AUTOCOMPOSITES

Autocomposites Commercialization Launchpad Kickoff Meeting Pre Read

Troy, MI

June 27, 2013

Thanks for attending the kickoff meeting for the Autocomposites Commercialization Launchpad

You are here.

In a post-workshop survey, participants and other stakeholders indicated strong interest in moving forward with commercialization

Findings from post workshop survey:

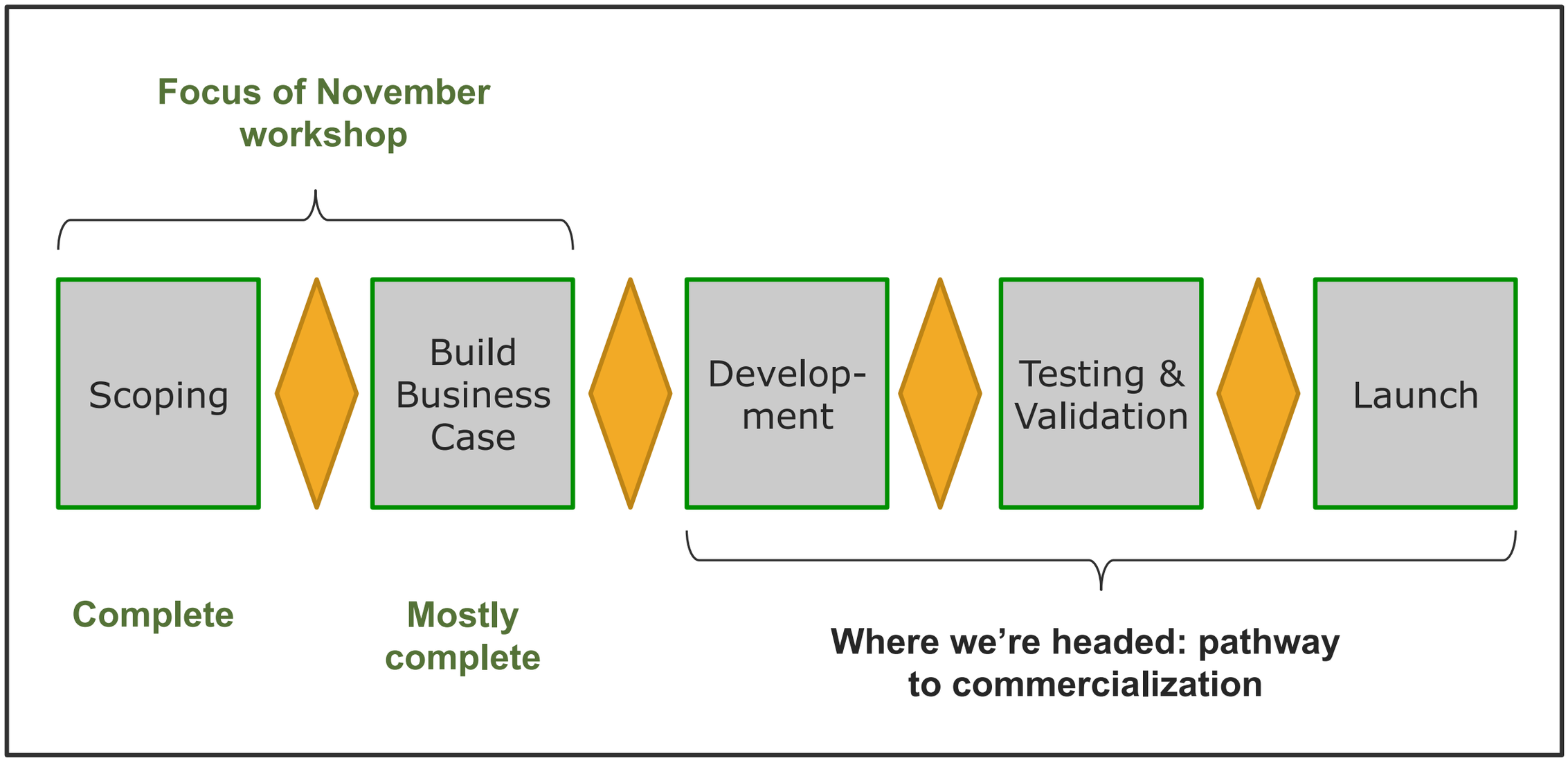
- Respondents were from across the supply chain: OEMs, Tier 1s, material suppliers, equipment and tooling suppliers, government, universities, national labs, and industry consultants.

- 18 of 21 respondents indicated they are “very interested” in a carbon fiber composite part commercialization effort

- Respondents were willing to contribute to the effort:
  - ➡ 14 said they could support with in-kind equipment, material, or labor
  - ➡ 3 said they could support with a direct financial contribution

The meeting will build from workshop outcomes and focus on a pathway to commercialization

Phase-gate Development Process:



Meeting Goals

1	Produce a commercialization plan based on the part development process
2	Identify and address technology and funding gaps on the pathway to part implementation on a model year 2018 vehicle at 50k units per year or more.
3	Identify and assign initial team roles and responsibilities and develop a plan to bring a large Tier 1 or OEM on board.

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A COLLABORATIVE APPROACH WITH STAKEHOLDERS FROM ACROSS THE SUPPLY CHAIN CAN OVERCOME BARRIERS TO COMMERCIALIZATION

Tier 1

OEM

Contribution:
- Guidance: production part design process and requirements

Value Derived:
- Access to a scale-capable supply chain team focused on high value applications

Tooling Providers

Contribution:
- Manufacturing equipment & expertise

Value Derived:
- Develop and demo equipment in customer-driven environment

CAE Software Providers

Contribution:
- Predictive tools & expertise

Value Derived:
- Develop and demo analysis capabilities for specific large-scale applications

