Modelling Transmission and Demand-Side Resources in RA Studies

Irene Danti Lopez
idantilopez@epri.com

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Modelling Transmission and Demand-Side Resources in RA: Context and Why This Matters

Transmission and Demand-Side Resources are Key Enablers for Net-Zero

Both transmission and demand-side resources can support wind and solar integration and avoid the construction of additional fossil-fired generation.

Lack of Standardized Modelling Approach and Framework for Planning

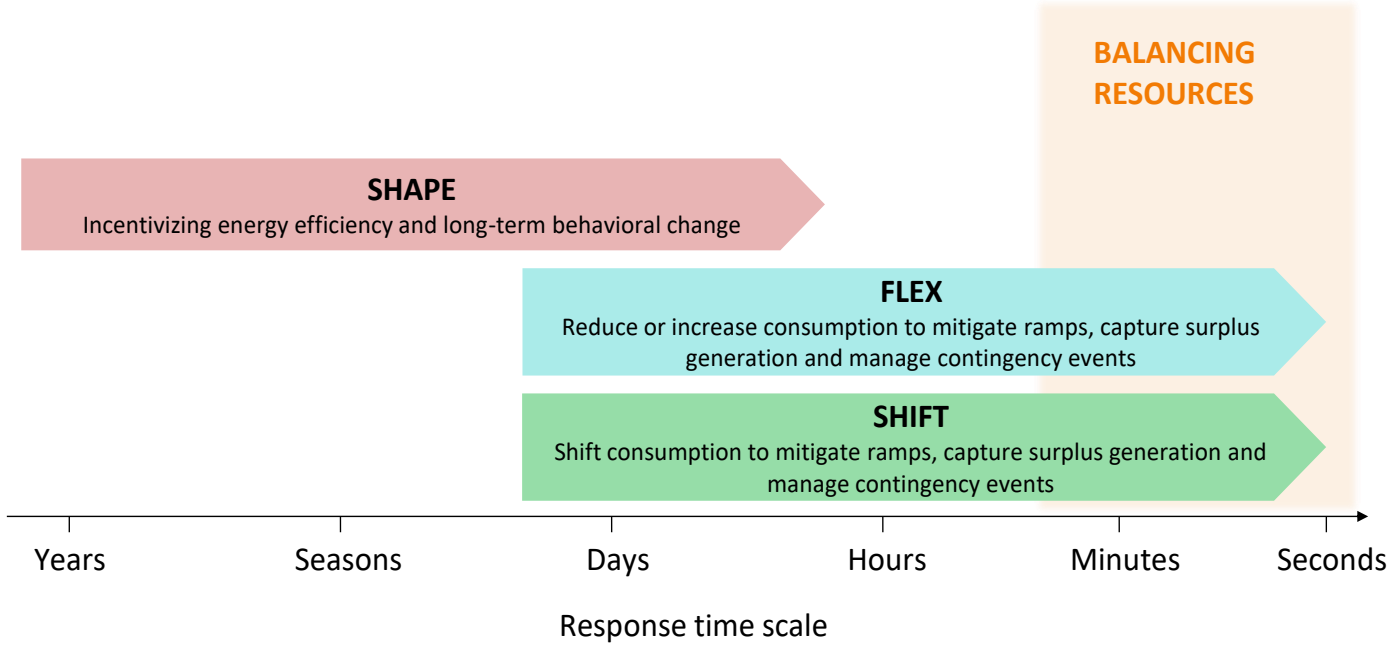
Many questions remain regarding how to appropriately model transmission constraints and demand-side resources in power system planning.

A clear framework for their implementation in RA is not available in the same way it is for supply-side resources.

Demand-Side Resources in RA

Defining Demand-Side Flexibility and Demand-Side Resources

Demand-side flexibility (DSF): any adjustment in customer net-load, measured at the customer meter, enabled by programs that trigger response from *demand-side resources*.



