

# PG&E VGI Valuation Method

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Together, Building  
a Better California



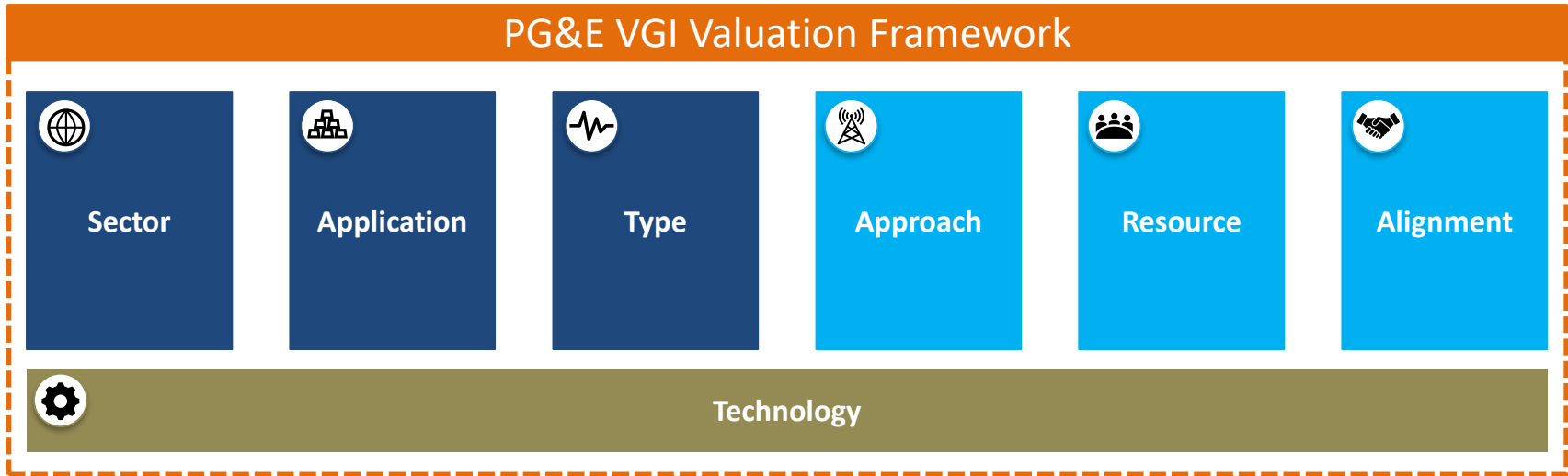
## List of criteria to define *success*:

- **Includes** every known VGI use-case today
- **Aligns** with other VGI and DER initiatives and policy efforts
- **Quantify** value, both benefits and costs
- **Leverages** available information and modeling efforts



# VGI Valuation Framework: Seven Dimensions

## PG&E VGI Valuation Framework



EV loadshapes: Residential, Commercial, Rideshare



Reliability and non-reliability services, for: **customers**, **T&D grids**, and **wholesale/RA**



Power flow between the EV and the grid: **V1G** and **V2G**



**Hardware & software:** including EV class, charging type, and communication standards/protocols



Control mechanisms: **direct** (active) or **indirect** (passive, mostly rates)



