

BIDIRECTIONAL EV WEBINAR

USE CASES FOR BI-DIRECTIONAL ELECTRIC VEHICLE CHARGING STATIONS

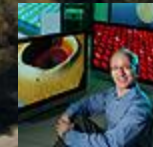


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Argonne National Laboratory
June 25, 2020

Argonne: The First U.S. National Laboratory

- Founded in 1943, made a national laboratory in 1946.
- 1500-acre site southwest of Chicago.
- 3,200+ employees.
- 7,900+ external facility users.
- \$890M operating budget.
- A broad, multidisciplinary R&D portfolio.

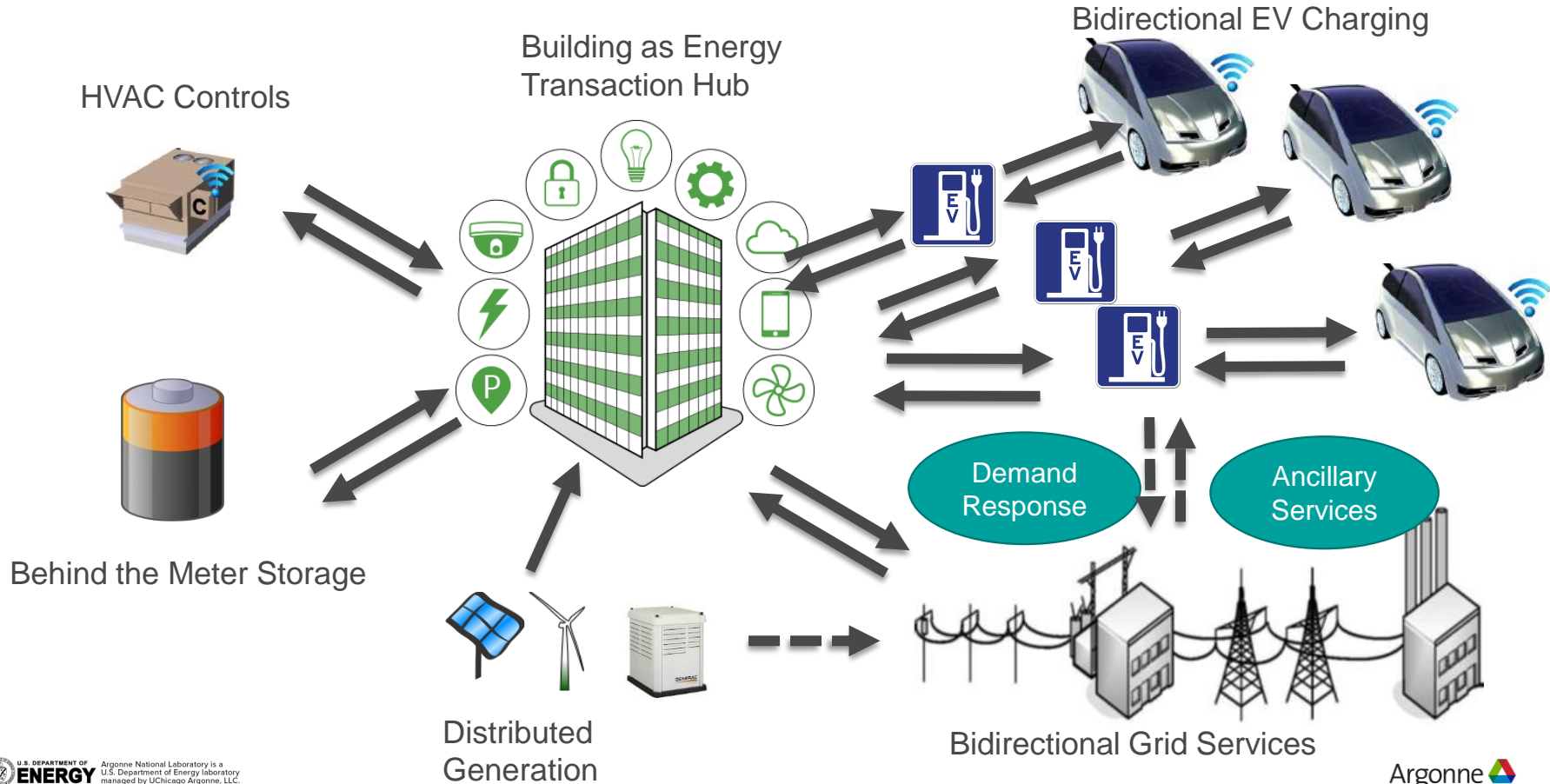