Fiber + Resin Producers

Contribution:
- Material systems & expertise

Value Derived:
- Access to growth market

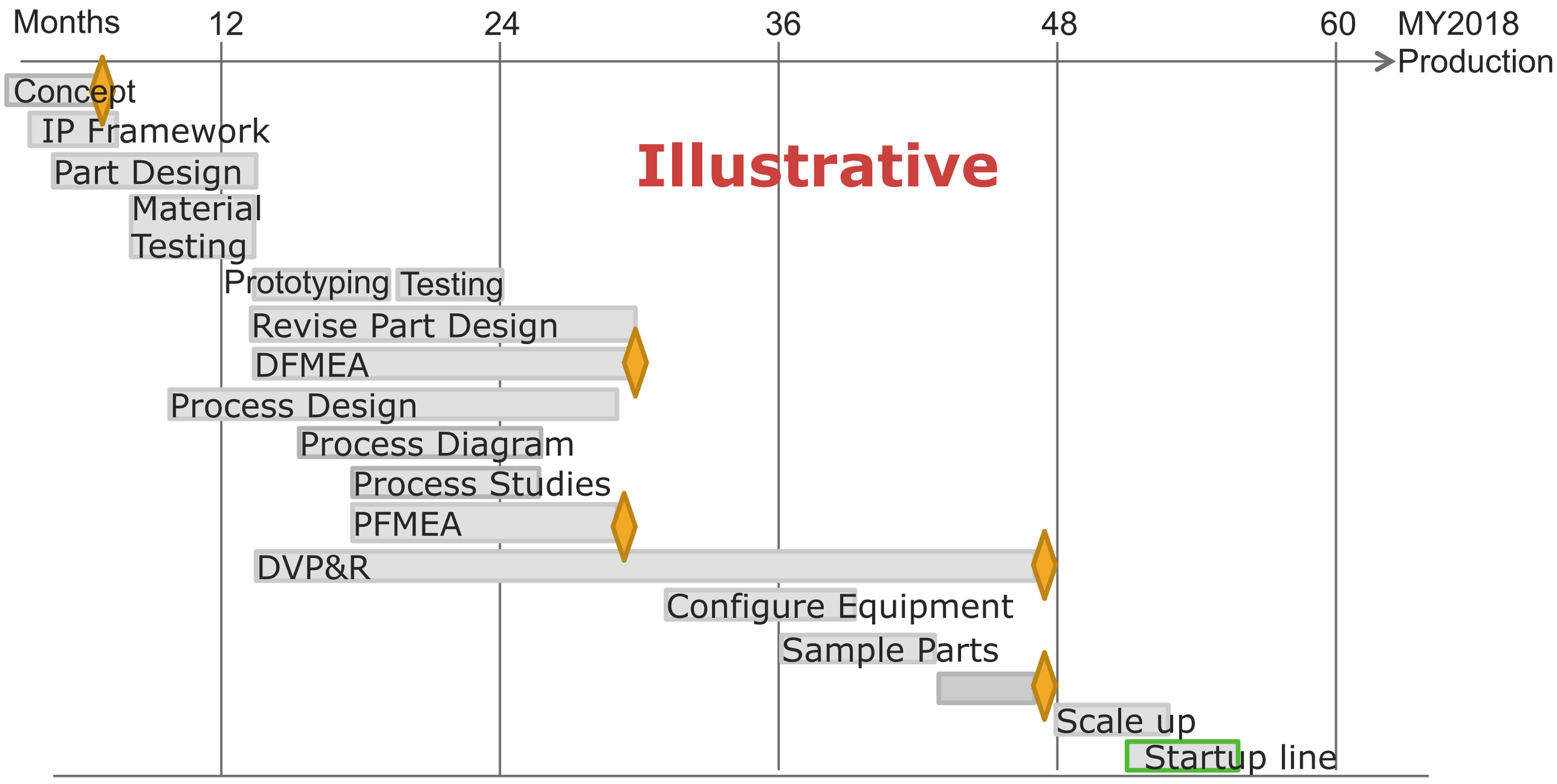
Gov't / DOE / ORNL

Contribution:
- Active collaboration with current programs (NNMI, VTP, CFTF)

Value Derived:
- Fossil fuel reduction goals advancement
- U.S. manufacturing competitiveness
- Bridging from pilot to commercialization

Potential roles to be discussed at meeting

Key technology and funding gaps can be identified by understanding the OEM production part approval process (PPAP)

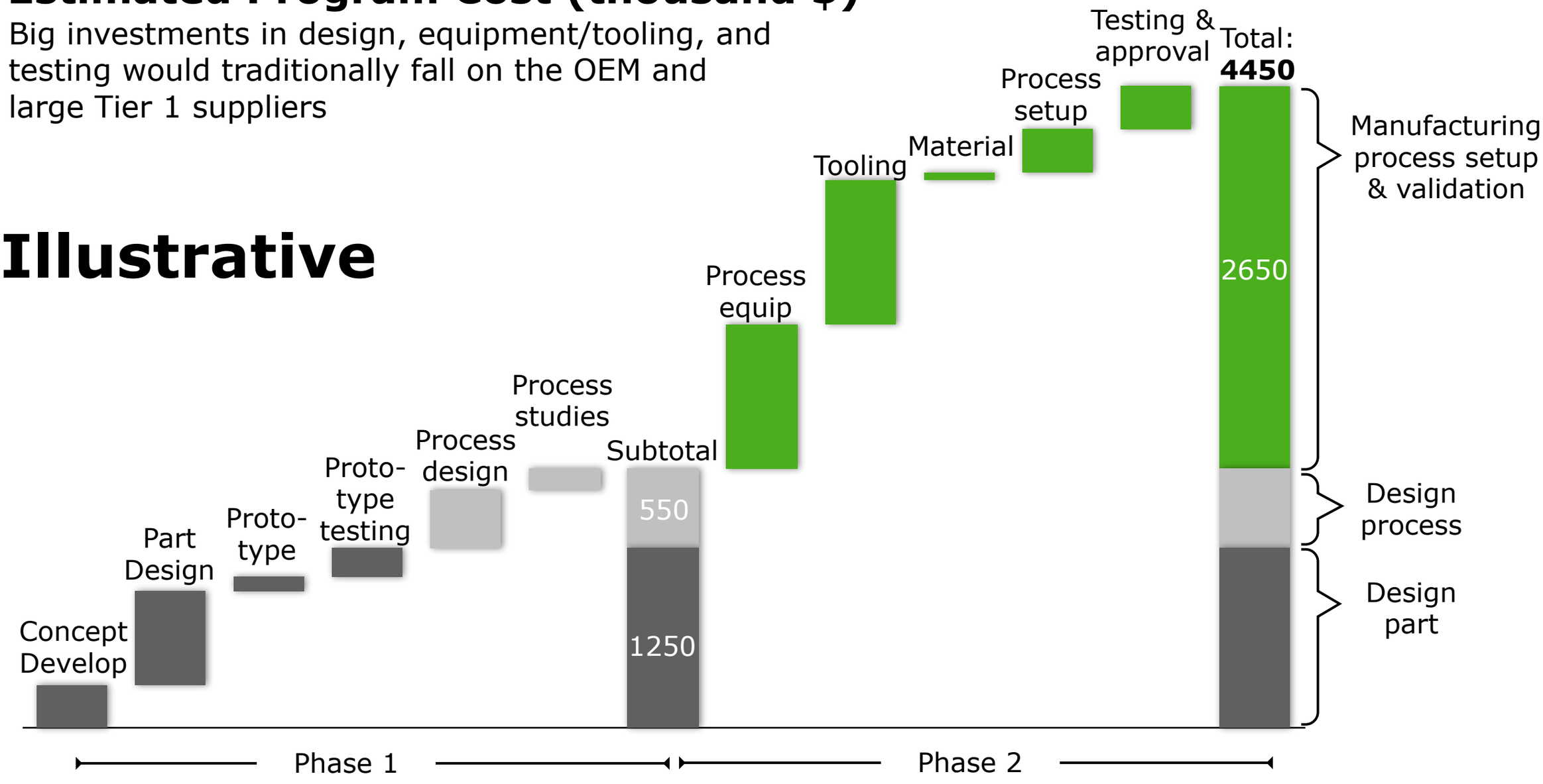


THE AUTOCOMPOSITES SUPPLY CHAIN WILL NEED TO WORK TOGETHER TO COVER UP FRONT COSTS ON THE PATH TO COMMERCIALIZATION

Estimated Program Cost (thousand $)