Timeline and categorization of demand-side response behavior (adapted from (Alston 2017))

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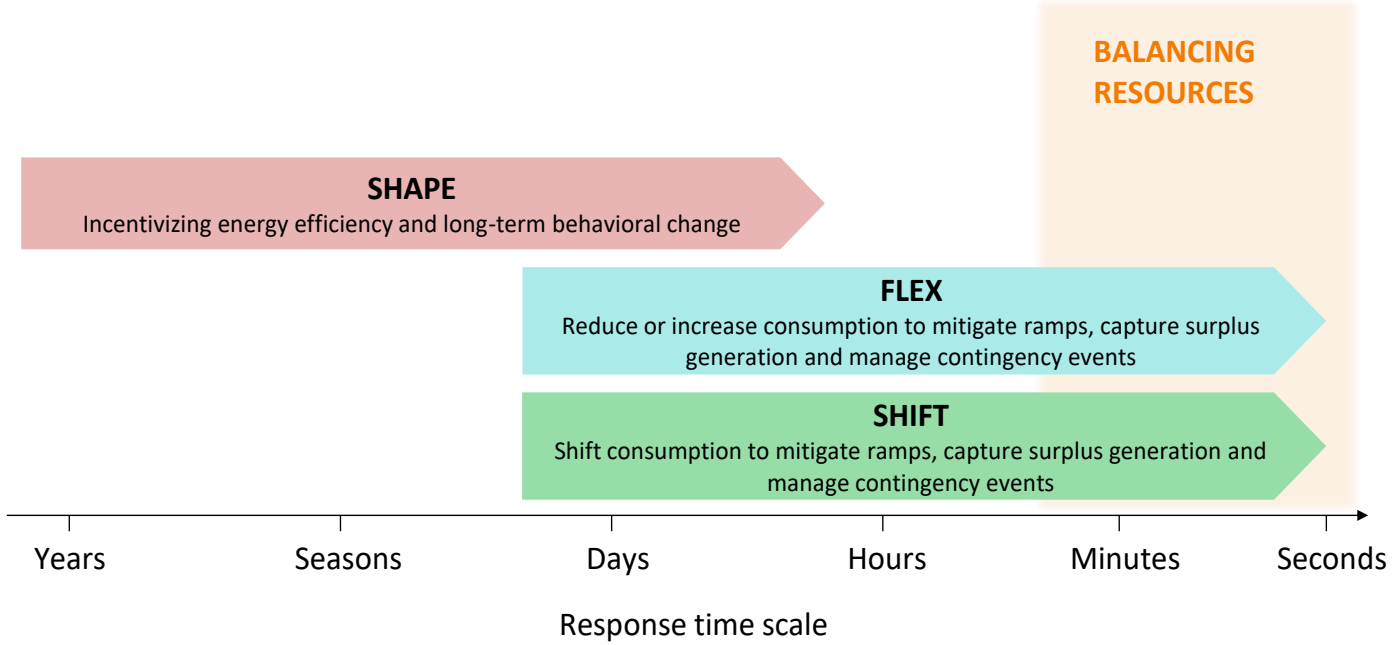
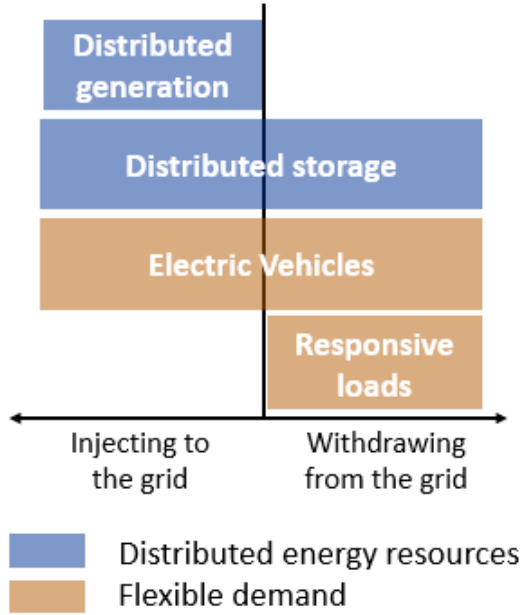