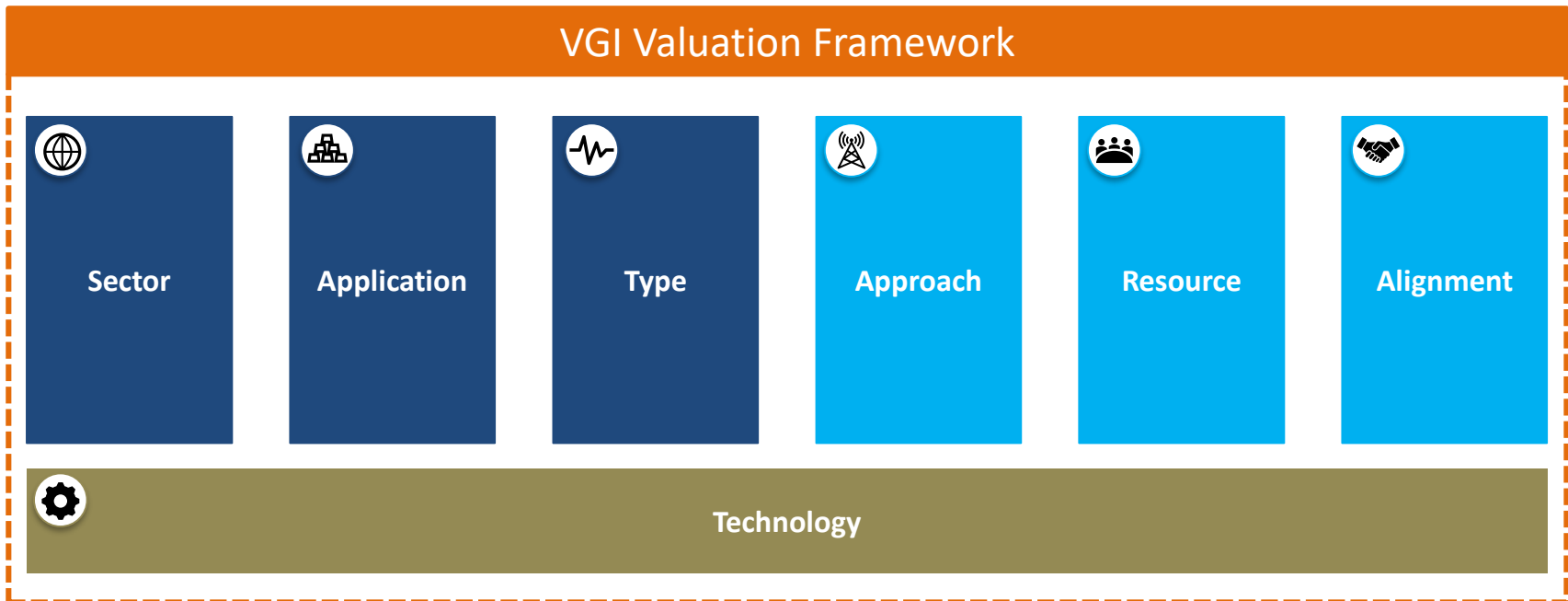
EV-EVSE ownership/operation: **unified** by the same actor, or **fragmented** among different actors



**Alignment:** in actions and incentives among the EV-actor and EVSE-actor



# VGI Valuation Framework captures both value creation and value enablement



- Values (i.e. benefits and costs) along these VGI dimensions are additive

- Values are not additive. Each dimension can be perceived as an enabler
- If not fully unlocked, it can be inefficiency that prevents realizing the full value of VGI: increase costs, reduce benefits, or both



# During the VGI Working Group...

## Examples of WG Stakeholder Discussions

- *Do the seven dimensions provided herein reflect key contours of today's VGI landscape?*



# VGI Valuation Framework results in an inclusive VGI Use-Case Matrix

VGI Use-Case Matrix elements	Value Creation			Value Enablement		
	Sector	Application	Type	Approach	Resource	Alignment
	Residential_SF	Customer_bill_mgmt	V1G	Rate	Unified	Aligned
	Residential_MUD	Customer_upgrade_deferral	V2G	Direct	Fragmented	Not Aligned
	Commercial_Workplace	Customer_backup_resiliency				
	Commercial_Public	Customer_renewables				
	Commercial_Fleet_truck	Grid_upgrade_deferral				
	Commercial_Fleet_bus	Grid_backup_resiliency				
	Rideshare_Res_SF	Grid_voltage_support				
	Rideshare_Res_MUD	WS_Energy				
Rideshare_Comm_Public	WS_frequency_regulation					
Rideshare_Comm_Fleet	WS_spin					
...	WS_non-spin					
	WS_flex_ramping					
	WS_overgeneration					
	RA_system_capacity					
	RA_flex_capacity					
	RA_local_capacity					

