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NREL

NATIONAL RENEWABLE ENERGY LABORATORY

**LA
DWP**

Los Angeles
Department of
Water & Power

OTC Study Update

June 7, 2018, 3PM
Benjamin J. Hwang, P.E.
Don Morrow, P.E.

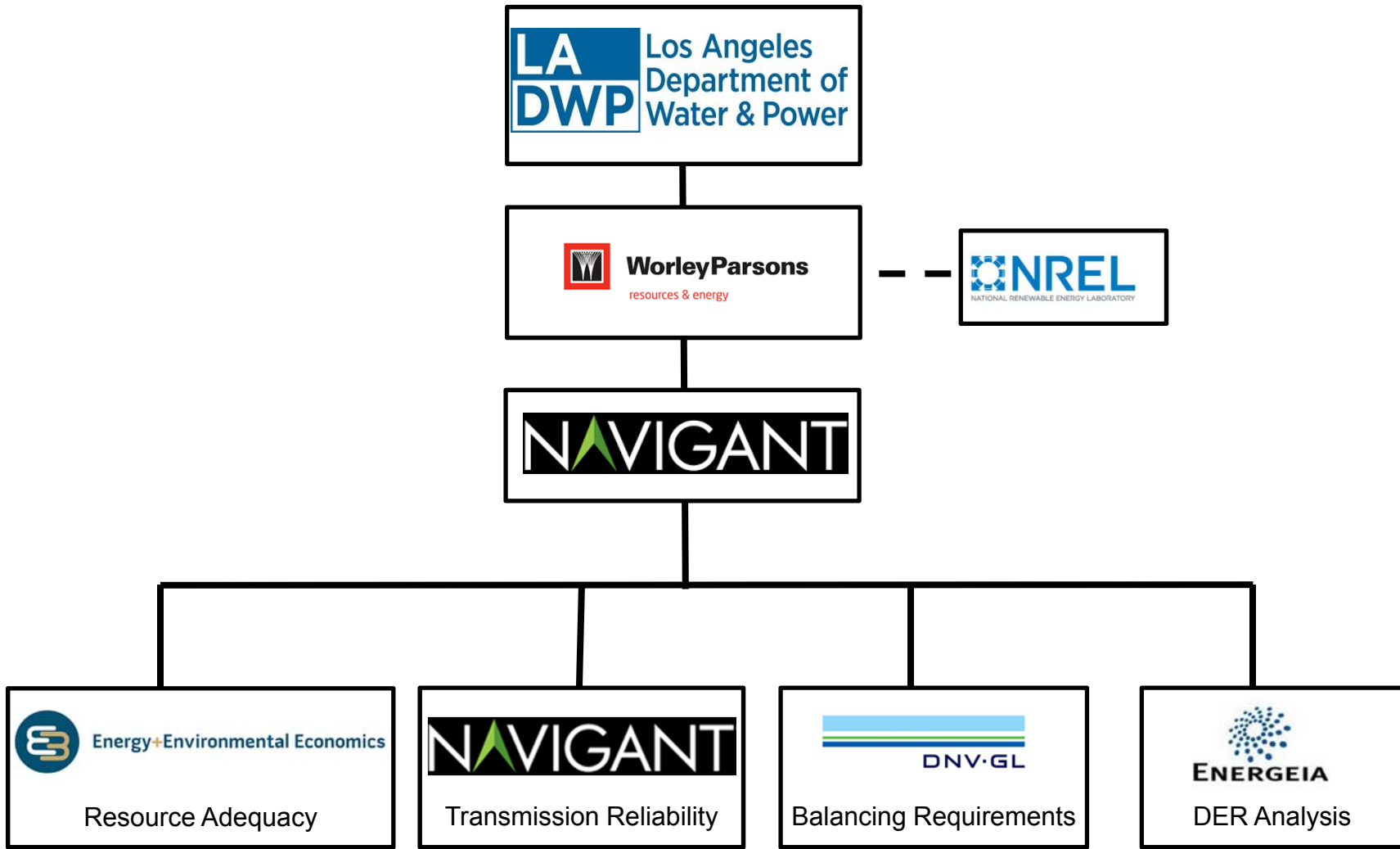
EcoNomics

Draft and Preliminary

Evaluate alternatives to LADWP's OTC repowering plan

- ▶ Third party, independent study
- ▶ Maintains system reliability through 2036
- ▶ Evaluates all non-emitting alternatives
- ▶ Requires proven technology
- ▶ Adopts and expands on 2016 IRP (excludes OTC repowering)
- ▶ Considers environmental constraints
- ▶ Evaluates the cost associated with various alternatives
- ▶ Provides an overall recommendation

