Pumped Storage
How much is enough?

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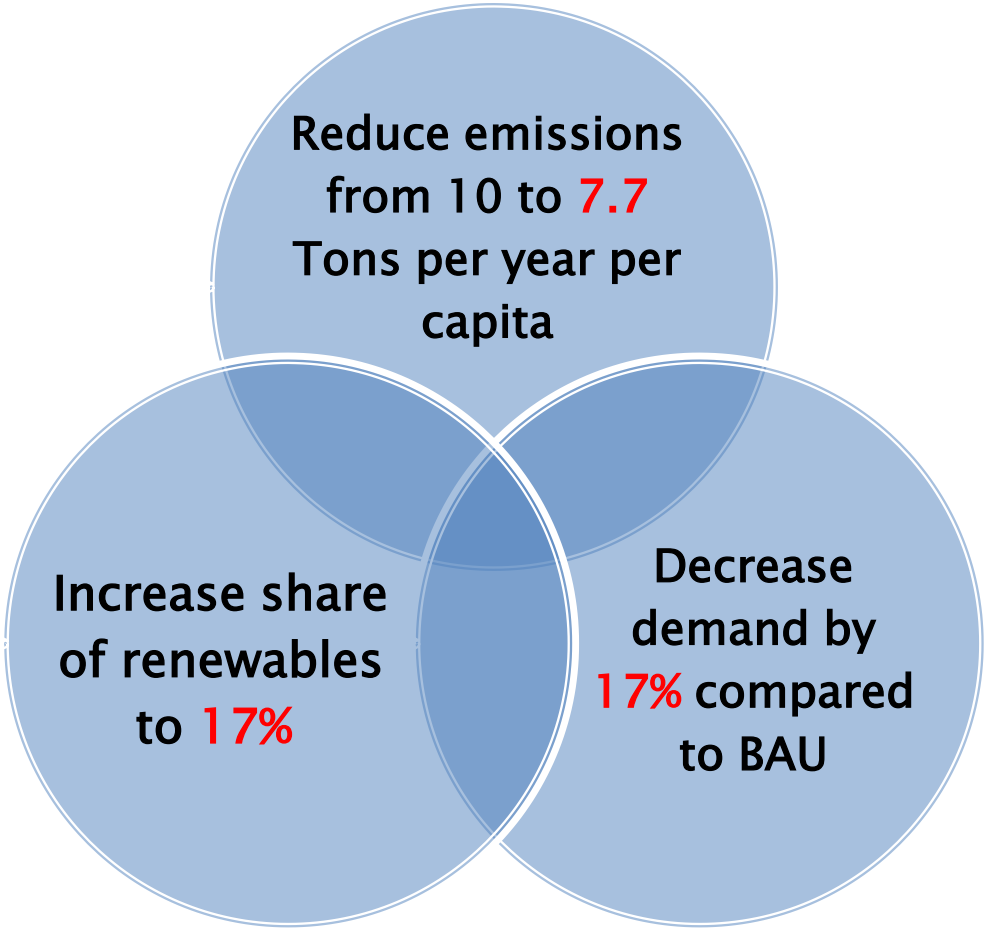
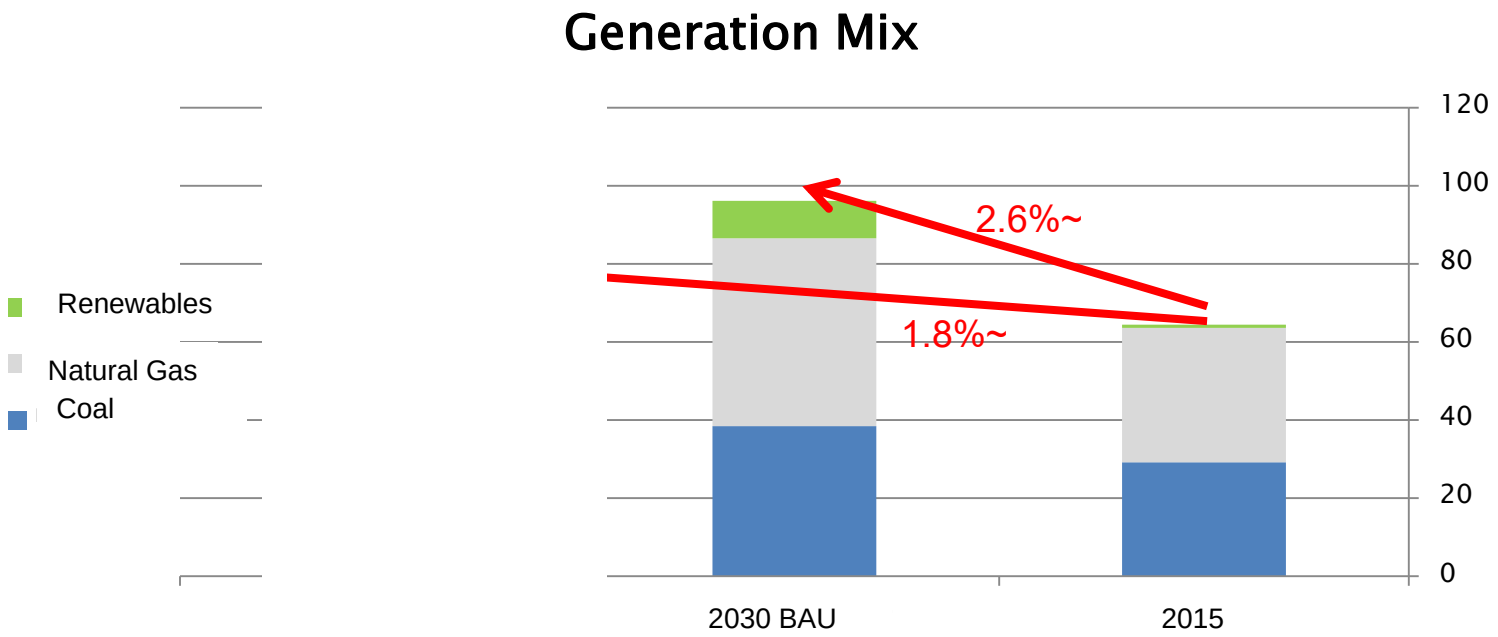
Eilat –Eilot 2016