Big investments in design, equipment/tooling, and testing would traditionally fall on the OEM and large Tier 1 suppliers

Illustrative



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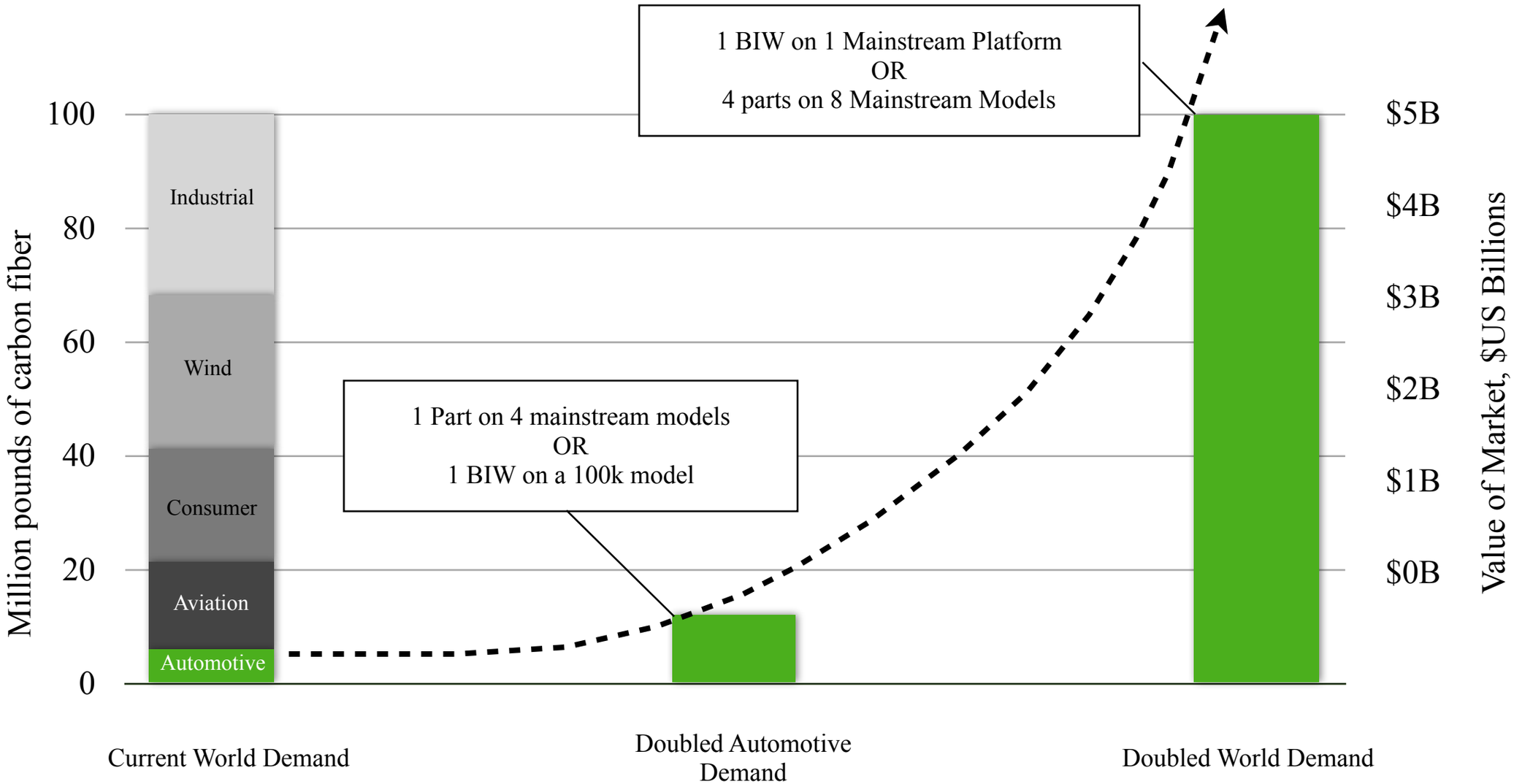
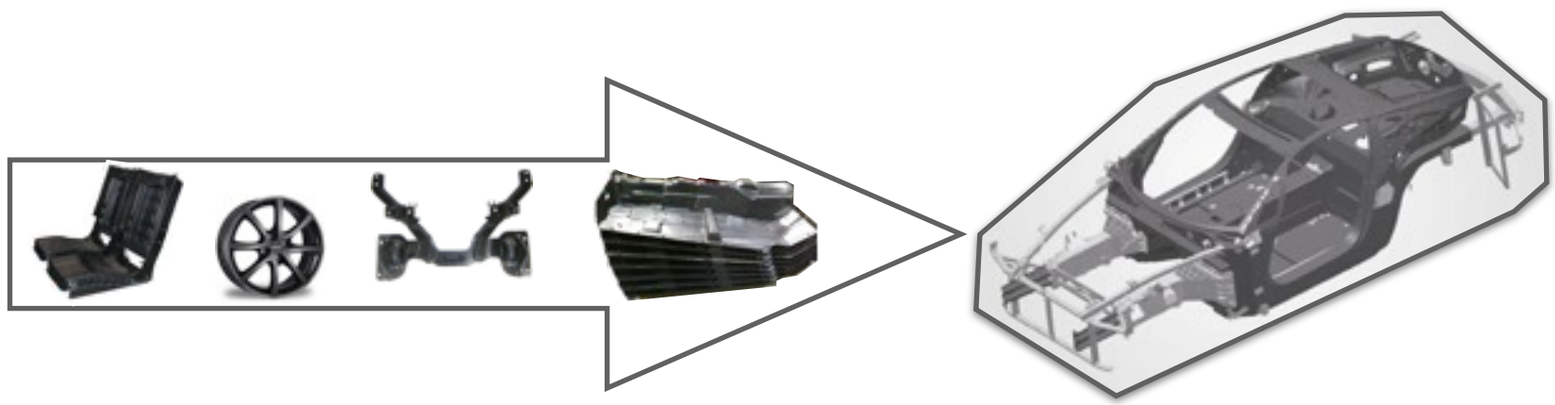
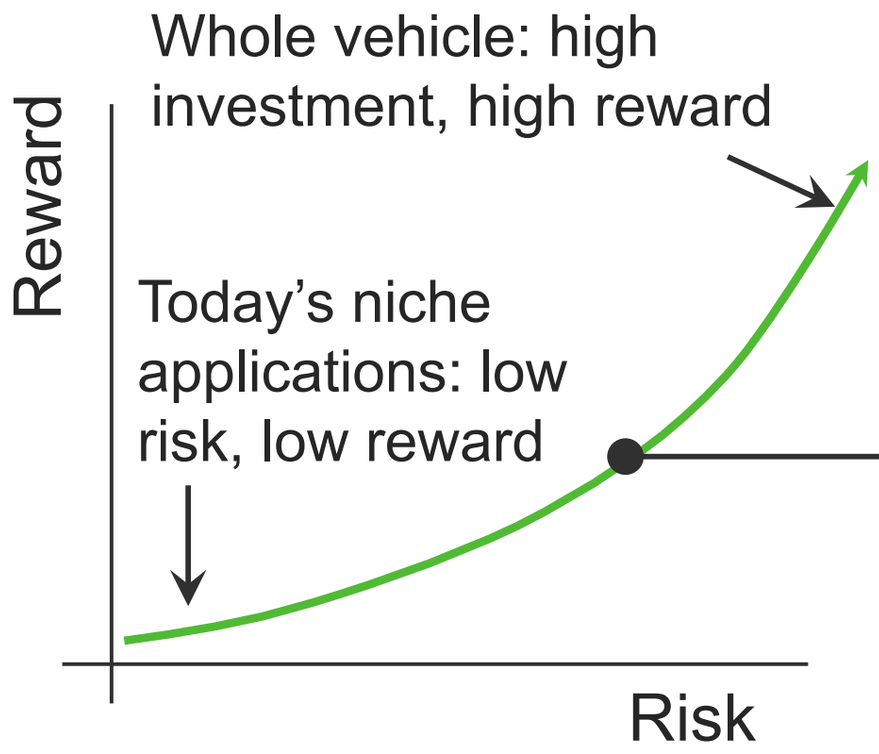
A FEW PARTS, IMPLEMENTED AT MAINSTREAM VOLUME, CAN DRIVE SIGNIFICANT SCALE AND INVESTEMENT WHILE PAVING THE WAY FOR COMPOSITE-INTENSIVE VEHICLES