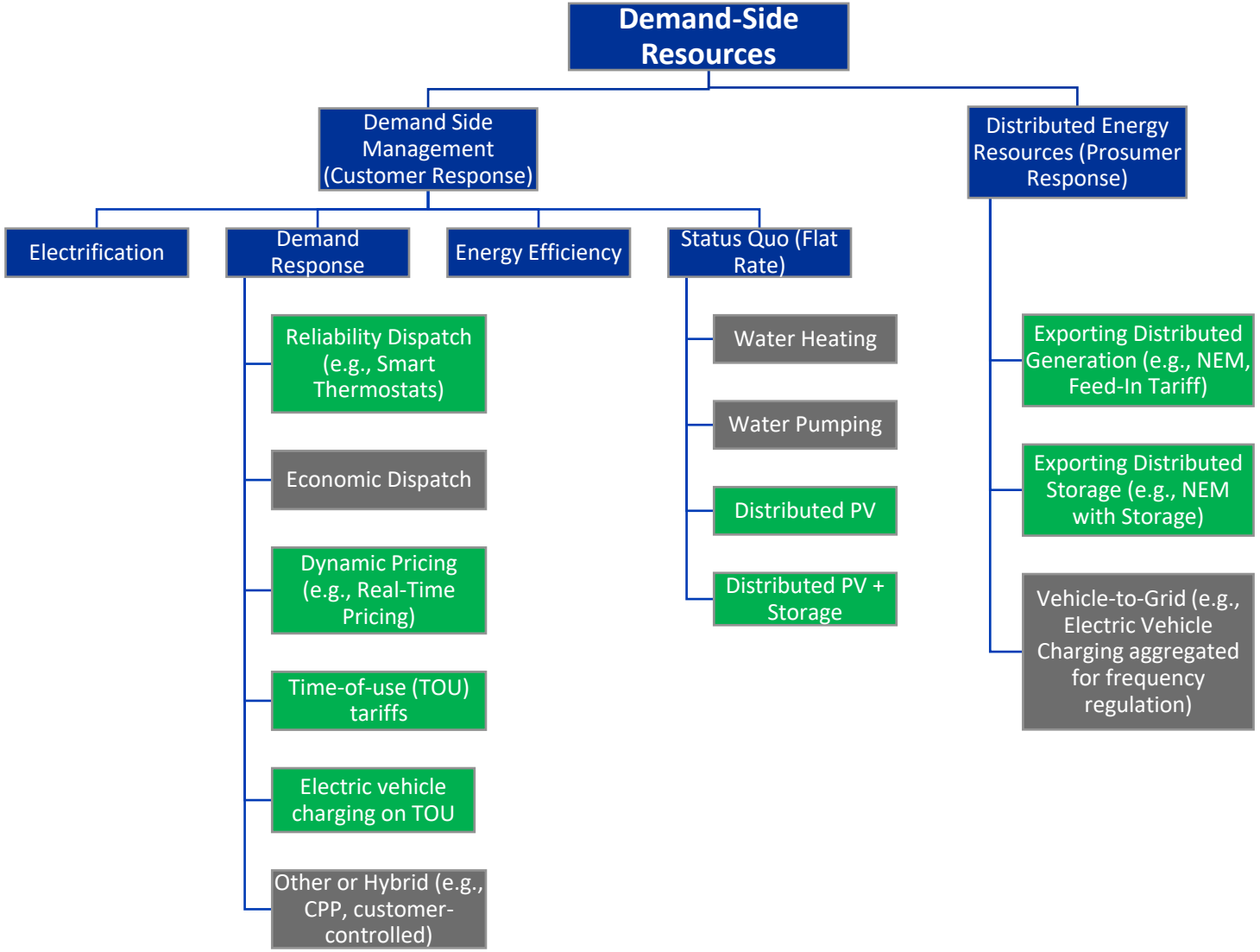
Timeline and categorization of demand-side response behavior (adapted from (Alston 2017))