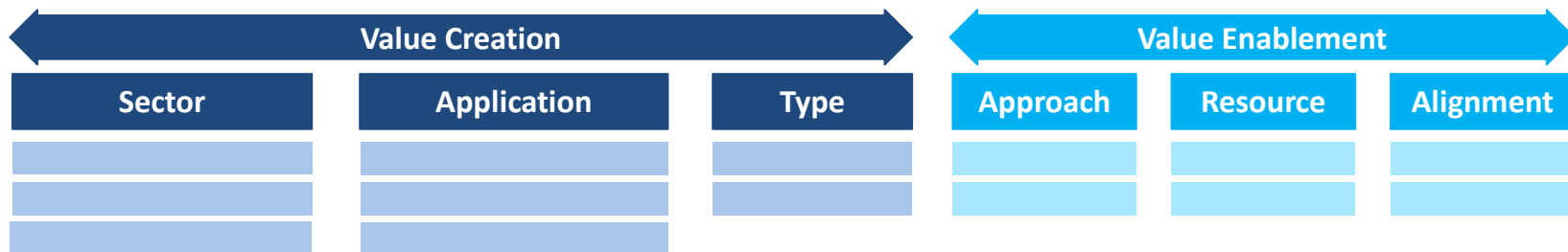
**Example use-cases: ChargeForward Pilot collaboration between BMW and PG&E**



Residential_SF	WS_Capacity	V1G	Direct	Unified	Aligned
Residential_SF	WS_Overgeneration	V1G	Direct	Unified	Aligned
Comm_Workplace	WS_Overgeneration	V1G	Direct	Fragmented	Not aligned



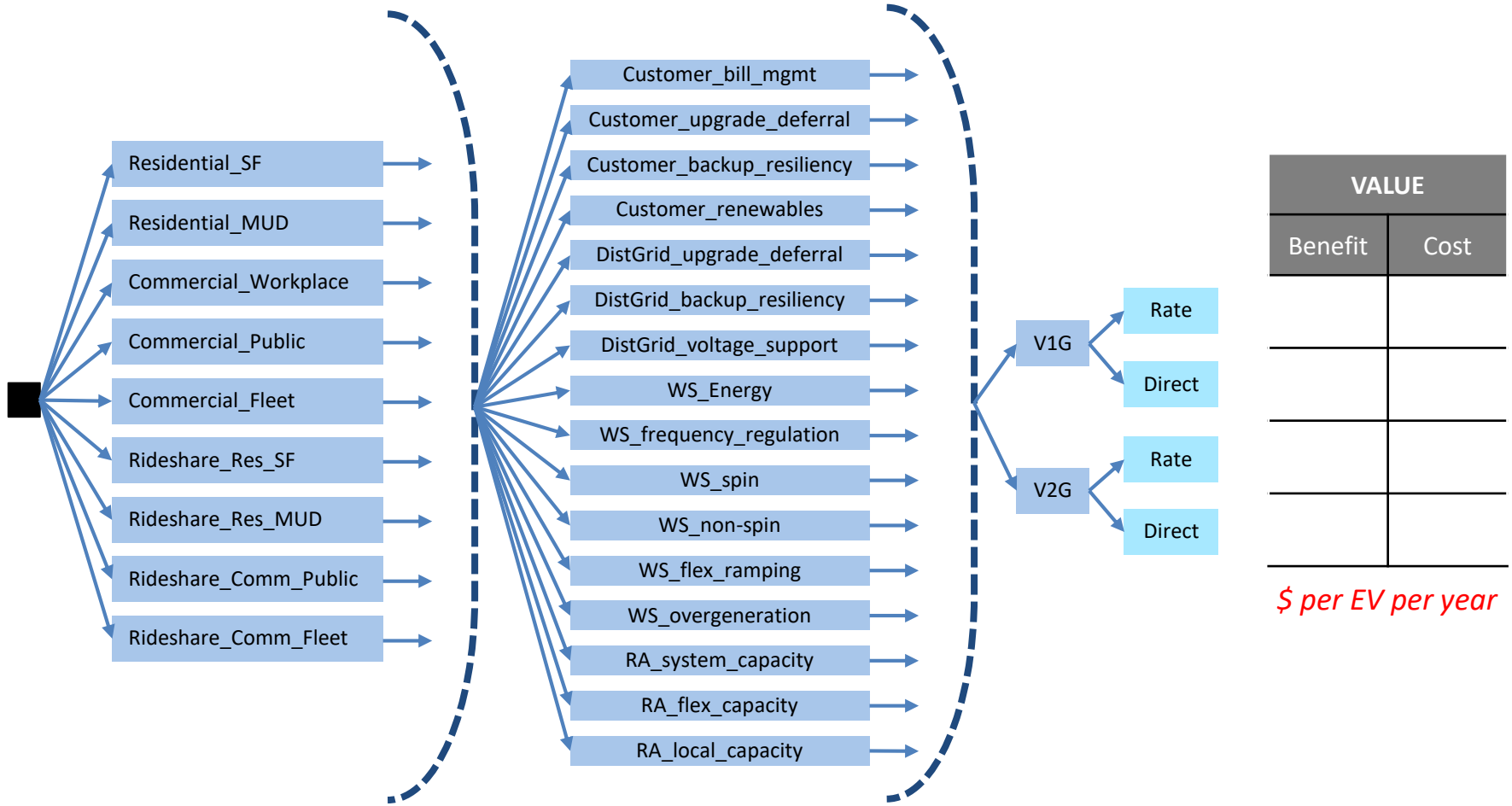
# VGI Use-Case Matrix facilitates policy alignment, modeling & analysis, and value quantification



