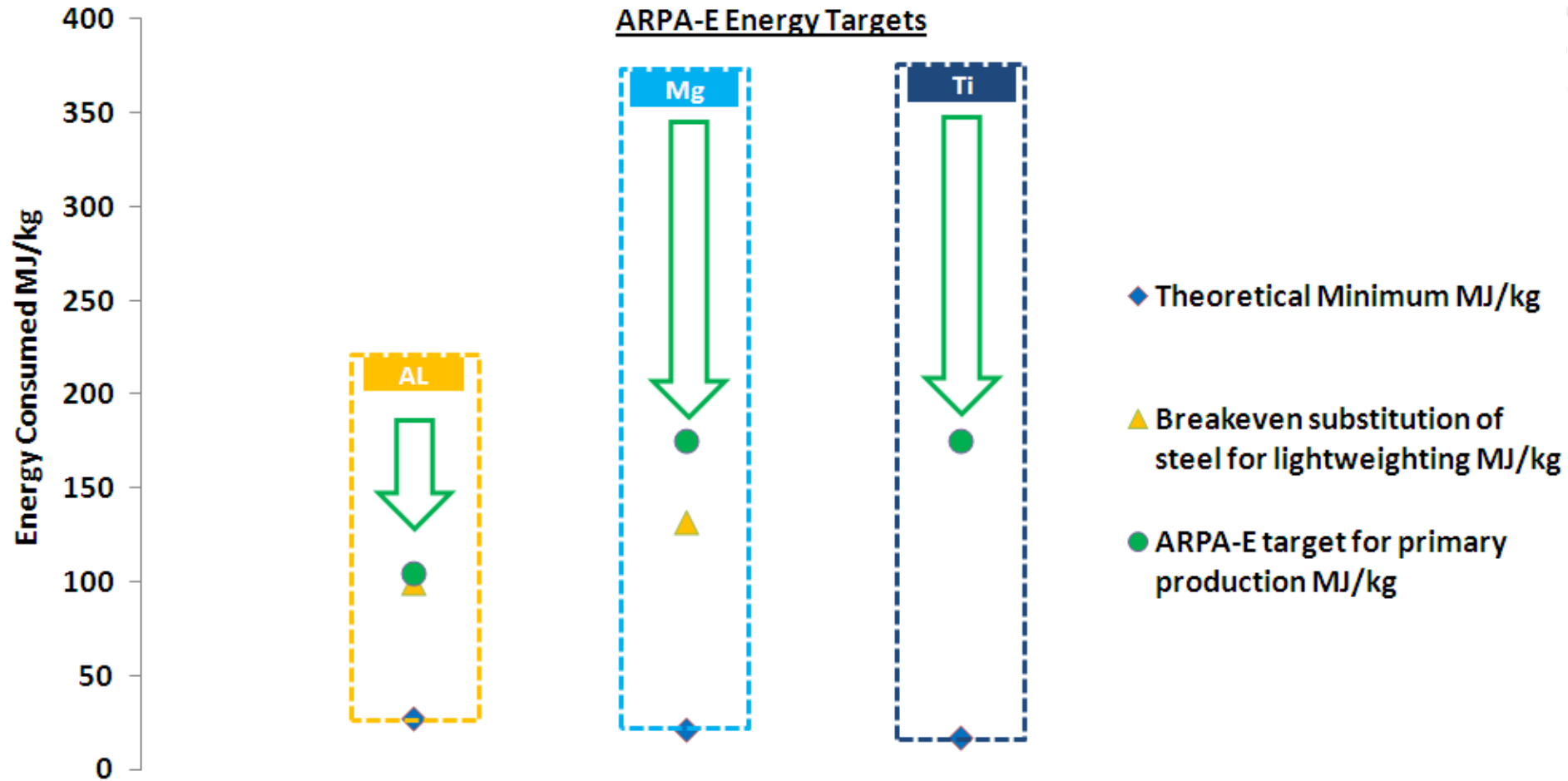




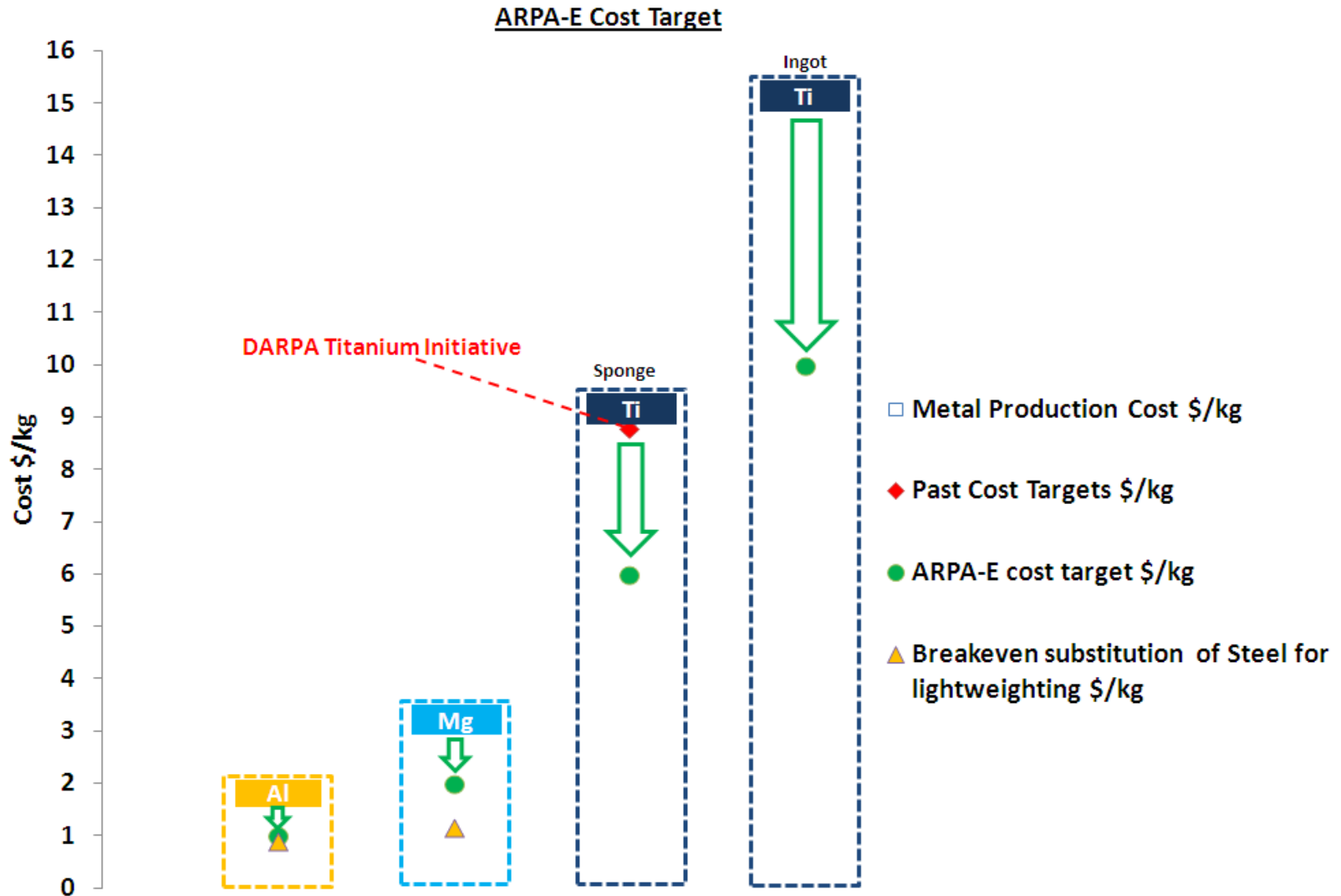
CHANGING WHAT'S POSSIBLE

Aluminum Production Metrics/Targets Breakout

Reminder - Energy Targets Under Consideration



Reminder – Cost Targets Under Consideration



ARPA-E is considering setting an energy extraction target of 105 MJ/kg for primary Al production. What are the challenges to meeting the target?