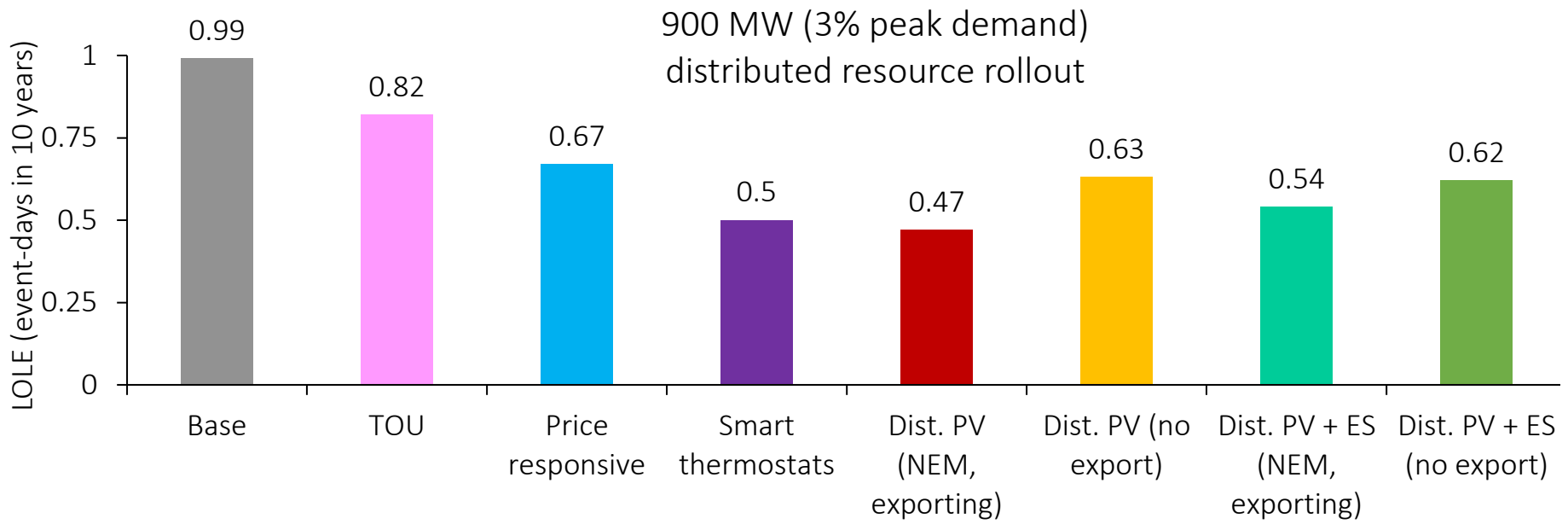
Demand-side resources: Classification based on end-use and potential to inject and withdraw from the grid (adapted from (EPRI 2009))

Demand-Side Resources (DSRs) include load, customer-located generation, and other customer-located technologies having the capability to provide demand-side flexibility