The parts approach focuses on near term commercialization while making barriers to CF adoption tangible



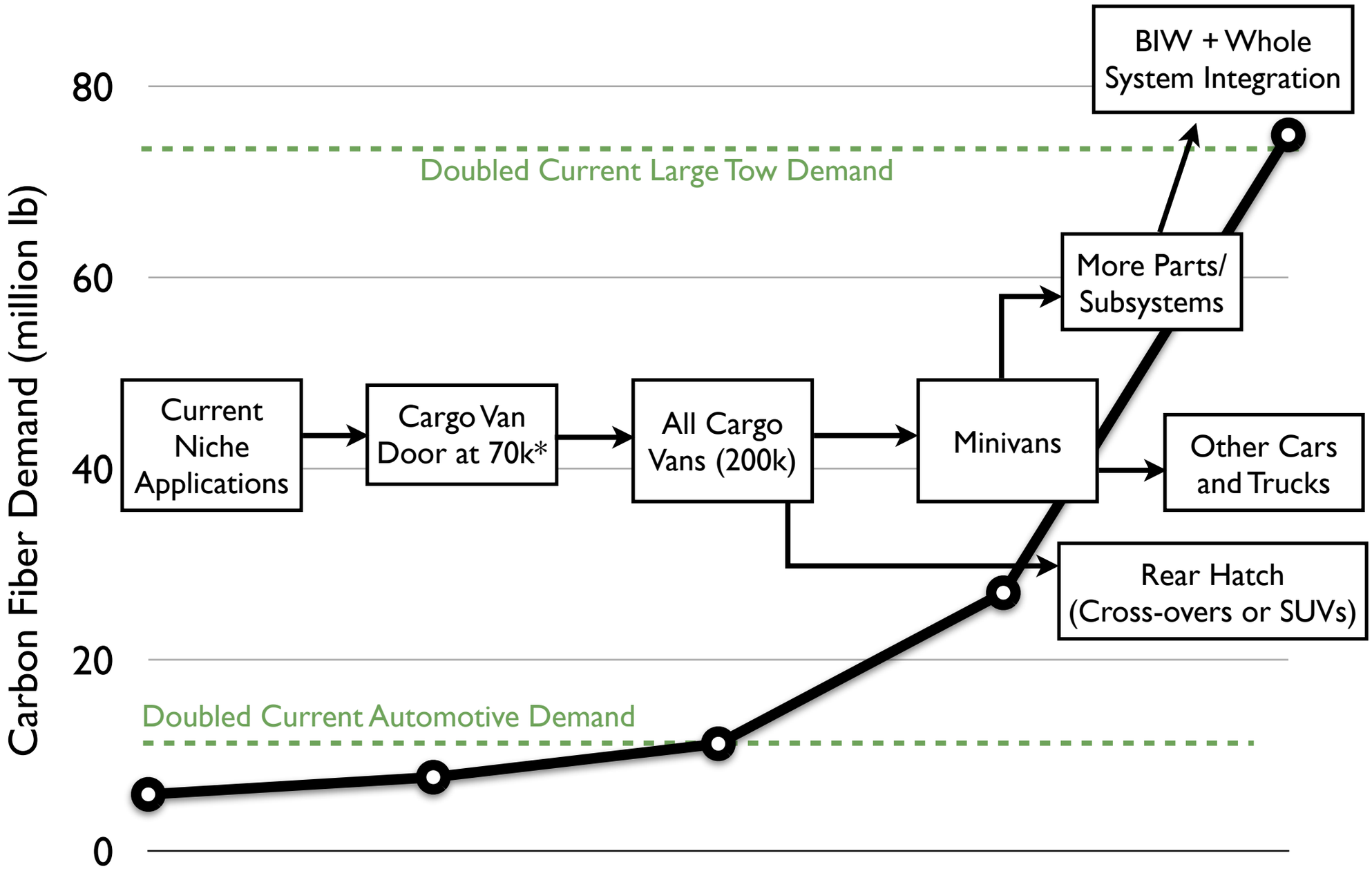
The parts approach:

Start with a well-chosen part + segment

- Find CF applications with high weight savings and tangible value
- Target and tailor to mainstream adoption w/ initial volumes 50-100k model year 2018
- Enable total transformation over time

The parts approach can turn the laundry list of barriers to CF adoption into a strategic, concrete list of near-term deliverables.

THE PARTS APPROACH OFFERS A STARTING POINT TOWARD CAPTURING THE FULL VALUE OF CF IN THE LONGER TERM



*Includes both (left and right) door

We explored the parts approach in a workshop setting with stakeholders across the autcomposites supply chain

Ontario
Ministry of Economic Development and Innovation

Continental Structural Plastics

PlastiComp

Altair

Mahindra

Top Five Incorporated

Materials Innovation Technologies

Oak Ridge National Laboratory
Managed by UT-Battelle for the Department of Energy

Chrysler

GM

MAGNA

Munro & Associates, Inc.

faurecia

North America
PLASAN
Innovate. Deliver. Protect.