OTC Consultants Organization Chart



Draft and Preliminary

Study Objective – Retirement Scenarios



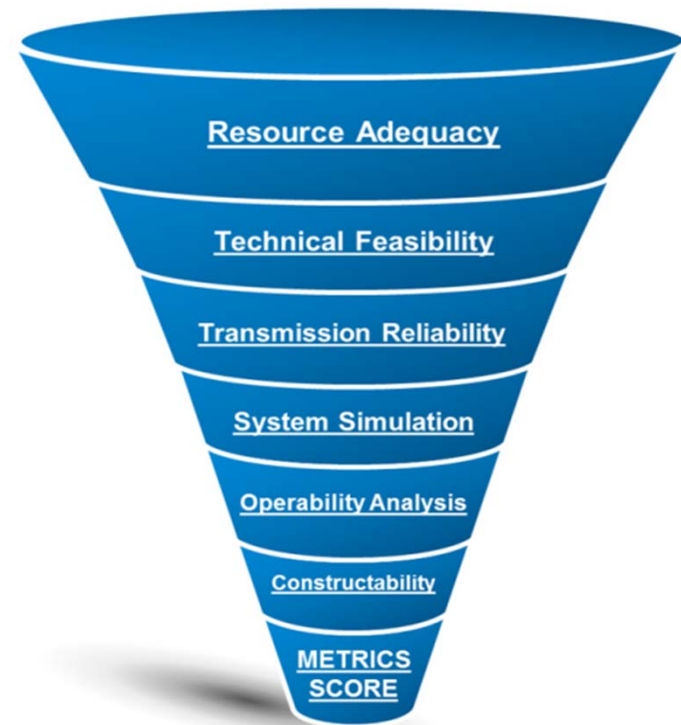
Existing OTC Capacity		
Unit	Nameplate Capacity (MW)	LADWP Compliance Date
Scattergood 1	163	12/31/2024
Scattergood 2	163	
Haynes 1	230	12/31/2029
Haynes 2	230	
Haynes 8, 9 & 10	630	12/31/2029
Harbor 1, 2 & 5	245	12/31/2029

Study Scenarios		
Scenario	OTC Units Retired	MW Retired (Nameplate)
A	None	0
B	All OTC Units	1,661
C	SCAT 1,2	326
D1	HAY 1,2,8,9,10	1,090
D2	HAY 8,9,10	630
D3	HAY 1,2	460
E	HAR 1,2,5	245
F	HAY 1,2,8,9,10 & HAR 1,2,5	1,335
G	SCAT 1,2 & HAY 1,2,8,9,10	1,416
H	SCAT 1,2 & HAR 1,2,5	571