Policy Alignment	<ul style="list-style-type: none"> <li>Aligns with <b>EV infrastructure &amp; resource planning</b></li> <li>Example: <b>TE OIR</b></li> </ul>	<ul style="list-style-type: none"> <li>Aligns with other <b>DERs</b></li> <li>Example: <b>MUA, IDER</b></li> </ul>	<ul style="list-style-type: none"> <li>Accounts for <b>unique VGI aspects</b></li> <li>Aligns with <b>Rule 21</b></li> </ul>	<ul style="list-style-type: none"> <li>Aligns with other <b>DERs</b></li> </ul>	<ul style="list-style-type: none"> <li>Accounts for <b>unique VGI aspects</b></li> </ul>	<ul style="list-style-type: none"> <li>Accounts for <b>unique VGI aspects</b></li> </ul>
Modeling & Analysis	<ul style="list-style-type: none"> <li>Private &amp; public <b>EV forecasts, load shapes</b></li> <li>Example: <b>AB 2127</b></li> </ul>	<ul style="list-style-type: none"> <li>Private &amp; public: <b>wholesale &amp; RA market price forecasts</b>; grid and customer <b>service forecasts</b></li> </ul>	<ul style="list-style-type: none"> <li>Private &amp; public <b>optimization assumptions</b></li> <li>Example: <b>EPIC reports</b></li> </ul>	<ul style="list-style-type: none"> <li>Rates &amp; DR programs</li> <li>Example: <b>Current DR pilots</b></li> </ul>	<ul style="list-style-type: none"> <li>Publicly &amp; privately funded pilots: implementation and operational experience</li> </ul>	
Value Quantification	<b>VGI supply</b>	<b>VGI demand</b>	<b>VGI constraints</b>			