Fraunhofer

FIBERFORGE

Ticona
Engineering Polymers

Allied Composite Technologies LLC

POINT380
Crucial Resource Strategy

MOMENTIVE

sabic

Molded Fiber Glass Companies

TORAY

BASF
The Chemical Company

TohoTenax

U.S. Department of Energy | Energy Efficiency & Renewable Energy

Rocky Mountain Institute

Criteria were developed to select the right part, segment, material specification, and volume

Criteria:

- High weight reduction potential
- Stiffness-driven
- Part count reduction
- Tangible customer value
  - Safety potential
  - Space savings
  - Ease of use
- Manufacturable at scale with current/forthcoming processes
- Avoids near-term safety challenges
- Readily adapted to additional models and platforms

Part Candidates

- Rear hatch inner
- Door inner + intrusion beam (van/cargo van in particular)
- Seat structure (stowaways in particular)
- Engine cradle

Segments

- Performance
- EVs
- Fleets

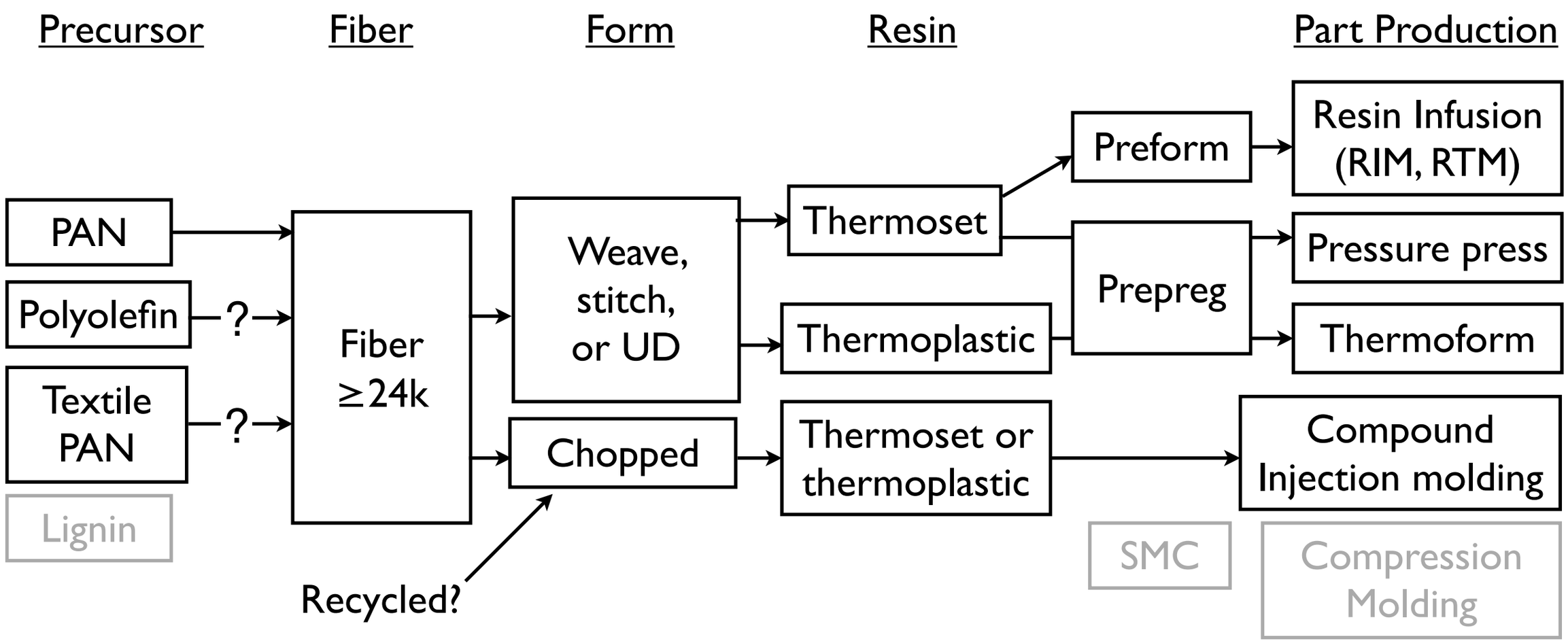
Material

- Large tow, non-cosmetic

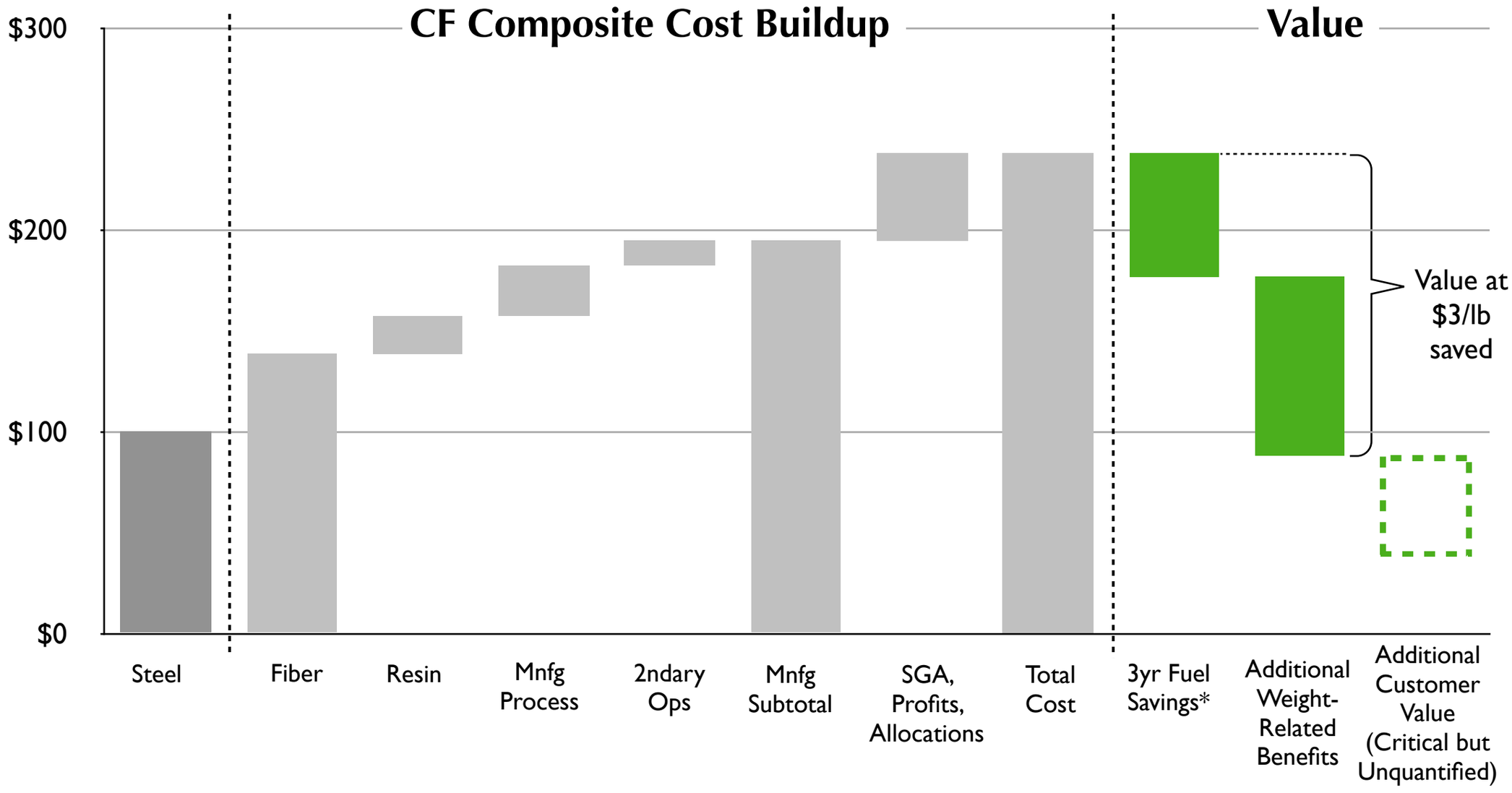
Volume

- 50–100k w/ integration into existing plants

Workshop participants identified several manufacturing pathways well-suited to automotive needs and capable of meeting volumes of 50-100k

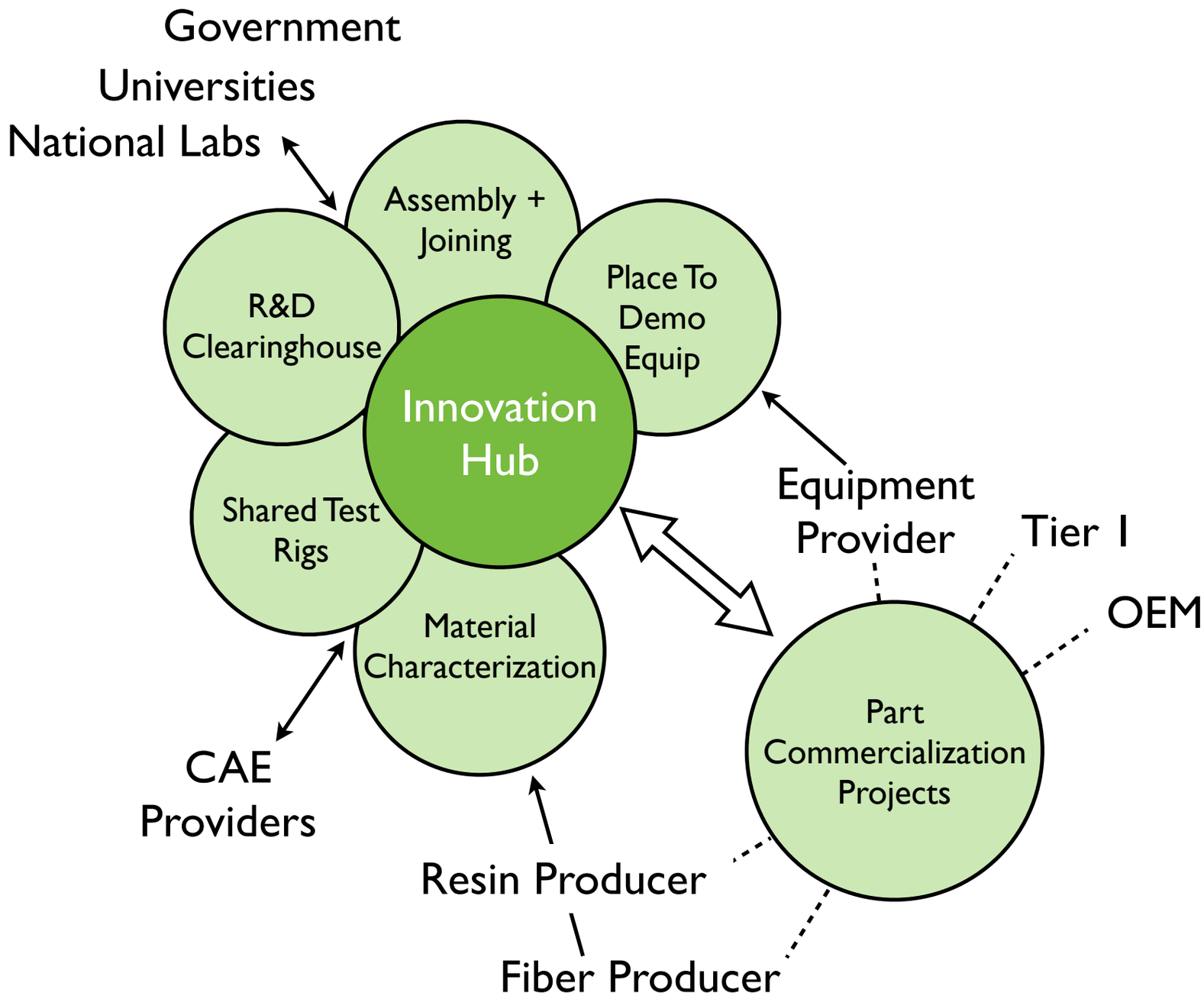


Initial results suggest that well-chosen CF composite parts offer equal or better value relative to the steel parts they would replace



*For EVs, 3yr fuel saving block will be reduced by two thirds, however roughly the same amount will be replaced by upfront battery cost savings

Commercialization projects can both benefit from and contribute to a broader Composites Innovation Hub (or Institute for Manufacturing Innovation)