ARGONNE'S ENERGY STORAGE RESEARCH

From fundamental research to transportation/grid systems analysis



BIDIRECTIONAL TRANSACTIONS

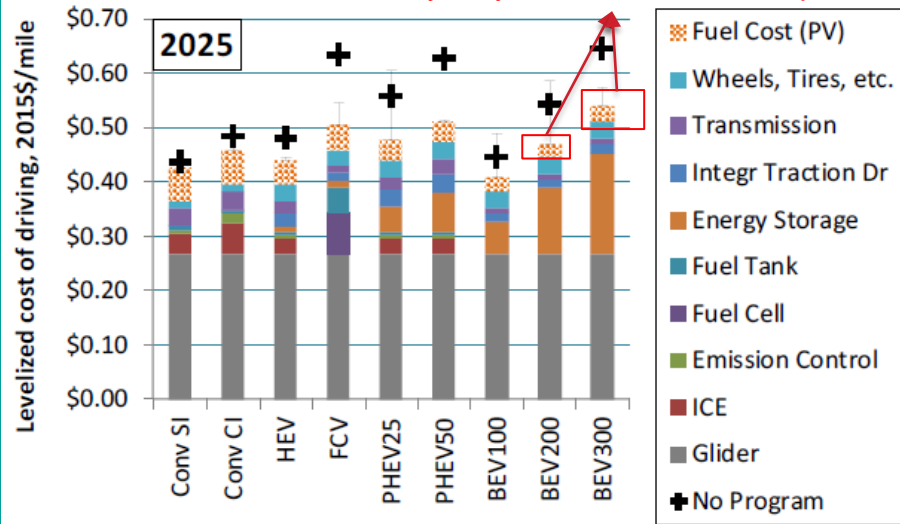


ELECTRICITY ONLY COUNTS 5-7% OF COST PER MILE FOR DRIVING

Different vehicle ownership or great incentive are needed to promote the adoption of Bi-directional EV

Modeling of costs at vehicle-level

Electricity only counts ~5% of cost per mile



Nationwide vehicle costs

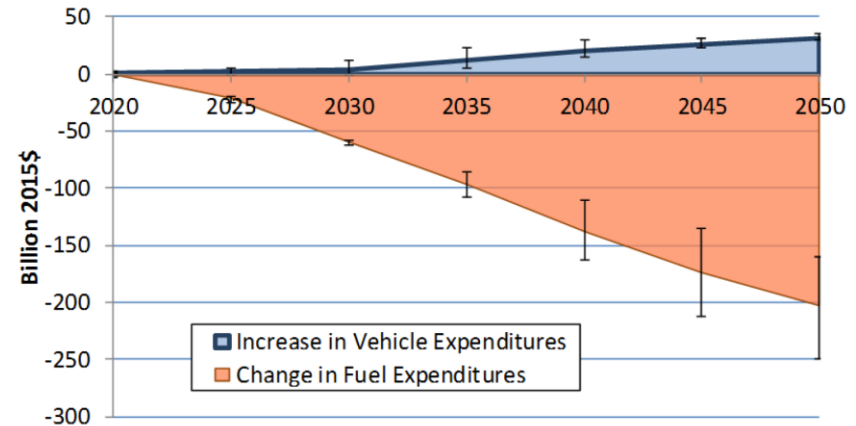
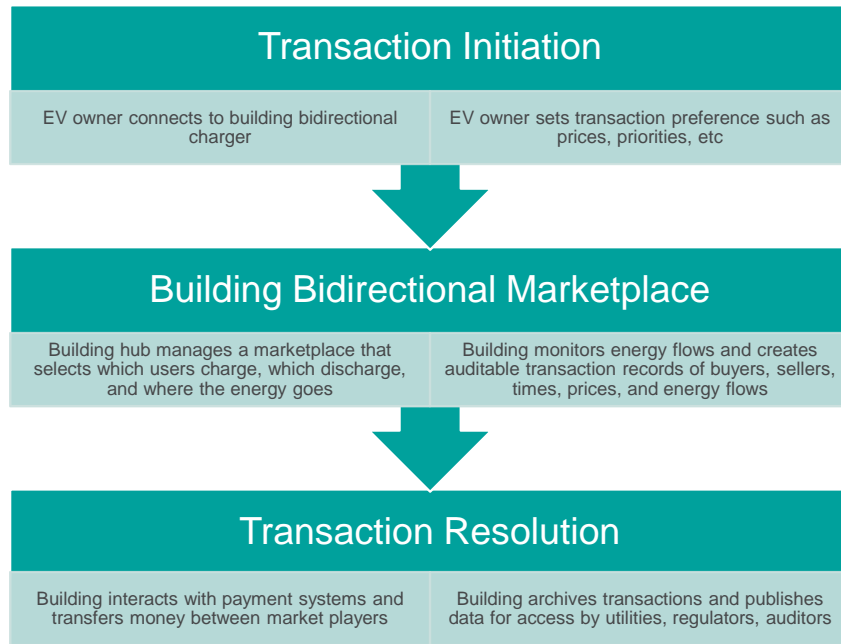
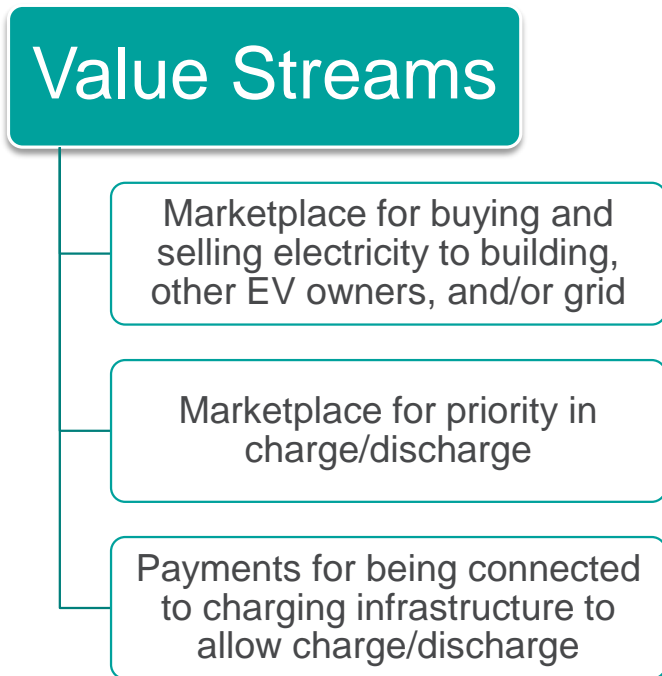