A Wide Range of End-use Technologies and Customer Programs May Impact Adequacy

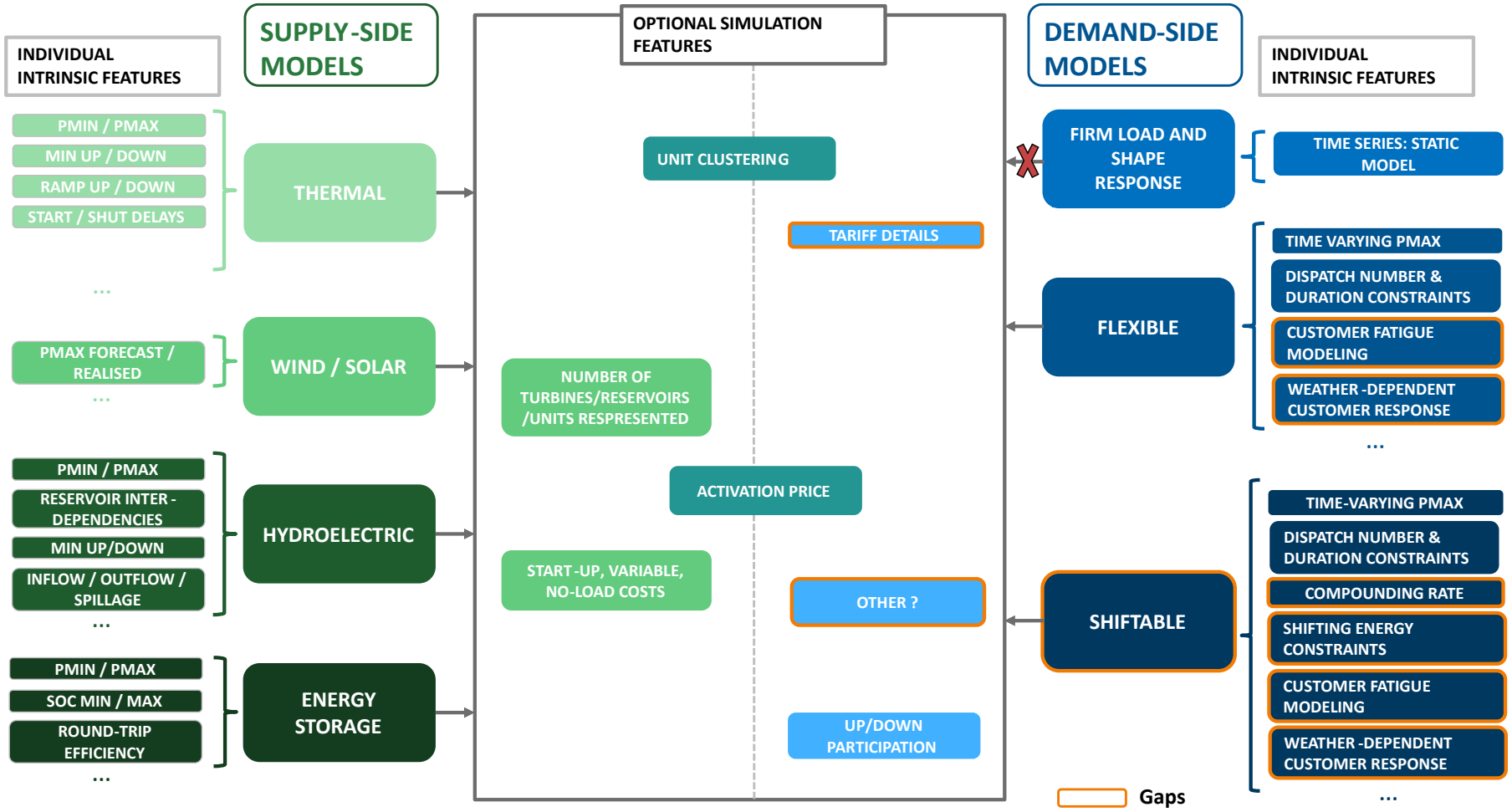


All Programs and Technologies Have Demonstrable Impact on Adequacy Assessment at Low and High Rollout Levels



