their production from 836.5 GWh in 2010, to 1,047 GWh leading to an increase of 25.1% in their production capabilities.

Cost: 11 Million USD

# New Projects

	Level 1	Level 2	Level 3	Total
	Minimum Selling Tariff < \$c8.1/kWh	Minimum Selling Tariff > \$c8.1/kWh & < \$c12/kWh	Minimum Selling Tariff > \$c12/kWh	
Number of Sites	13	12	4	29
Power (MW)	139	94	17	250
CAPEX (M\$)	273	287	78	638
Production (GWh)	713	413	68	1,194
Average cost (\$) of installed (kW)	2,070	3,220	4,310	

# New Projects within the NREAP

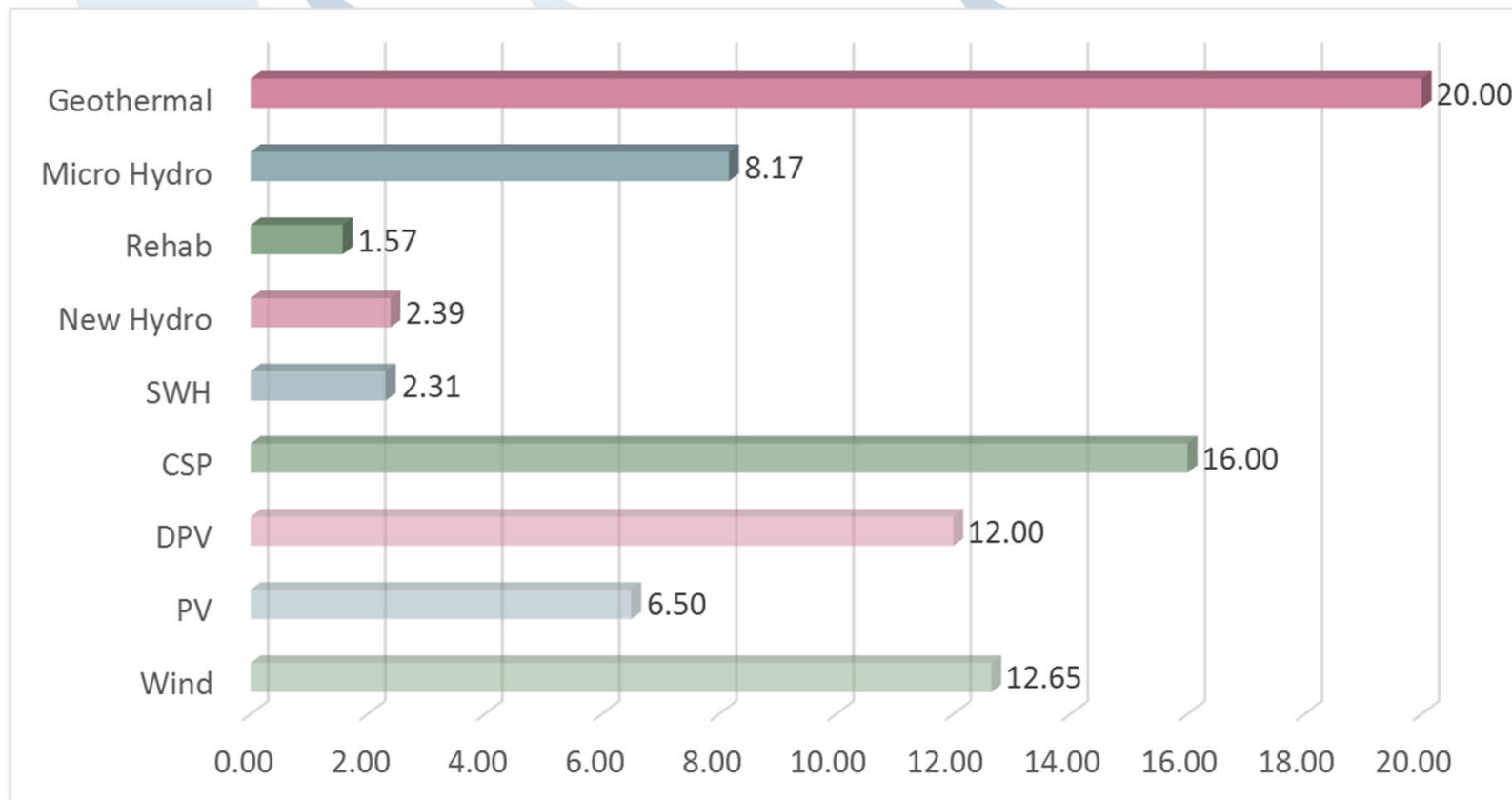
Plant	Optimistic	Realistic	Pessimistic
Number of Sites	12	13	5
Power (MW)	94	139	N.A.
CAPEX (M\$)	287	273	
Production (GWh)	413	713	210.5