# VGI Use-Case Matrix transforms into a tree of use-cases, each with distinct benefits & costs



**600+** hypothetical VGI use-cases

VALUE	
Benefit	Cost

*\$ per EV per year*





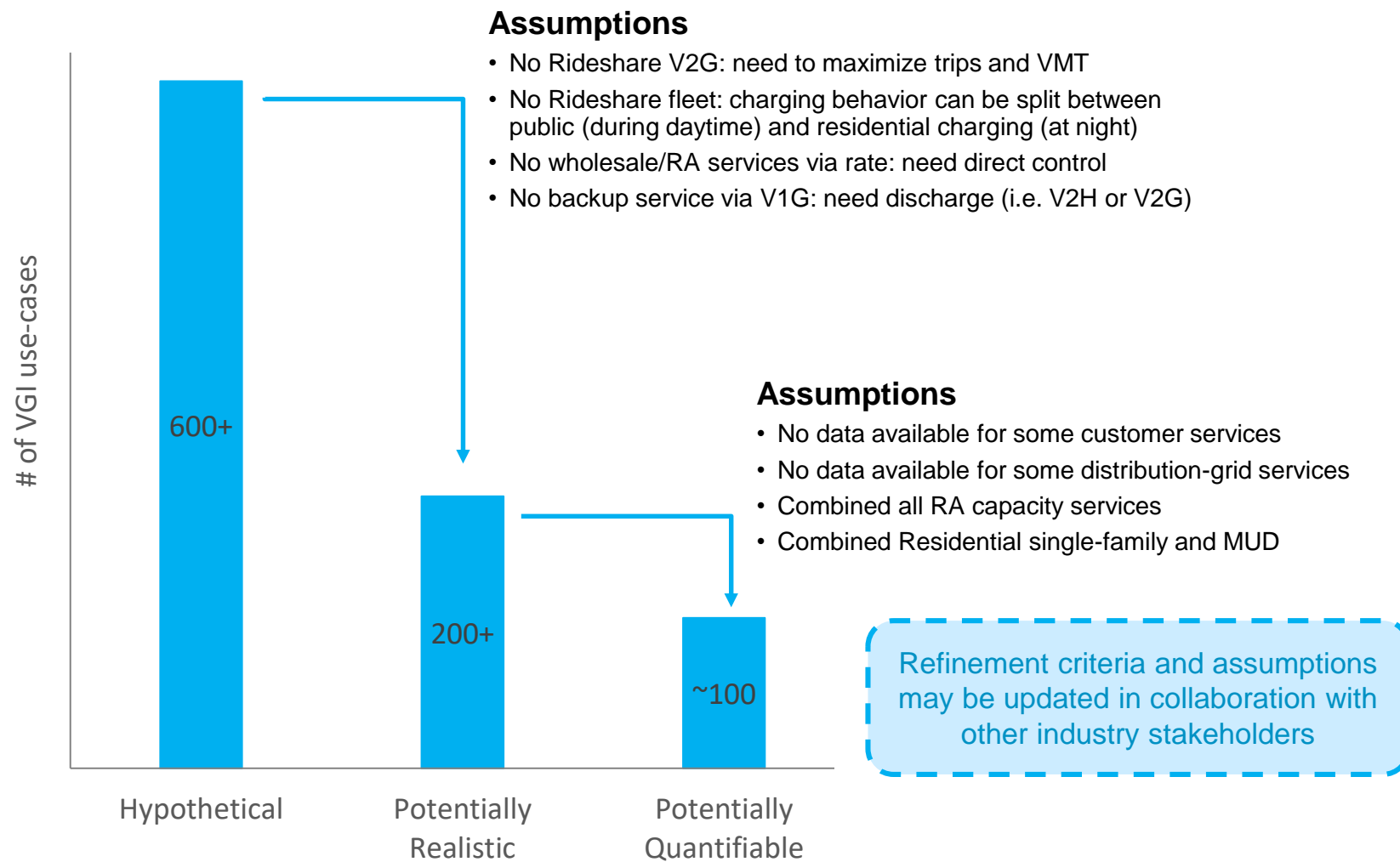
# During the VGI Working Group...