<u>Aluminum</u>	SOA	ARPA-E?
Energy (MJ/kg)	211	105
Cost (\$/kg)	1.70	1

ARPA-E is considering setting a cost target of \$1/kg for primary Al production. Can this target be met solely through energy reduction?

<u>Aluminum</u>	SOA	ARPA-E?
Energy (MJ/kg)	211	105
Cost (\$/kg)	1.70	1

ARPA-E is considering setting a purity constraint on primary aluminum of >98%. Considering different alloys require different purity constraints, is a purity target appropriate?

<u>Aluminum</u>	SOA	ARPA-E?
Energy (MJ/kg)	211	105
Cost (\$/kg)	1.70	1

Are there any other targets or constraints that ARPA-E should consider setting besides energy, cost, and purity?

<u>Aluminum</u>	SOA	ARPA-E?
Energy (MJ/kg)	211	105
Cost (\$/kg)	1.70	1

What specifications should be placed on recycled Aluminum?

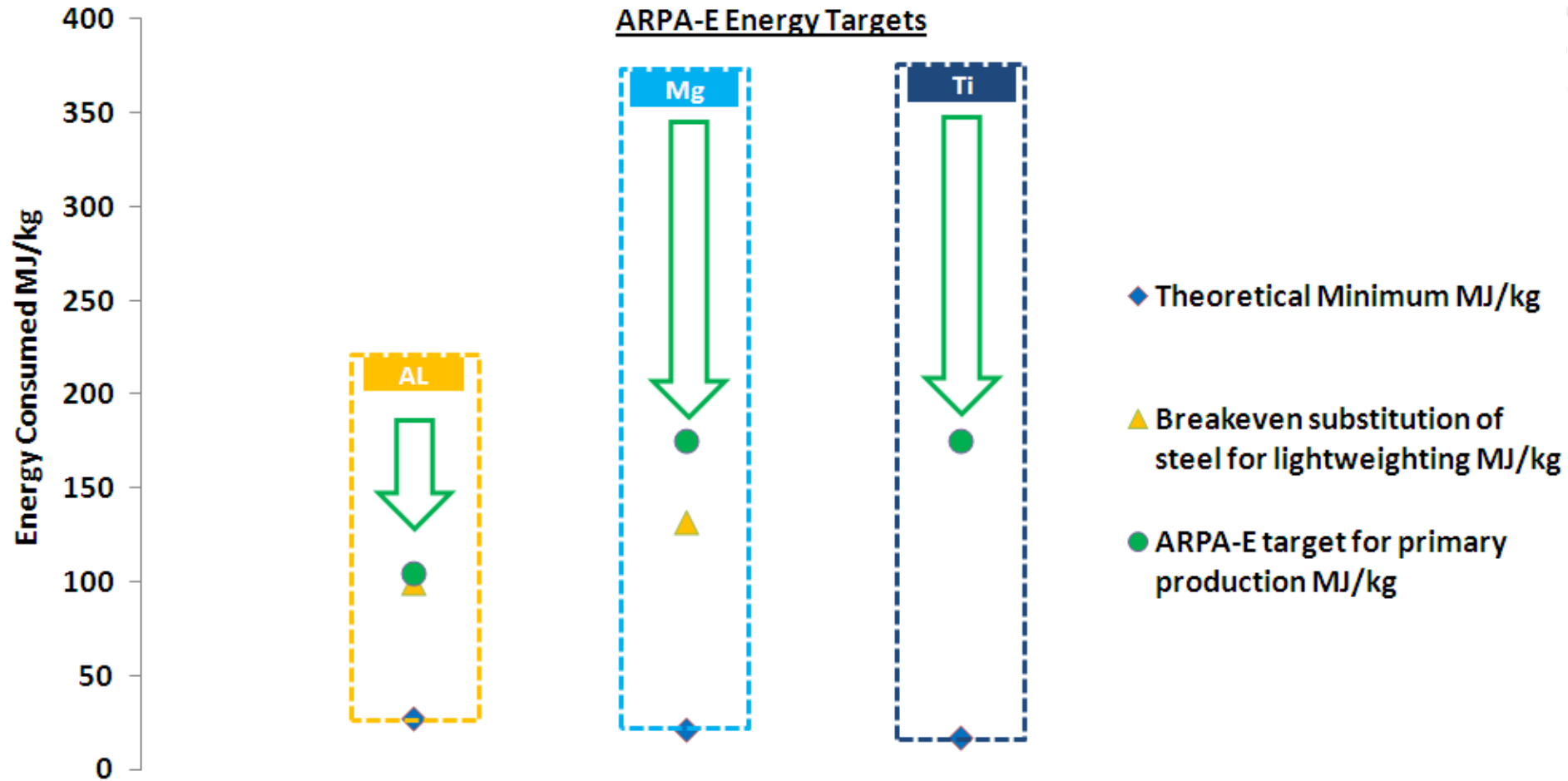
<u>Aluminum</u>	SOA	ARPA-E?
Energy (MJ/kg)	211	105
Cost (\$/kg)	1.70	1