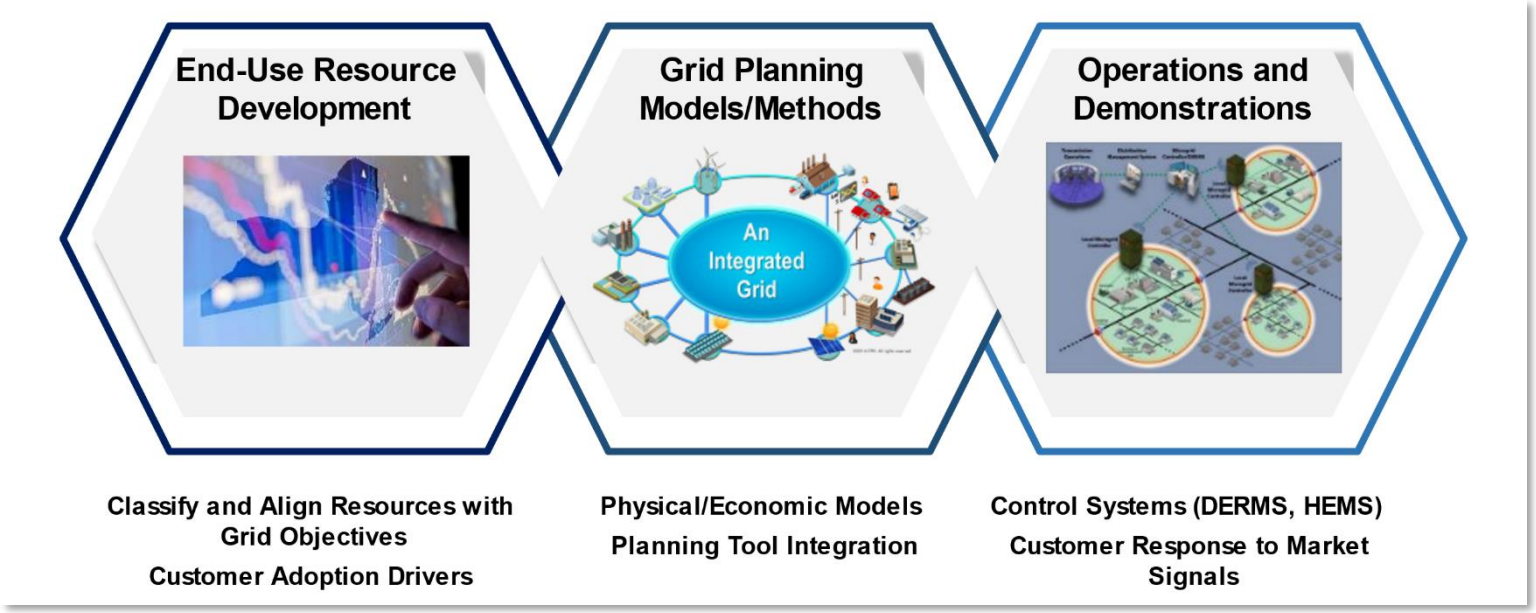
Significant reductions in Loss of Load Expectation obtained when accounting for all distributed resources considered

Need to Develop a Standardized Modeling Framework Capturing Demand-Side Resource Behavior In RA



Next Steps

How is the role/value of demand-side response affected by its participation in the provision of multiple services?