FIGURE ES-3 Difference in Annual National Consumer Costs of Vehicle Purchases and Fuel Costs for On-road Vehicles through 2050 for the No Program and Program Success Cases

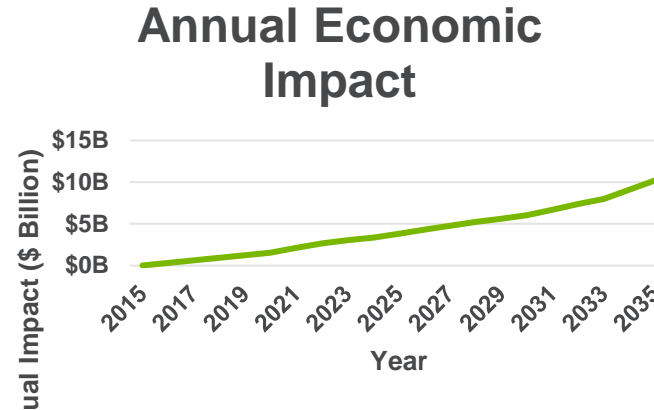
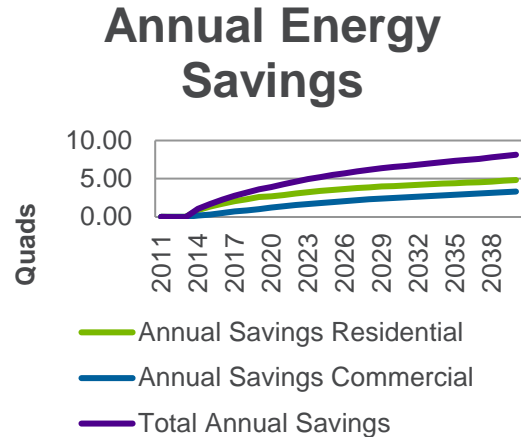
BIDIRECTIONAL EV CHARGING MANAGEMENT BY BUILDINGS

Building/Owners act as bidirectional energy brokers



ENERGY AND ECONOMIC IMPACTS OF BUILDING MANAGED TRANSACTIONS

From Argonne 2015 Report on Buildings as Bidirectional Transaction Hubs



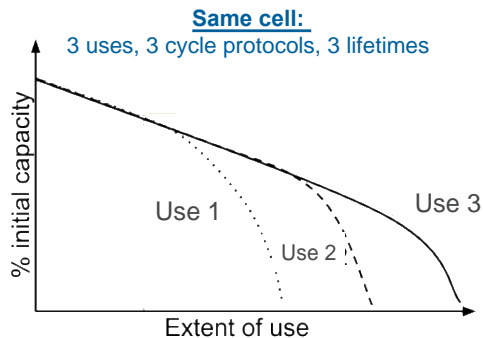
- Energy savings estimated from enabling High Adoption Scenarios in 2014 EIA Annual Energy Outlook
- Economic impact estimated from 50% of difference between mid and high penetration scenarios in the 2013 ACEEE “Intelligent Efficiency” report

AI: UNIQUE KEY TO COMPLEX DEPLOYMENT ECONOMICS

High quality economic algorithms need high quality input

1.