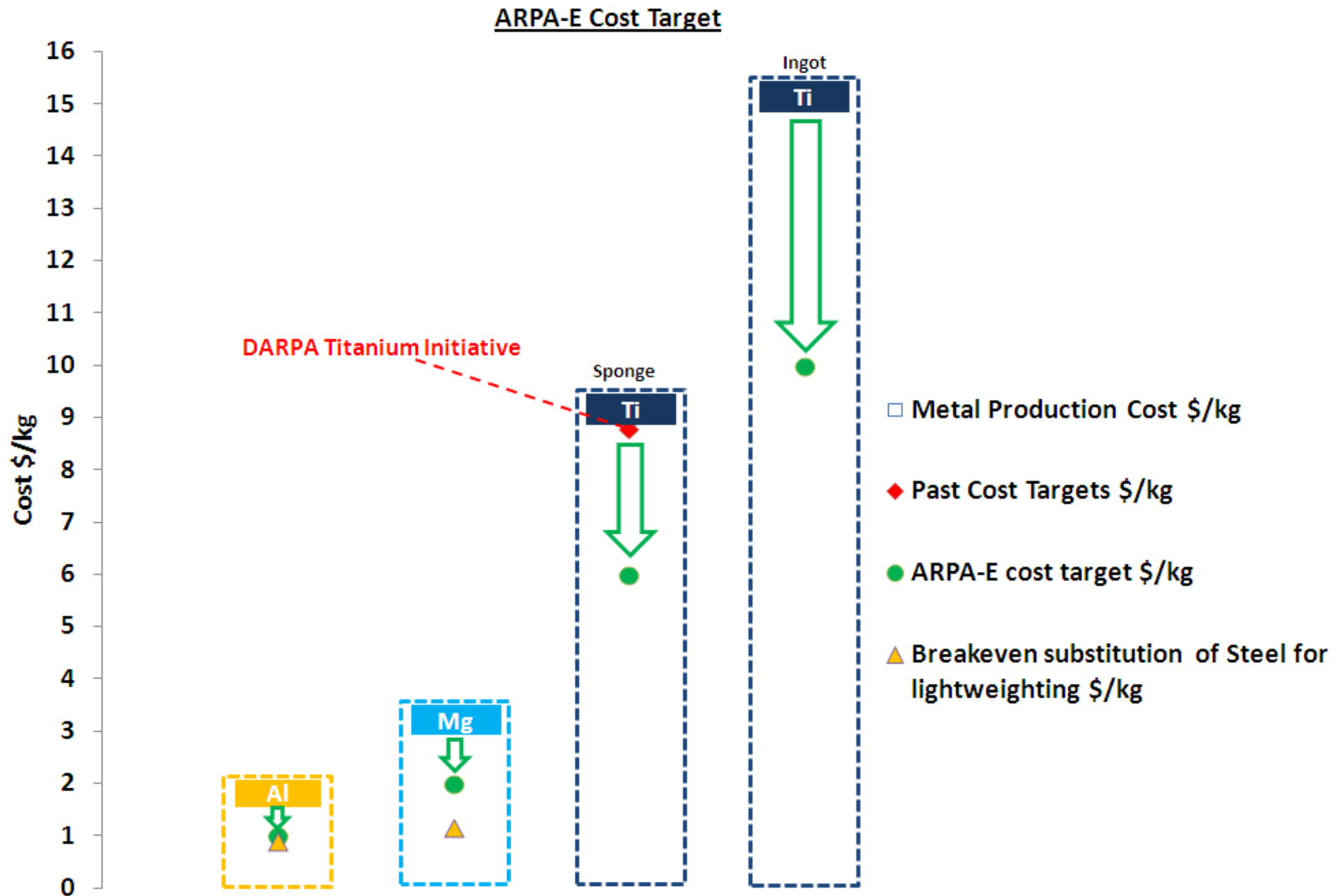
CHANGING WHAT'S POSSIBLE

Magnesium Production Metrics/Targets Breakout

Reminder - Energy Targets Under Consideration



Reminder – Cost Targets Under Consideration



ARPA-E is considering setting an energy extraction target of 175 MJ/kg for primary Mg production. What are the challenges to meeting the target?

<u>Magnesium</u>	SOA	ARPA-E?
Energy (MJ/kg)	361	175
Cost (\$/kg)	3.10	2

ARPA-E is considering setting a cost target of \$2/kg for primary Mg production. Can this target be met solely through energy reduction?

<u>Magnesium</u>	SOA	ARPA-E?
Energy (MJ/kg)	361	175
Cost (\$/kg)	3.10	2

ARPA-E is considering setting a purity constraint on primary magnesium of >99.5%. Considering different alloys require different purity constraints, is a purity target appropriate?

<u>Magnesium</u>	SOA	ARPA-E?
Energy (MJ/kg)	361	175
Cost (\$/kg)	3.10	2

Are there any other targets or constraints that ARPA-E should consider setting besides energy, cost, and purity?

<u>Magnesium</u>	SOA	ARPA-E?
Energy (MJ/kg)	361	175
Cost (\$/kg)	3.10	2

What specifications should be placed on recycled magnesium?