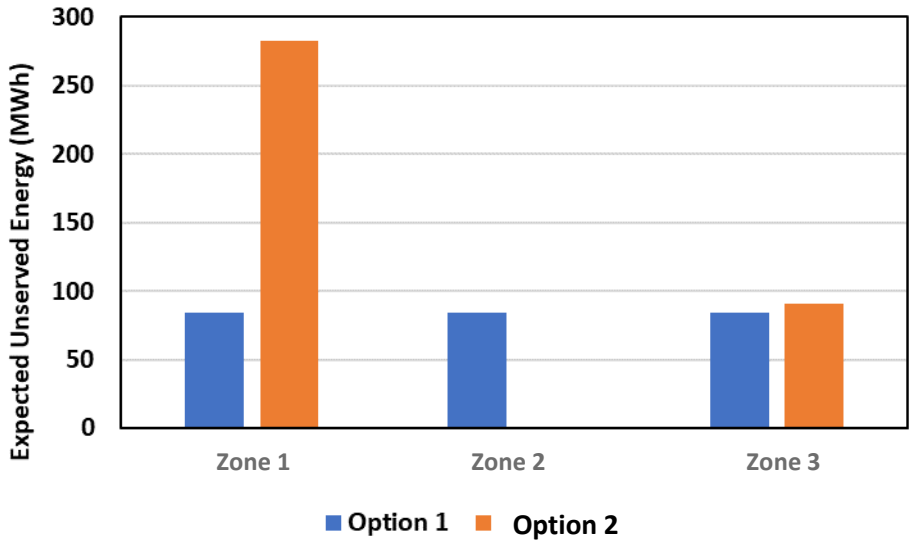


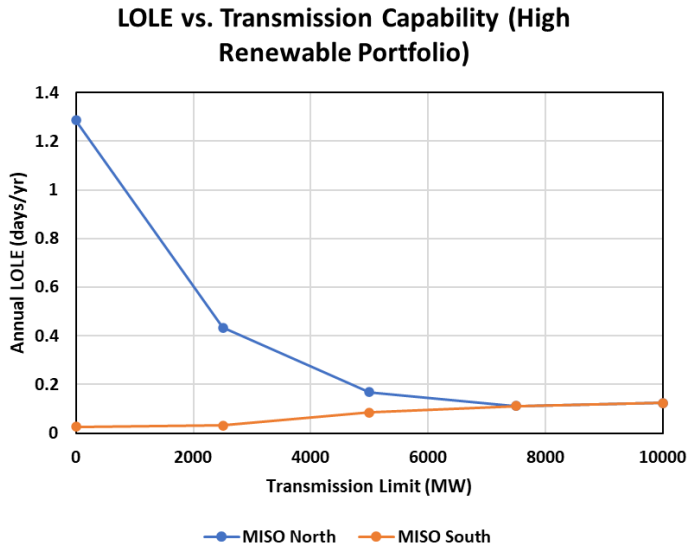
CAPACITY EXPANSION | **RESOURCE ADEQUACY** | **TRANSMISSION PLANNING** | **DISTRIBUTION PLANNING**

Transmission Constraints in RA

Different Ways of Thinking About Lost Load When Modelling Transmission Constraints in RA

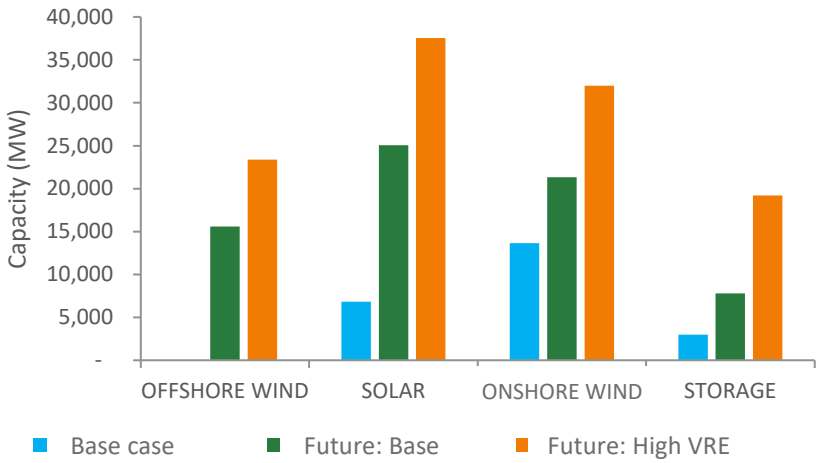
Option	Considerations
1. Equally shared across all co-dispatched regions	• EUE metrics will be shared across all regions in copper sheet case
2. Load shed allocated pro rata based on zonal load/resource balance prior to transfers	• Regions with highest deficit prior to external assistance receive highest EUE • Highlights regional areas of greatest need





There are different ways to think about lost load when modelling transmission constraints impacting RA results