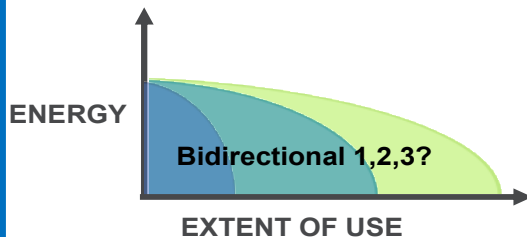
Battery capacity is a key variable in economic assessments; degrades with use in a complex manner



2.

Degradation evaluations are resource & time intensive, ~2 years for EV to 80%

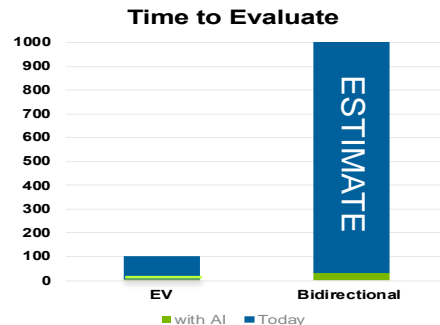
Bidirectional: more complex & resource intensive



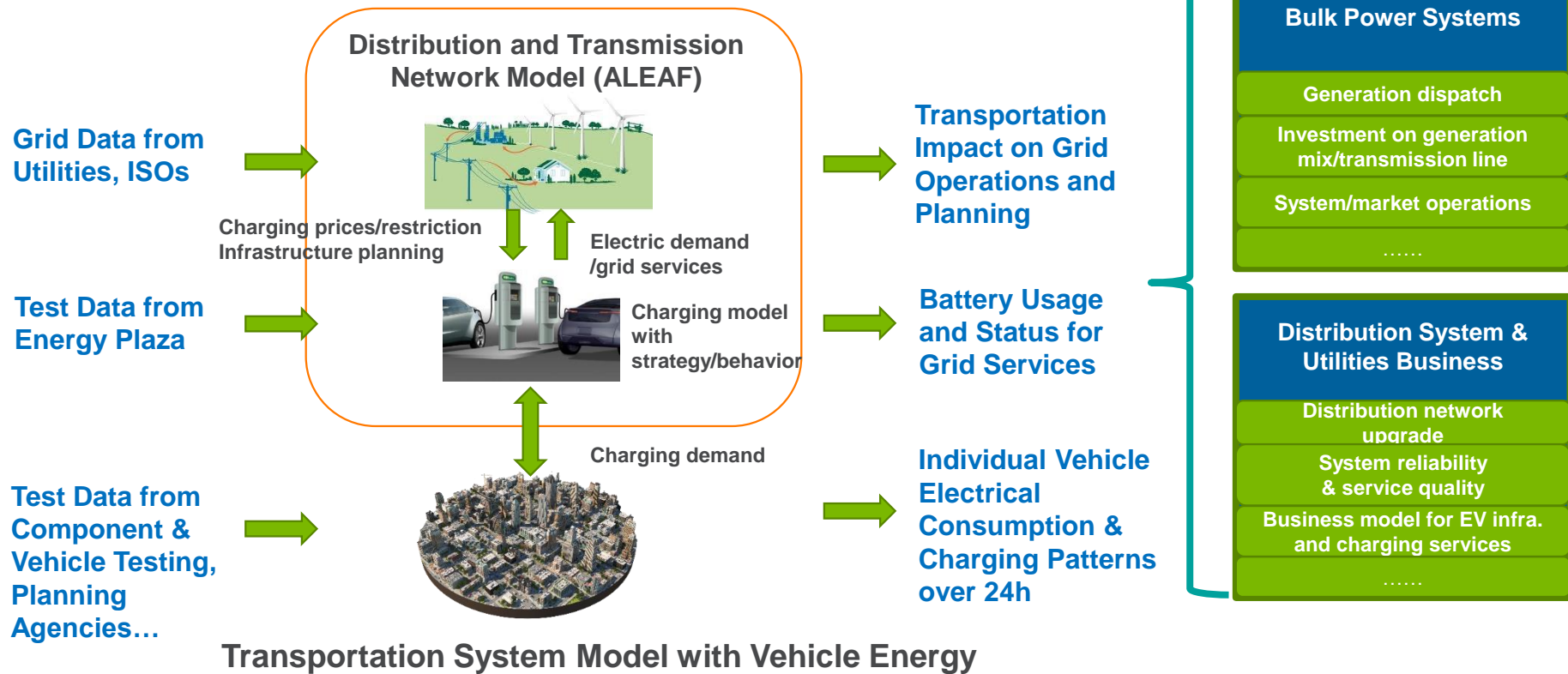
3.