## Examples of WG Stakeholder Discussions

- *Are the most likely Sectors, Applications, and Approaches of VGI properly accounted for in the outlined Elements under each Dimension?*
- *Should the list of elements be “locked down” to allow for efficiency in implementing subsequent steps?*
- *Considering simple use-cases relative to other simple use-cases may be more practical than comparing advanced use cases. How should this relative simplicity be take into account?*



# VGI use-cases are refined based on technical & market assumptions, and data availability





# During the VGI Working Group...

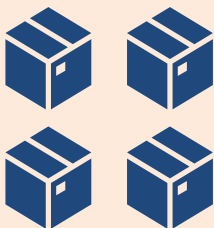
## Examples of WG Stakeholder Discussions

- *Which screens are objective and non-controversial? Which screens are subjective?*
- *What standards or guidelines could be used to design, interpret, and/or implement such screens?*
- *Could any of the screens be changed through policy amendments? If so, identify them for further consideration in step 6.*



# Quantifying use-case value: Individual “building-blocks”, and advanced “stacking”

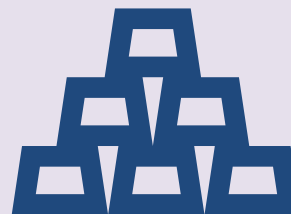
## Phase 1: Building-block use-cases



- 1 sector loadshape
- 1 service / application
- V1G or V2G
- Active or passive control



## Phase 2: Advanced use-cases



- Combined sectors' loadshapes
- Combined services / applications
- Market saturation
- System infrastructure



- Quantify benefits and costs
- Prioritize attractive use-cases
- Identify data and modeling gaps



# Quantifying benefits and costs require different types of data inputs and computation methods

Use-case	Reference	Benefits Optimization		Benefits	Costs	
		Input	Output			
Use-case 1	Reference charging	EV Plug-in time	Mobility Constraints	Optimized charging	= Optimized charging – Reference charging	= CAPEX + OPEX
		Price Signal	Battery Constraints			
Use-case 2	Reference charging	EV Plug-in time	Mobility Constraints	Optimized charging	= Optimized charging – Reference charging	= CAPEX + OPEX
		Price Signal	Battery Constraints			
Use-case 3	Reference charging	EV Plug-in time	Mobility Constraints	Optimized charging	= Optimized charging – Reference charging	= CAPEX + OPEX
		Price Signal	Battery Constraints			
Use-case 4	Reference charging	EV Plug-in time	Mobility Constraints	Optimized charging	= Optimized charging – Reference charging	= CAPEX + OPEX
		Price Signal	Battery Constraints			