Internal vs. External Transmission Constraints in RA



Sensitivity	scenario	REGION A	B	C	D	E	F
All transmission capacity x 1.5	Base	-	0.03	0.02	0.01	0.01	0.01
	Future: Base	-	0.03	0.02	-	-	-
	Future: Base	-	0.04	0.02	-	-	-
All transmission capacity x 2	Base	-	0.01	0.01	-	-	0.01
	Future: Base	-	0.01	-	-	-	-
	Future: Base	-	0.01	-	-	-	-
All transmission capacity x 999999	Base	-	-	0.01	-	-	0.01
	Future: Base	-	-	-	-	-	-
	Future: Base	-	-	-	-	-	-
External transmission capacity x 1.5	Base	0.01	0.10	0.05	0.06	0.02	0.07
	Future: Base	-	0.10	0.04	0.04	-	0.07
	Future: Base	-	0.10	0.06	0.03	-	0.07
External transmission capacity x 2	Base	-	0.10	0.03	0.04	0.01	0.05
	Future: Base	-	0.10	0.03	0.01	-	0.04
	Future: Base	-	0.10	0.05	0.01	-	0.05
External transmission capacity x 999999	Base	-	0.10	0.03	0.02	0.01	0.02
	Future: Base	-	0.10	0.02	-	-	-
	Future: Base	-	0.10	0.05	-	-	-
Internal transmission capacity x 1.5	Base	0.08	0.03	0.06	0.01	0.04	0.02
	Future: Base	0.07	0.04	0.08	-	0.05	-
	Future: Base	0.07	0.04	0.05	-	0.05	-
Internal transmission capacity x 2	Base	0.08	0.01	0.06	0.01	0.03	0.01
	Future: Base	0.07	0.01	0.08	-	0.05	-
	Future: Base	0.07	0.02	0.05	-	0.05	-
Internal transmission capacity x 999999	Base	0.08	-	0.06	-	0.03	0.01
	Future: Base	0.07	-	0.08	-	0.05	-
	Future: Base	0.07	-	0.05	-	0.05	-

Modelling both internal and external transmission constraints allows for more locally-targeted resource planning

Internal vs. External Transmission Constraints in RA

Increasing all transmission capacity by 1.5 enough to eliminate most of the system's risk.

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	Future: Base	-	0.10	0.04	0.04	-	0.07
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External transmission capacity x 2	Base	-	0.10	0.03	0.04	0.01	0.05
	Future: Base	-	0.10	0.03	0.01	-	0.04
	Future: Base	-	0.10	0.05	0.01	-	0.05
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	Future: Base	-	0.10	0.02	-	-	-
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Internal transmission capacity x 1.5	Base	0.08	0.03	0.06	0.01	0.04	0.02
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	Future: Base	0.07	0.04	0.05	-	0.05	-
Internal transmission capacity x 2	Base	0.08	0.01	0.06	0.01	0.03	0.01
	Future: Base	0.07	0.01	0.08	-	0.05	-
	Future: Base	0.07	0.02	0.05	-	0.05	-
Internal transmission capacity x 999999	Base	0.08	-	0.06	-	0.03	0.01
	Future: Base	0.07	-	0.08	-	0.05	-
	Future: Base	0.07	-	0.05	-	0.05	-

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Region B does not see any benefit from increasing imports.

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	Future: Base	-	0.01	-	-	-	-
All transmission capacity x 999999	Base	-	-	0.01	-	-	0.01
	Future: Base	-	-	-	-	-	-
	Future: Base	-	-	-	-	-	-
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Internal transmission capacity x 999999	Base	0.08	-	0.06	-	0.03	0.01
	Future: Base	0.07	-	0.08	-	0.05	-
	Future: Base	0.07	-	0.05	-	0.05	-

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Region A and C don't see much benefit from relieving internal constraints.

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	Future: Base	-	0.10	0.02	-	-	-
	Future: Base	-	0.10	0.05	-	-	-
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