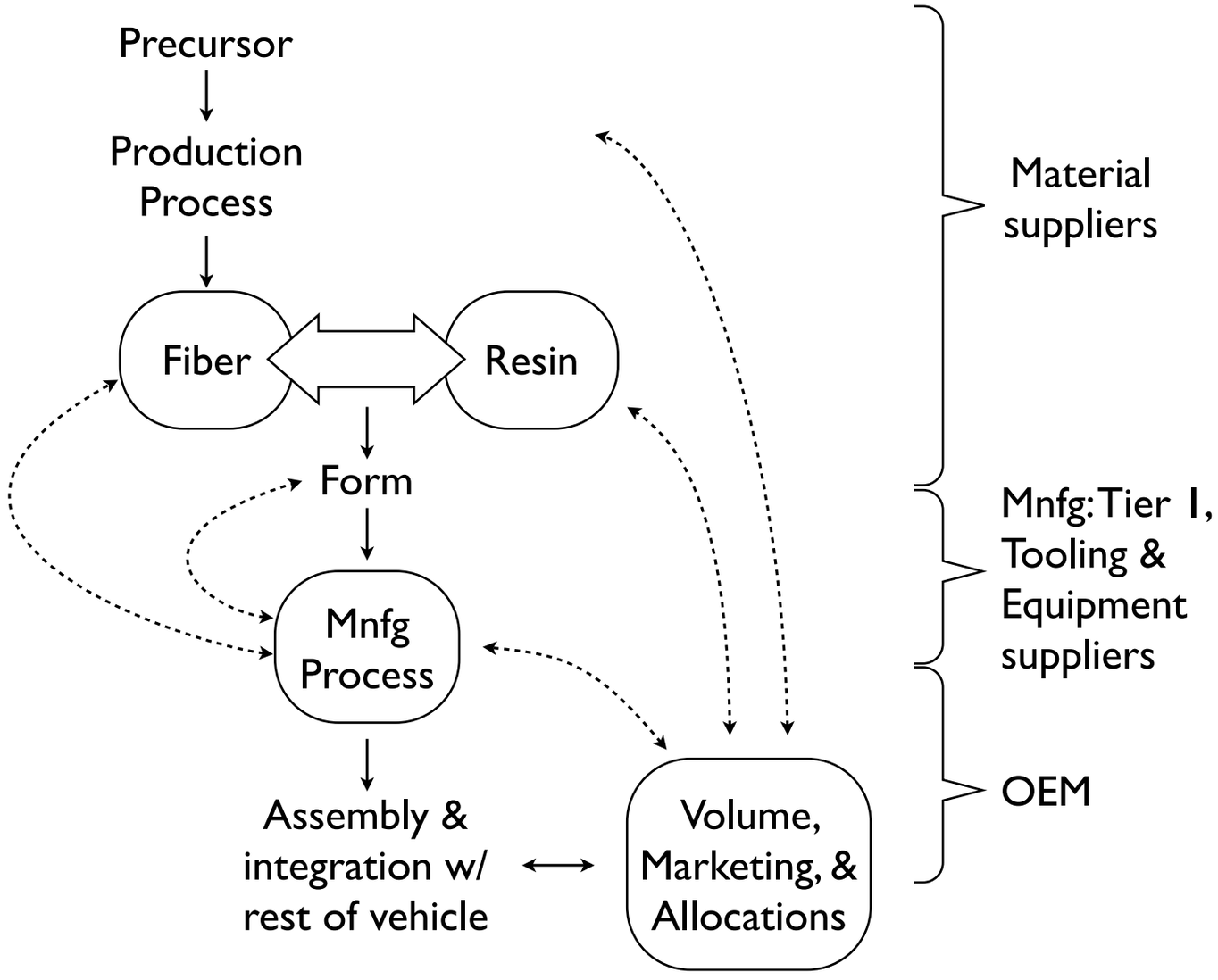


Collaboration will be key. Co-opetition and co-fudning can help overcome complex, cross-disciplinary development challenges

1. Complex, cross-disciplinary challenges

- New material
- New design
- New Process

2. Decision making interactions across the supply chain



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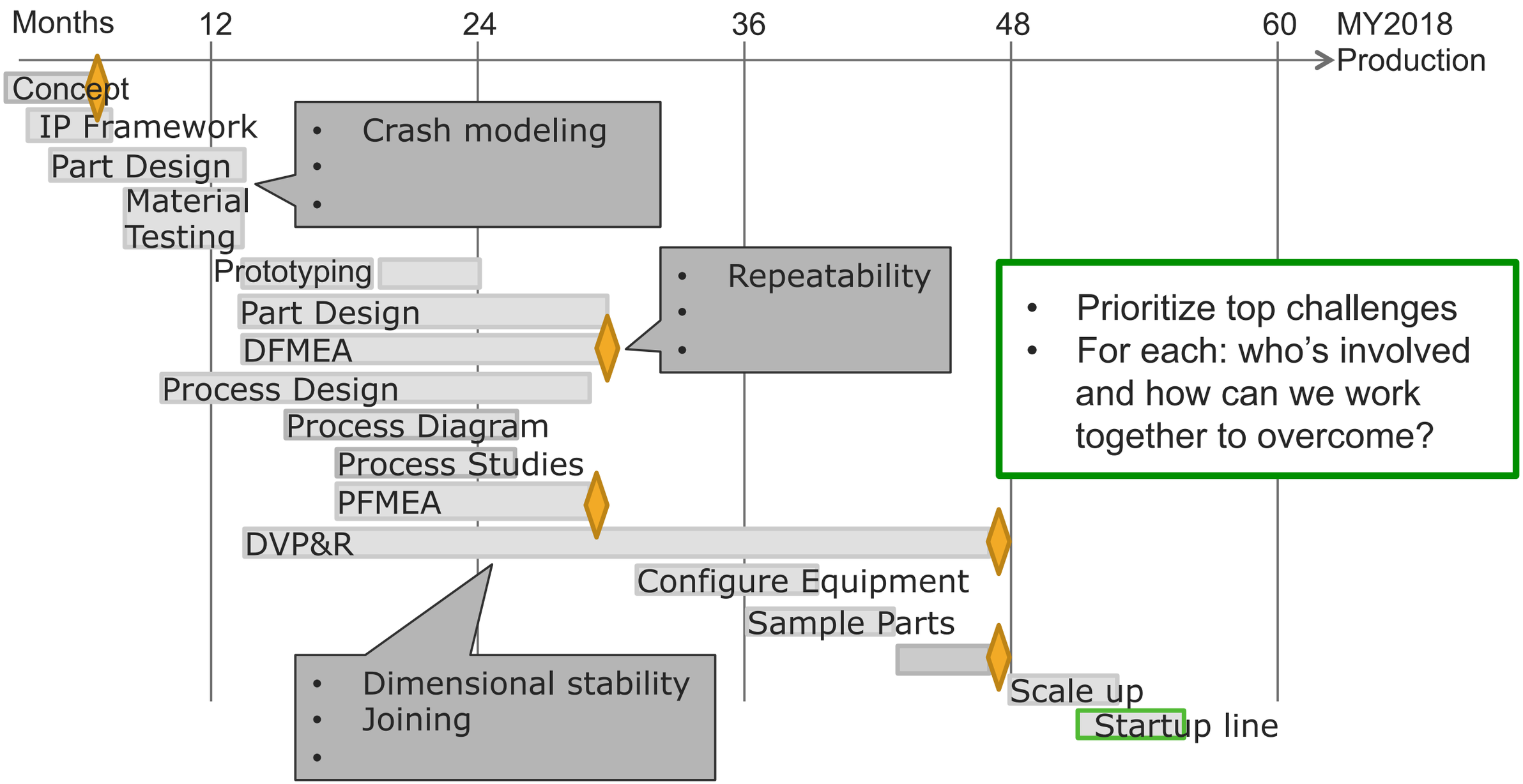
Commercialization will face technology Barriers

- New Material
- New Process
- Complex interactions across the supply chain

Technical Challenges:

- CAE tools
- Assembly
- Finishing
- Cycle times
- Repair & Replacement
- Material data
- Crash safety
- Recyclability

Where are the key technology gaps? How and when can they be overcome?