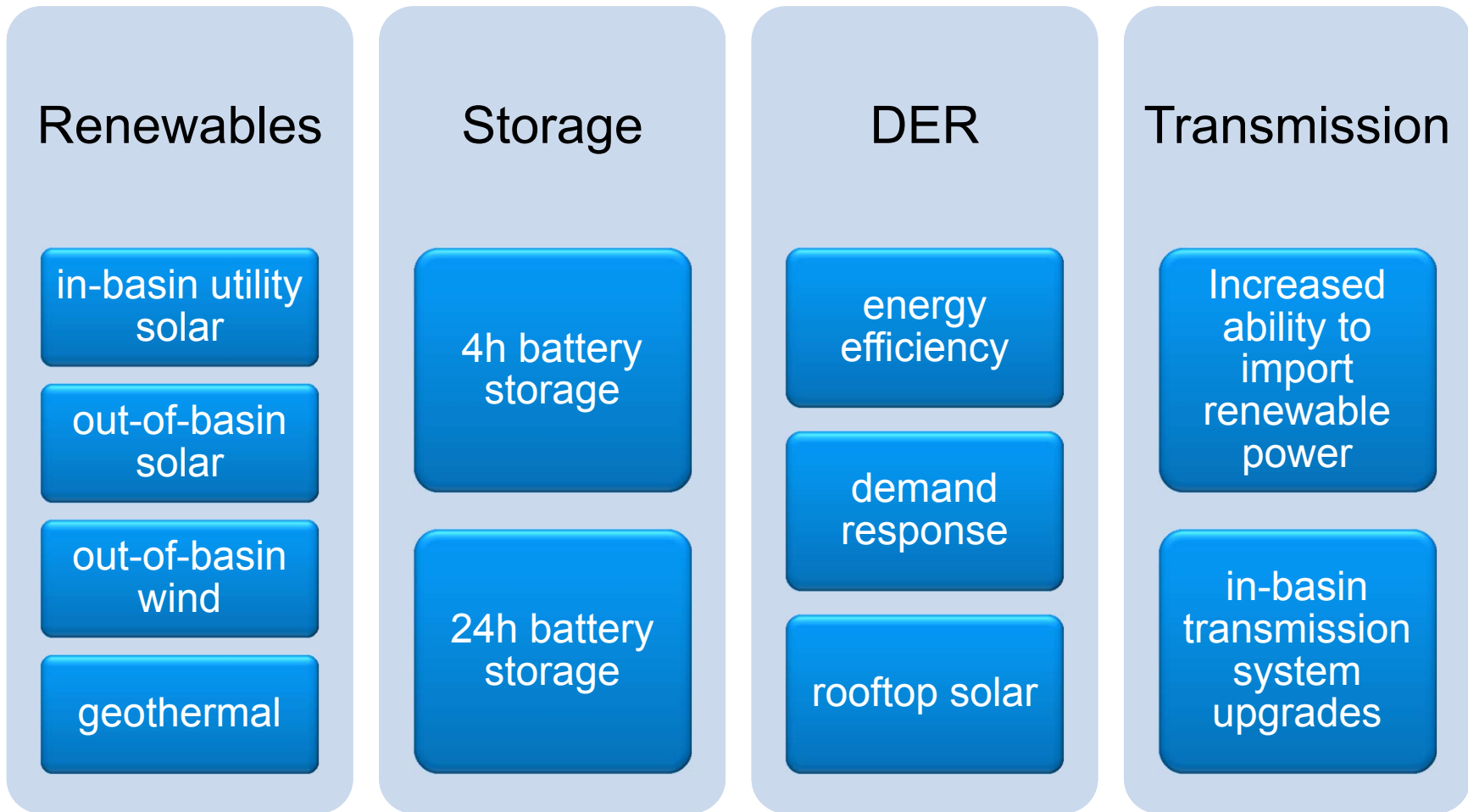
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Performs system reliability assessment of each OTC repowering alternative which includes:

- ▶ Resource adequacy analysis
- ▶ Technical feasibility evaluation
- ▶ Transmission system reliability analysis
- ▶ System economics estimate for each alternative
- ▶ Generation balancing and load following (duck curve performance)
- ▶ Constructability assessment



Alternatives Strategy



Other resources were considered but excluded due to technology maturity, construction timing, and GHG emissions

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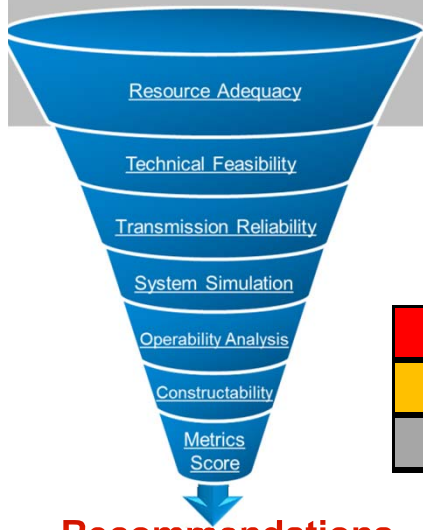
- ▶ Adopts and expands on 2016 IRP (excludes OTC repowering)
- ▶ Utilizes the 10-year transmission assessment plan as starting point
- ▶ Utilizes the following approved WECC base Cases
 - HS 2022, HS 2027
- ▶ Models approved projects
- ▶ Complies with NERC planning standards
- ▶ Satisfies WECC planning criteria
- ▶ Utilizes LADWP standard operating criteria
- ▶ Adopts LADWP's 2016 load forecast