AI will significantly decrease evaluation times, can address bidirectional complexity

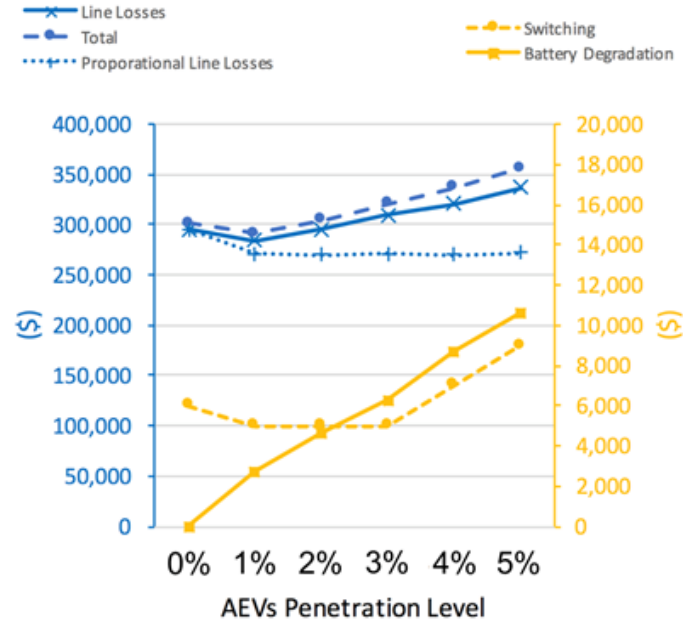
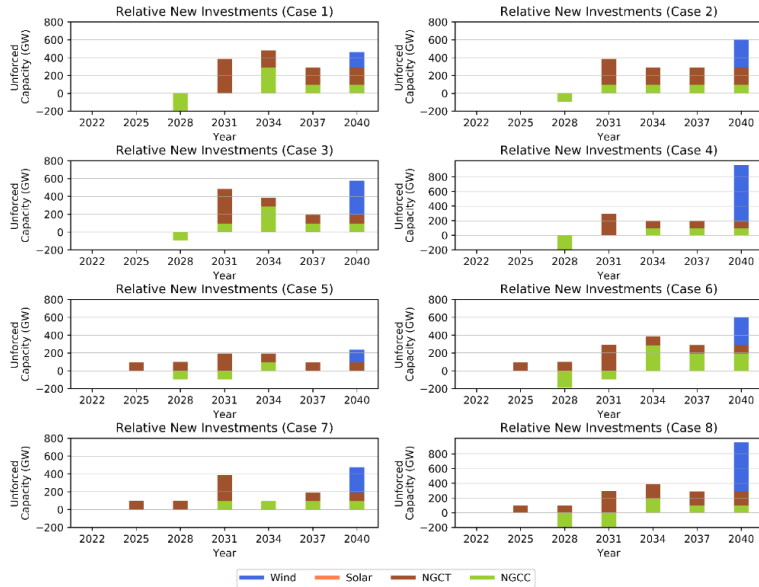
Target: ~30X reduction



MOBILITY REVOLUTION HAS SIGNIFICANT IMPACT ON GRID



IMPACT ON TRANSMISSION AND DISTRIBUTION GRID



Guo, et. al. "Impacts of Integrating Topology Reconfiguration and Vehicle-to-Grid Technologies on Distribution System Operation." *IEEE Transactions on Sustainable Energy* 11, no. 2 (2019): 1023-1032.

Transmission System:

- Increases in PEV charging demand may lead additional investments in conventional units
- High penetration of PEV requires the system to have additional ramping capability

Distribution System:

- Grid impact (e.g. Line losses and switching frequency) may be nonlinear with EVs penetration level
- A low level of EVs is the most beneficial, which indicate an upgrade need to improve grid efficiency

THANK YOU!

WE START WITH YES.

AND END WITH THANK YOU.



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CONNECTING ARGONNE'S STRONG CAPABILITIES