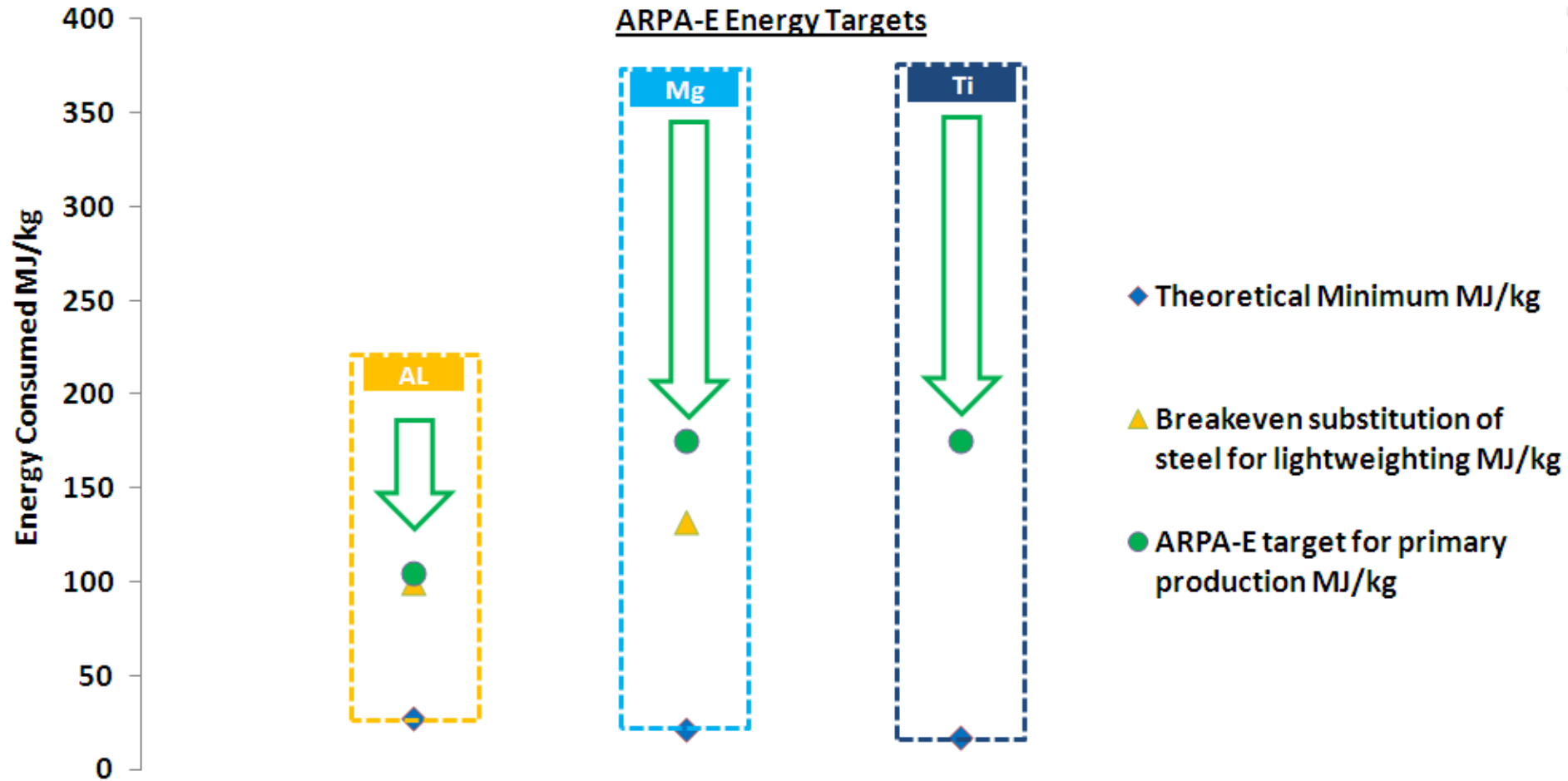
<u>Magnesium</u>	SOA	ARPA-E?
Energy (MJ/kg)	361	175
Cost (\$/kg)	3.10	2