Assumptions – Resource Adequacy



- ▶ Renewable profiles generated using NREL data and calibrated to LADWP resources.
- ▶ Weather model based on 40-year WECC history
- ▶ Storage dispatch allowed for reliability purposes
- ▶ Southern Transmission System - 1,200 MW
- ▶ Alternative resource adequacy to maintain the same level as the OTC repowering projects

Evaluation Process



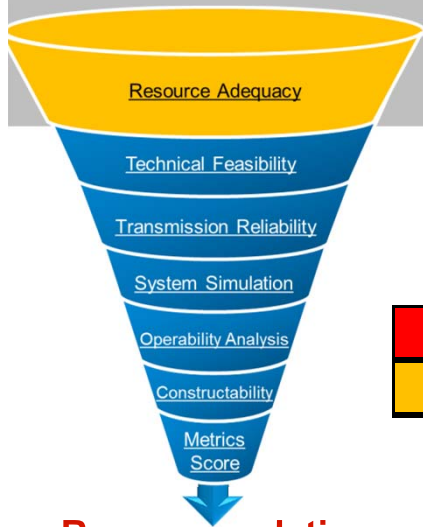
■ Does not pass the current evaluation criteria
■ Passes current evaluation criteria; continue to next stage
■ Did not pass previous evaluation criteria

Recommendations

OTC Units Retired →		None	All OTC Units	SCAT 1,2	HAY 1,2,8,9,10	HAY 8,9,10	HAY 1,2	HAR 1,2,5	HAY 1,2,8,9,10 & HAR 1,2,5	SCAT 1,2 & HAY 1,2,8,9,10	SCAT 1,2 & HAR 1,2,5
OTC Retired Nameplates (MW) →		0	1,661	326	1,090	630	460	245	1,335	1,416	571
Resource Options		A	B	C	D1	D2	D3	E	F	G	H
Solar, Wind	1	Calibrated Baseline according to 2016 IRP									
Solar, Wind, Geo			ii								
ES	2										
EE, DR	3										
Transmission (Tx)	4										
Solar, ES	5		i								
Solar, ES, EE, DR			ii								
Solar, ES (24 hr), EE, DR			iii								
ES, Tx	6		i								
Solar, Wind, ES, Tx			ii								
Geo, Tx			iii								
Solar, Wind, Geo, Tx			iv								
Solar, Wind, ES, Geo, Tx			v								
Solar, Wind, ES, Geo, EE, DR, Tx			vi								

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Resource Adequacy Evaluation



Does not pass resource adequacy evaluation

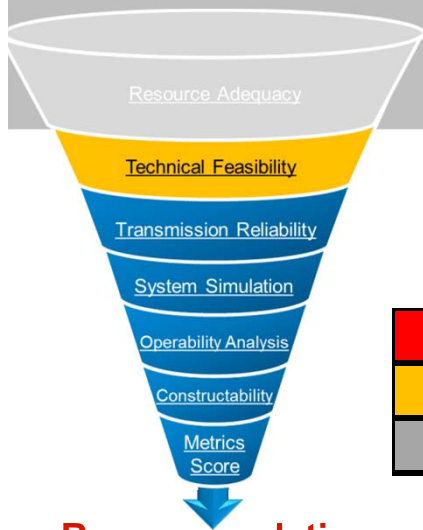
Passes resource adequacy evaluation; continue to the next stage

Recommendations

OTC Units Retired →			None	All OTC Units	SCAT 1,2	HAY 1,2,8,9,10	HAY 8,9,10	HAY 1,2	HAR 1,2,5	HAY 1,2,8,9,10 & HAR 1,2,5	SCAT 1,2 & HAY 1,2,8,9,10	SCAT 1,2 & HAR 1,2,5	
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Draft and Preliminary