Israel's Emission Reduction Resolution

2030 Targets



Implications



Reduce Demand Growth

Reduce Coal

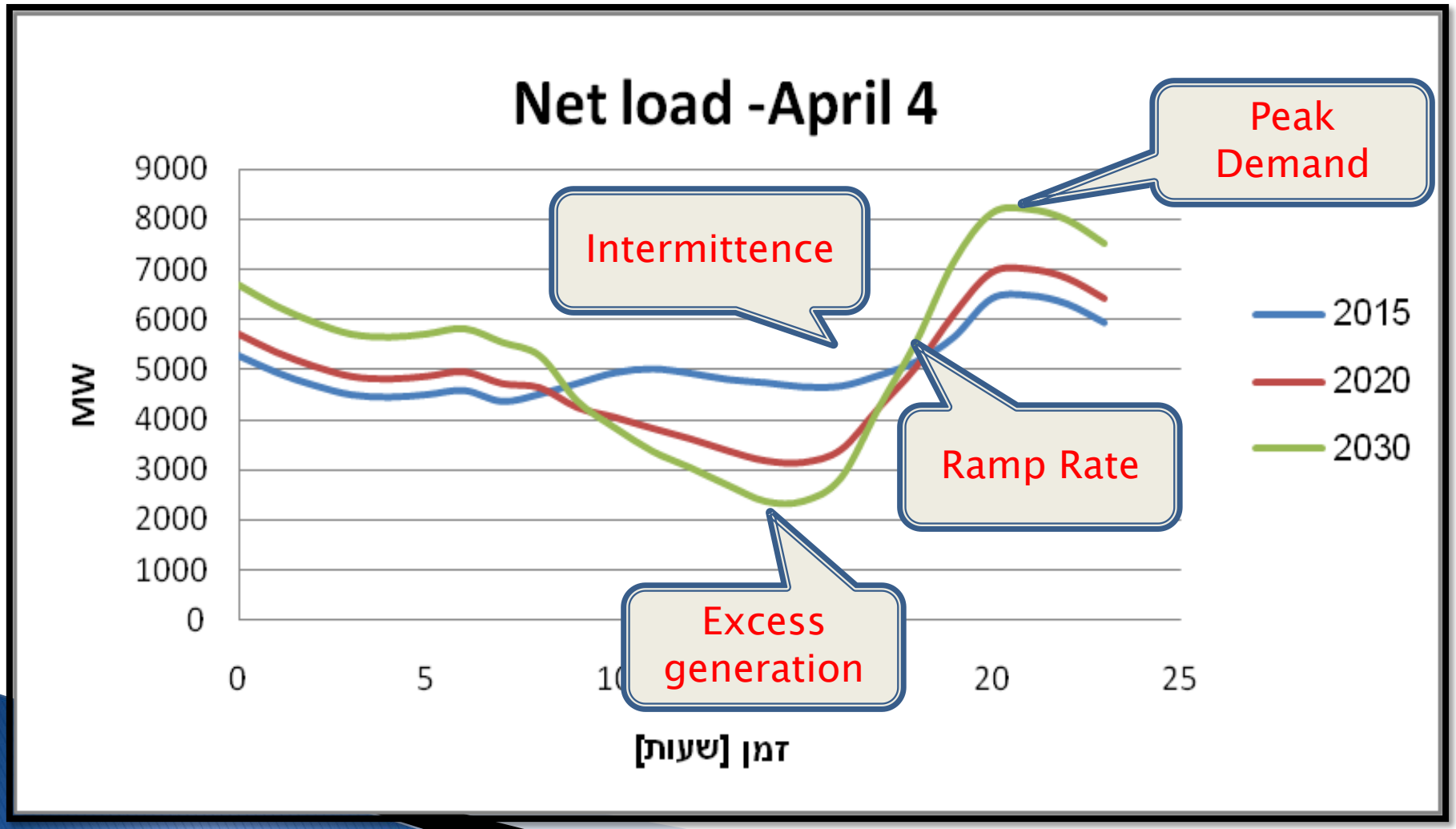
Increase Renwables

Increase Gas Capacity

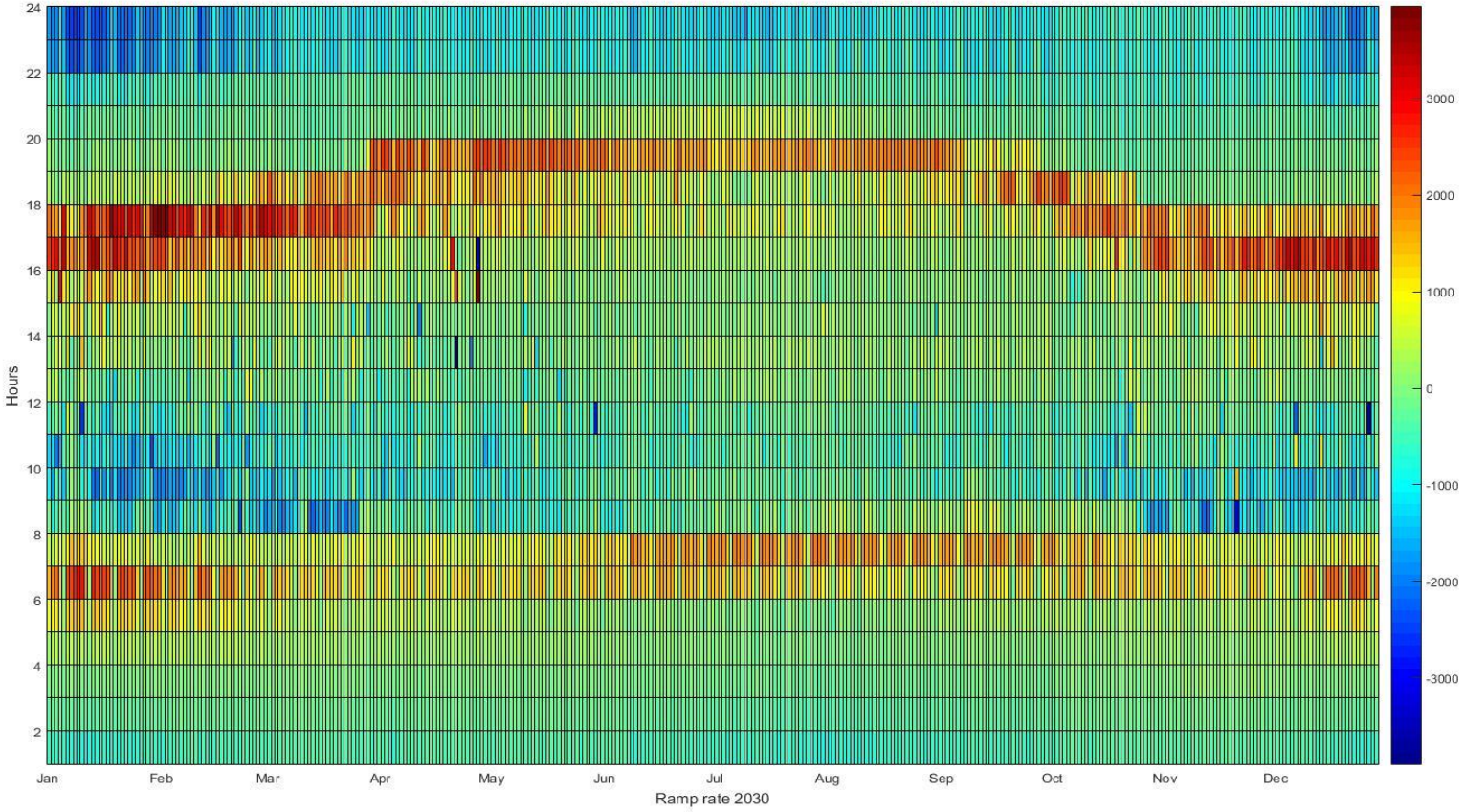
Storage Analysis

- Analyze the use of storage
- Focus on third plant