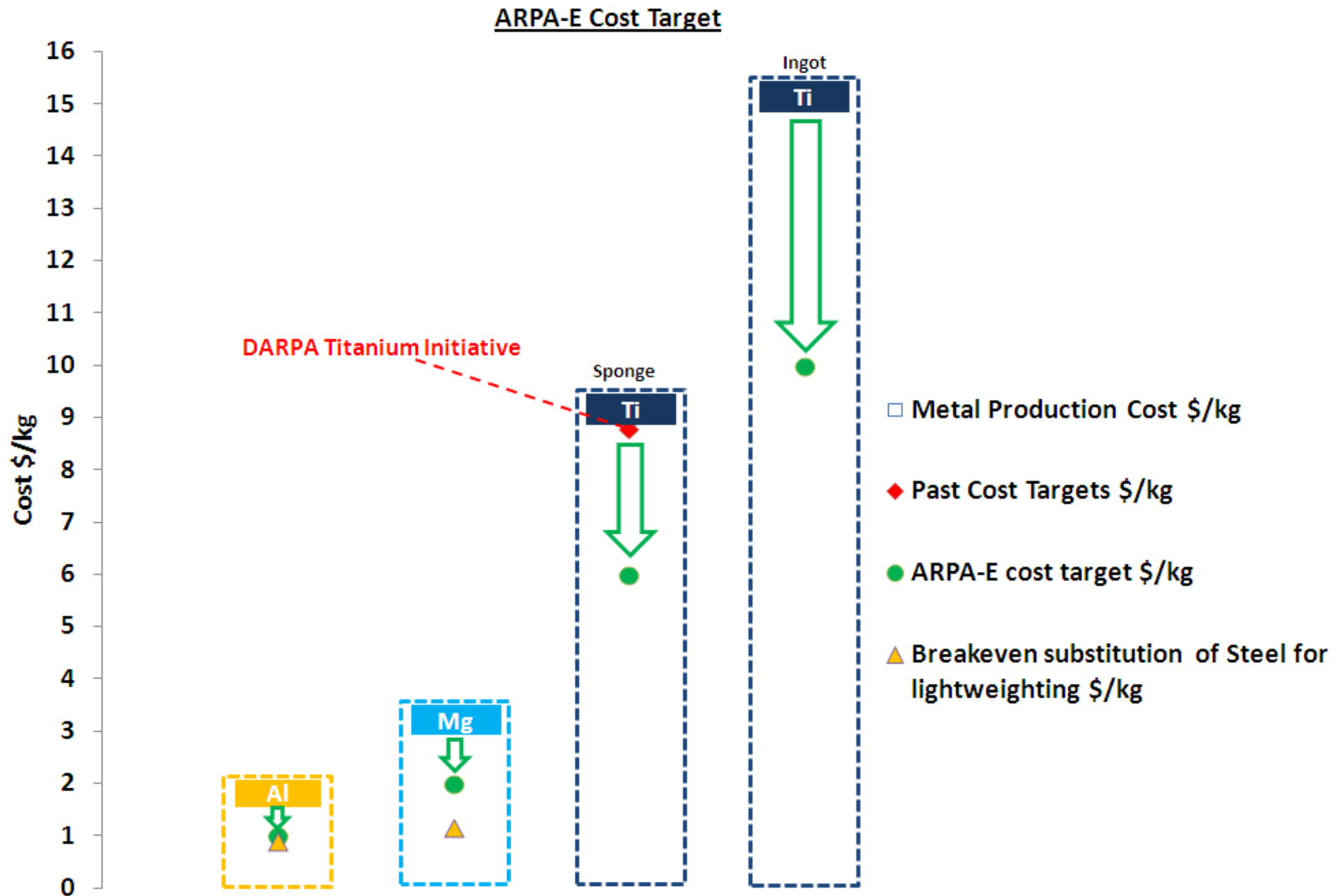
CHANGING WHAT'S POSSIBLE

Titanium Production Metrics/Targets Breakout

Reminder - Energy Targets Under Consideration



Reminder – Cost Targets Under Consideration



ARPA-E is considering setting an energy extraction target of 175 MJ/kg for primary Ti production. What are the challenges to meeting the target?

<u>Titanium</u>	SOA	ARPA-E?
Energy (MJ/kg)	366	175
Cost (\$/kg)	9 (sponge) 15 (ingot)	6 (sponge) 10 (ingot)

ARPA-E is considering setting a cost target of \$6/kg for primary Ti sponge and \$10/kg for primary Ti ingot. Can these targets be met solely through energy reduction?

<u>Titanium</u>	SOA	ARPA-E?
Energy (MJ/kg)	366	175
Cost (\$/kg)	9 (sponge) 15 (ingot)	6 (sponge) 10 (ingot)

ARPA-E is considering setting a purity constraint on Titanium of >99%. Considering different alloys require different purity constraints, is a purity target appropriate?

<u>Titanium</u>	SOA	ARPA-E?
Energy (MJ/kg)	366	175
Cost (\$/kg)	9 (sponge) 15 (ingot)	6 (sponge) 10 (ingot)

Are there any other targets or constraints that ARPA-E should consider setting besides energy, cost, and purity?

<u>Titanium</u>	SOA	ARPA-E?
Energy (MJ/kg)	366	175
Cost (\$/kg)	9 (sponge) 15 (ingot)	6 (sponge) 10 (ingot)

Given that titanium has excellent strength/weight and corrosion resistance characteristics, what markets and applications relevant to energy provide a growth opportunity for the usage of Ti (eg. Nuclear? Shipping? Others?)? Where can the use of Ti have the greatest impact on energy technologies?