Technical Feasibility Evaluation



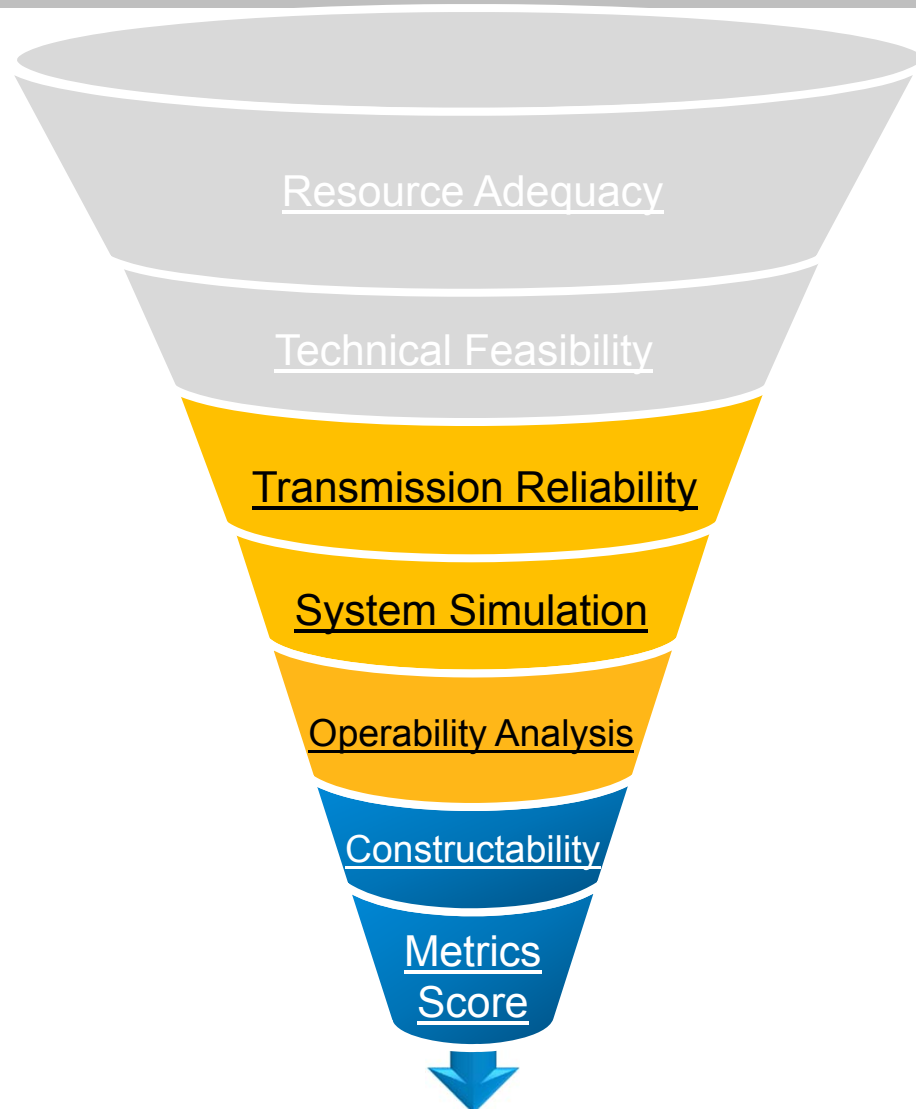
- Does not pass technical feasibility evaluation
- Passes technical feasibility evaluation; continue to next stage
- Did not pass previous evaluation criteria

Recommendations

OTC Units Retired →			None	All OTC Units	SCAT 1,2	HAY 1,2,8,9,10	HAY 8,9,10	HAY 1,2	HAR 1,2,5	HAY 1,2,8,9,10 & HAR 1,2,5	SCAT 1,2 & HAY 1,2,8,9,10	SCAT 1,2 & HAR 1,2,5
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Draft and Preliminary

Study Progress Summary



Ranking of Final Recommendations

Draft and Preliminary

Summary of Evaluations
126 total options evaluated
101 options maintain resource adequacy
76 options are technically feasible
12 options under detailed study
64 options for future study

Next Steps / Milestones



- ▶ June 2018: Preliminary results
- ▶ August 2018: Draft preliminary report
- ▶ Oct/Nov 2018: Outreach by LADWP
- ▶ Dec 2018: Final Report