# Micro Hydro and non river resources

- ❖ A UNDP-CEDRO (2013) publication: “Hydropower from Non-river Sources,”
- ❖ Namely hydropower from the cooling systems of near shore power-plants, irrigation channels, water networks, and sewage networks.
- ❖ Approximately 5 MW of power is identified in this study, however much more potential remains to be identified and tapped into.
- ❖ Estimated energy generation around 14.3 GWh
- ❖ Estimated cost around 10 Million USD

# Levelized cost of energy of each of the renewable energy resources

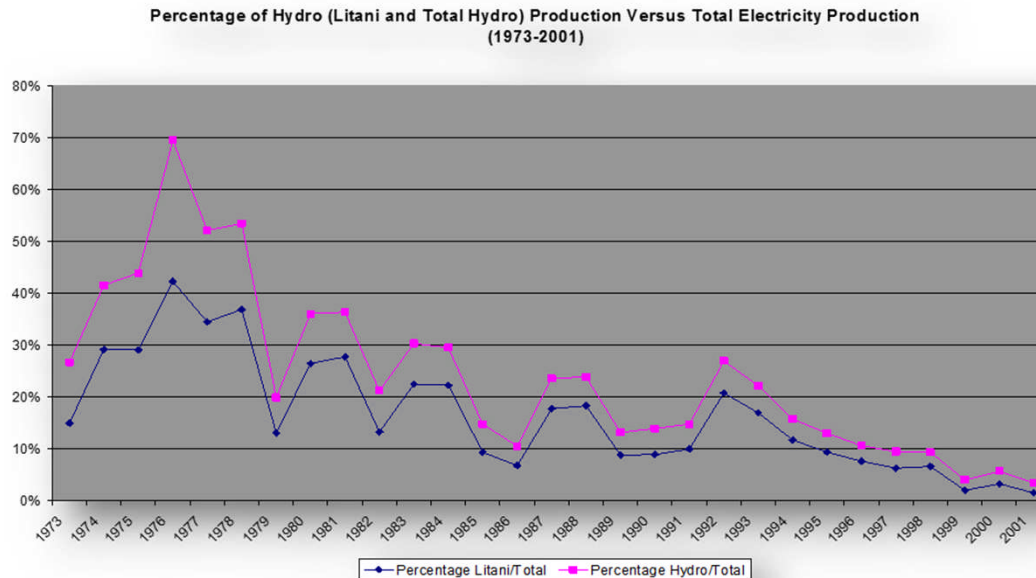


# Janneh Hydro Plant: A Case Study

- ❖ Dam Storage Capacity 37 Mm<sup>3</sup>
- ❖ Water Height 350 to 429 m depending on the water level in the dam.
- ❖ 3 Pelton Multijets Turbines to adapt easily to variations in water flow
- ❖ Base Power 32 MW / Peak Power 96 MW
- ❖ ROR Capex 47.8 M.\$ / Peak Capex 111.5 M.\$
- ❖ ROR 162 Gwh/year / Peak 207 Gwh/year
- ❖ Minimum selling Tariff 12% IRR
- ❖ Base Tariff 3.4 c/kwh / Peak Tariff 11.22 c/kWh
- ❖ EDL selling Tariff 9.58 c/kWh

# Conclusion

- ❖ Hydropower represented more than 70% in the energy mix of 1970's in Lebanon.
- ❖ Major barriers for the development of the sector include:
  - Lack of legislative framework
  - Need for large scale investment
- ❖ Big potential for small scale metropolitan projects





# Thank You!

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