- Cost benefit analysis of the alternatives

Why do we need storage?
Net Demand Analysis



2030 Ramp Rate Map

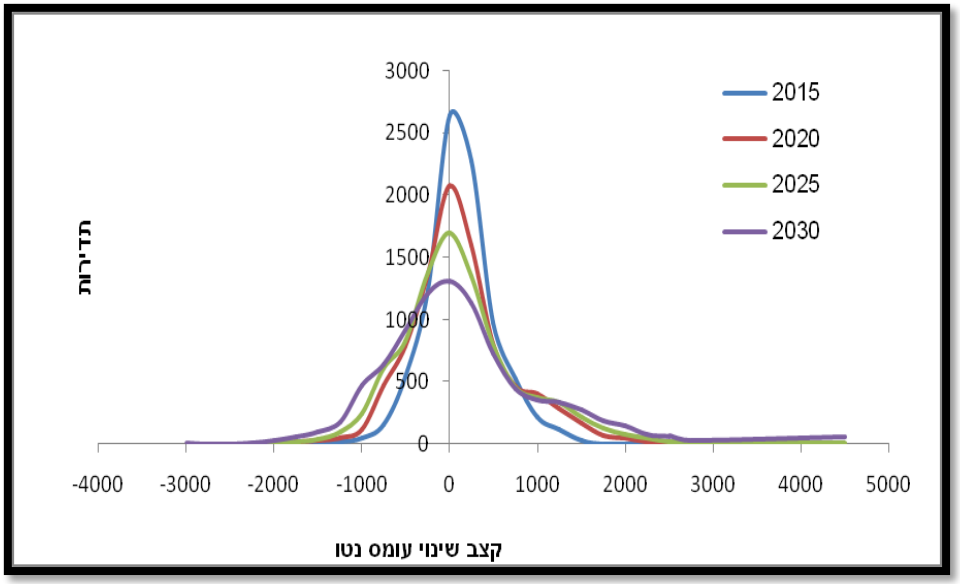


Hours

Days

Ramp Rate Distribution

2015-2030



Hours higher than 2015	Ramp Rate	Year
48-52	up	2020
7-11	down	
46-64	up	2025
5-9	down	
119-251	up	2030
14-55	down	