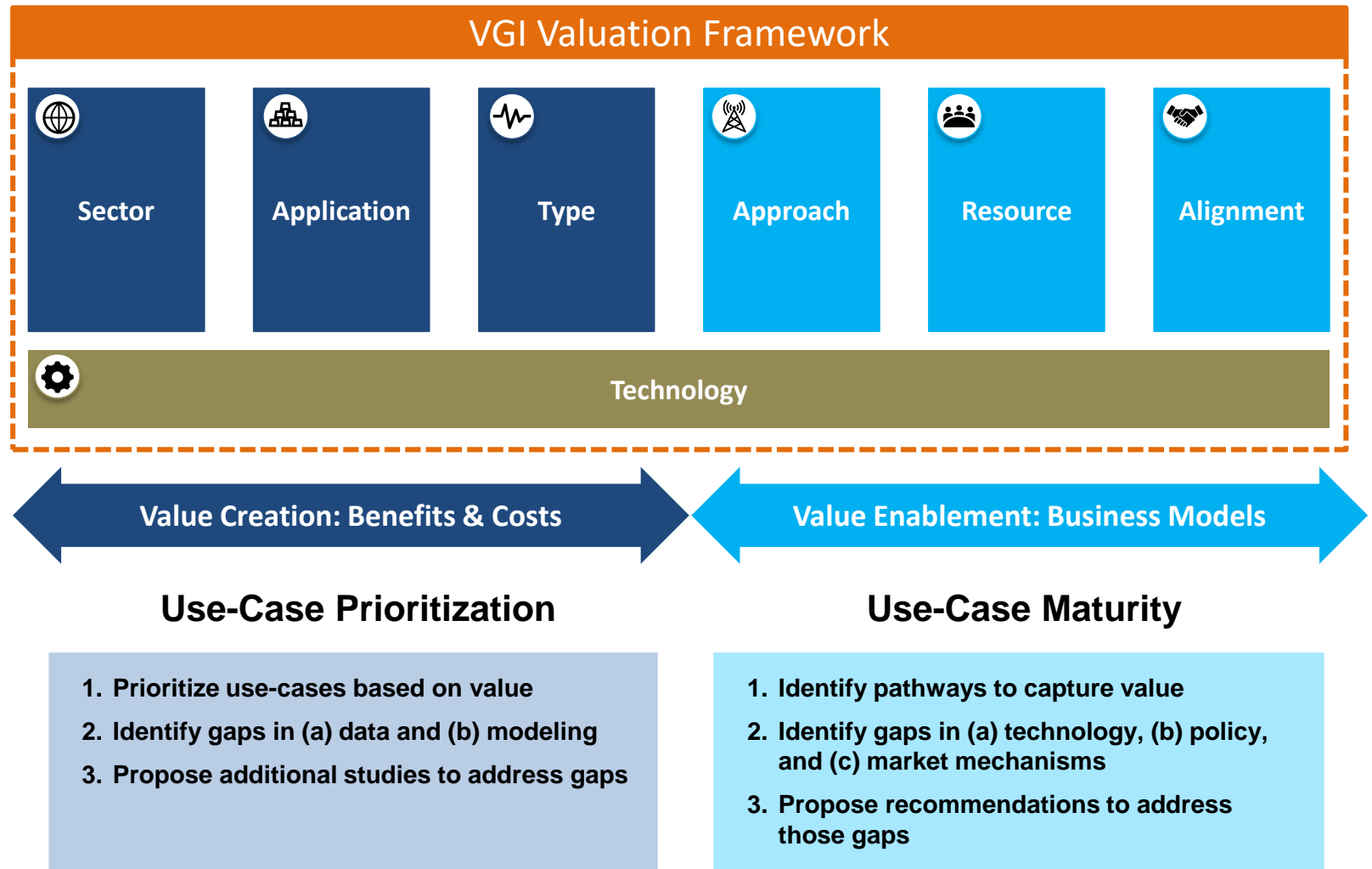


# During the VGI Working Group...

## Examples of WG Stakeholder Discussions

- *What valuation metric(s) should be used to assess benefits? costs?*
- *Have all potential benefits and/or costs of a use-case been identified and assessed?*
- *What publicly available sources of benefit and cost values, including existing tools and/or datasets, can be leveraged for this step?*

# Understanding value helps inform efforts and policies to prioritize and enable VGI use-cases





# During the VGI Working Group...

## Examples of WG Stakeholder Discussions

- *What metrics may be considered to rank or prioritize use-cases?*
- *Are there factors impacting the timing and practicality of implementing a use-case that should be considered?*
- *Should there be a “cut off” value by which higher value use-cases move forward and get prioritized? If so, what should that cut off be?*





# During the VGI Working Group...

## Examples of WG Stakeholder Discussions

- *What potential policy, market, or technology screens in Step 3 warrant a recommendation to policy makers, market participants, or technology providers in Step 6?*
- *What policy or market changes which impact the value of a use-case warrant a recommendation?*

# Thank you

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