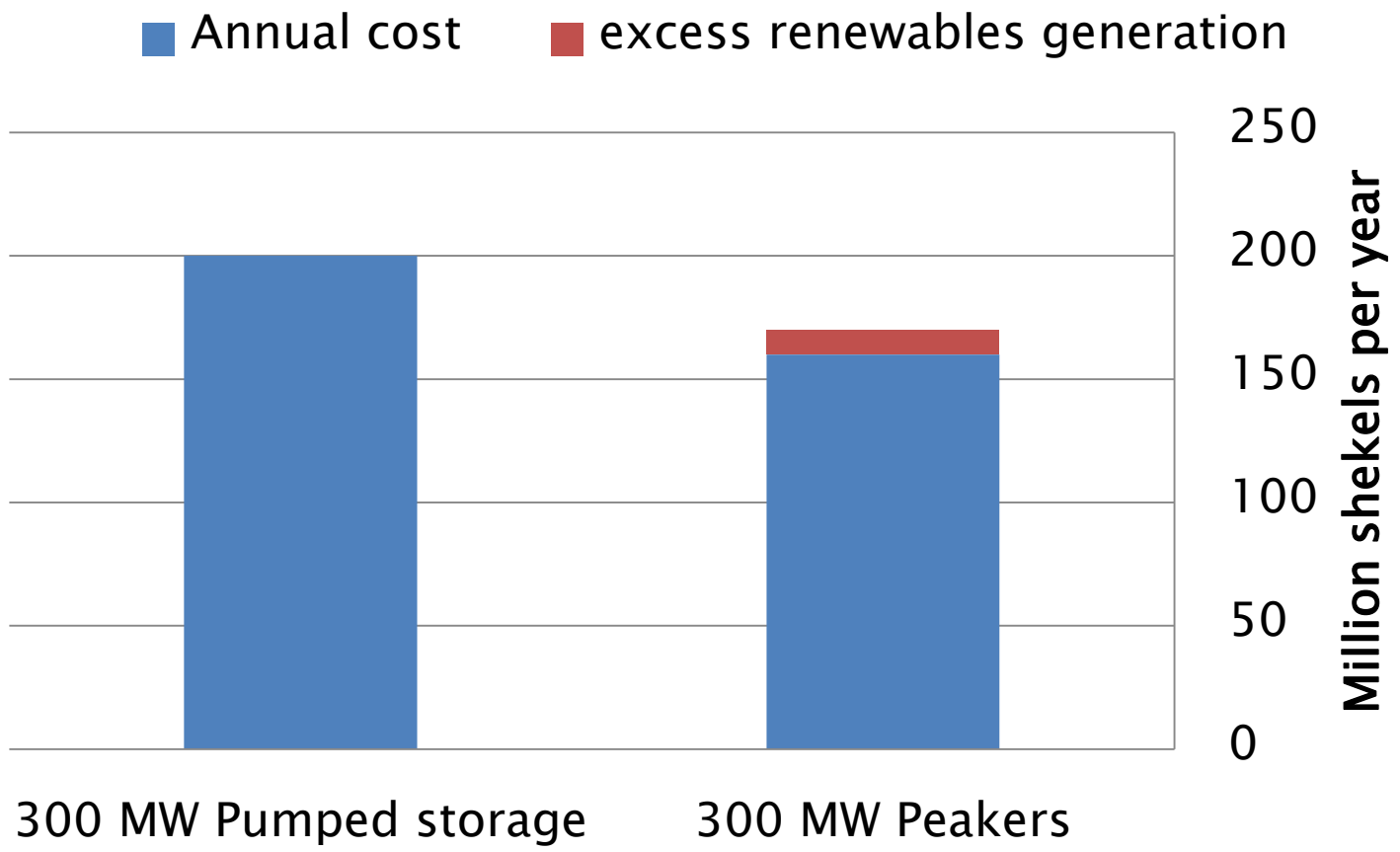
In 2030 hundreds of hours with ramp rate significantly higher than 2015

How much flexibility do we have?

Expected Future Capacity	2016 Capacity	
1440 MW will phase out in 2022	From a minimum of 2600 MW to full capacity -4800 MW	**coal**
Expected to phase out in 2020	~1200 MW	**Peakers**
Limited start ups	~600 MW	**Flexible CCGT**
MW 640	0	**Pumped Storage**

Large flexible capacity would be needed in 2030

Are there better Alternatives?



Conclusions

- Increasing share of renewable stresses the need for more flexibility in the system
  - Phasing out of coal capacity increases the challenge
- Excess renewable generation is not expected to be a major problem in Israel
- Pumped storage might not be the cheapest solution for flexibility