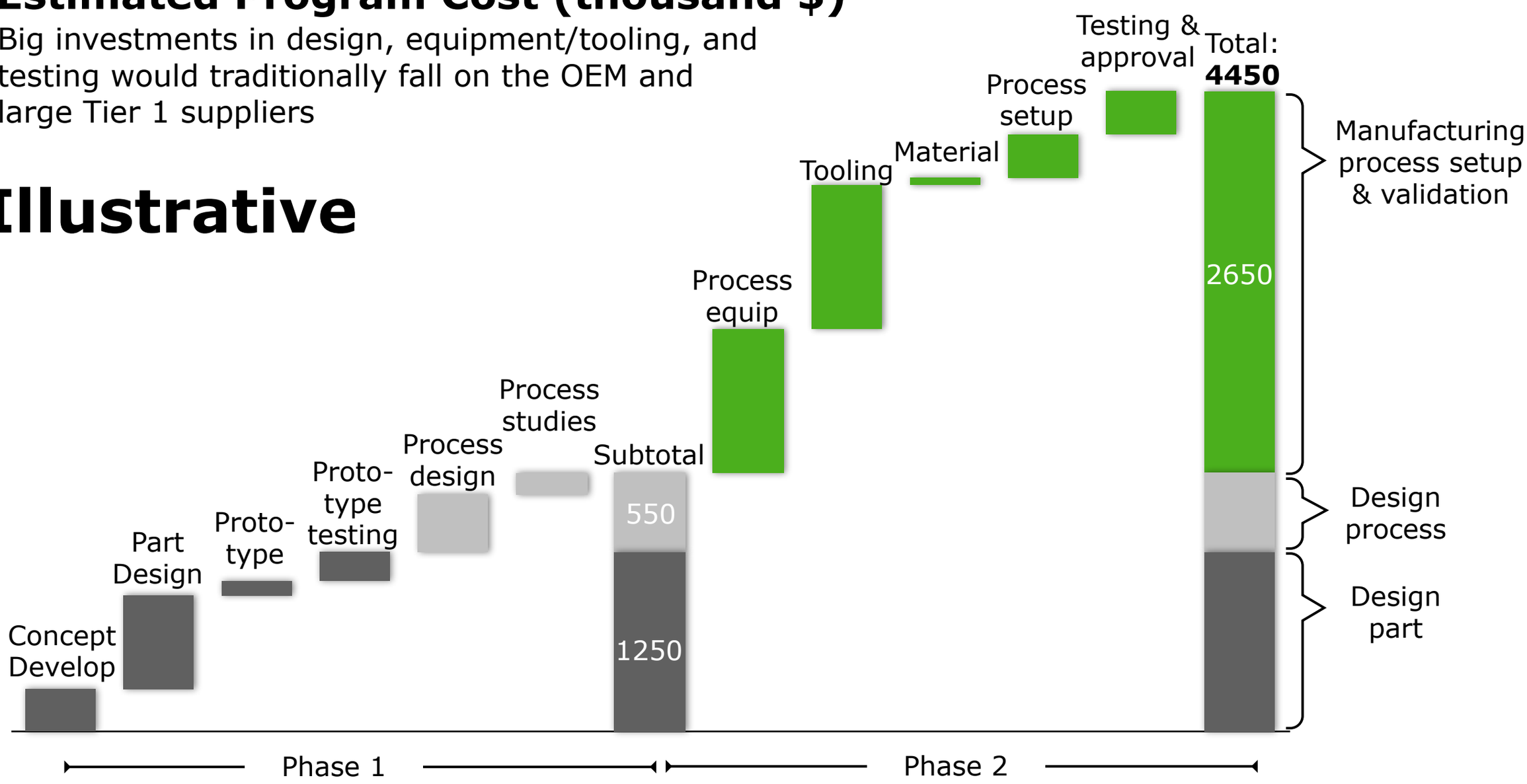
Illustrative

Where are the key funding gaps and how can they be overcome?

Estimated Program Cost (thousand $)

Big investments in design, equipment/tooling, and testing would traditionally fall on the OEM and large Tier 1 suppliers

Illustrative



Consider:

- Which partners will incur the highest costs?
- Do they have the money to invest?
- Do they have enough incentive to invest? Is risk aligned with reward?

How will this effort differ from existing industry consortia and commercialization-focused initiatives?

Organization	Country	Participants				Funding Source		Funding Mechanism				Budget (USD Equiv.)
		Industry	Gov't	Academia	Non-profit	Public	Private	Grants	Cost-Sharing	Membership Fees	Contracts	
Automotive Composites Consortium (ACC)	**US**	X	X	-	-	X	X	X *DOE*	X *DOE and OEMs*	-	-	n/a
National Composites Center (NCC)	**UK**	X	X	X	-	X	X	X *British gov't agencies*	-	X	-	38 million
Fraunhofer ICT	**Germany**	X	X	X	-	X	X	X *German gov't and EU*	-	-	X	42 million
Aachen Center for Integrated Lightweight Production (AZL)	**Germany**	X	X	X	-	X	-	X *German gov't*	-	-	-	n/a
Cooperative Research Centre – Advanced Composite Structures (CRC-ACS)	**Australia**	X	X	X	-	X	X	X *Australian gov't*	X	-	-	3.4 million (est.)
Composite Vehicle Research Center, Michigan State University	**US**	X	X	X	-	X	-	X *TARDEC and ARL*	-	-	-	6.8 million
European Thermoplastics Automotive Composites Consortium (eTAC)	**Netherlands**	X	-	-	X	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Composites Innovation Center	**Canada**	X	X	X	X	X	X	X	-	X	-	n/a
Affordable Composites for Lightweight Car Structures (ACOMPLICE)	**UK**	X	-	-	-	X	X	X *UK Technology Strategy Board*	-	X	-	1.15 million (est.)
Advanced Manufacturing Research Centre (AMRC)	**UK**	X	X	X	-	X	X	X *UK Technology Strategy Board*	-	X	-	n/a
Composites at Sheffield	**UK**	X	X	X	-	X	X	X *UK and EU*	-	-	-	n/a
The Welding Institute (TWI)	**UK**	X	-	X	-	-	X	-	-	X	X	76 million
National Additive Manufacturing Innovation Institute (NAMII)	**US**	X	X	X	X	X	X	X *DOE and DOD*	X *50/50 between gov't and members on projects*	X	-	70 million with 1 billion proposed
Industry and University Cooperative Research Centers (IUCRCs)	**US**	X	X	X	X	X	X	X	X *NSF*	-	-	n/a

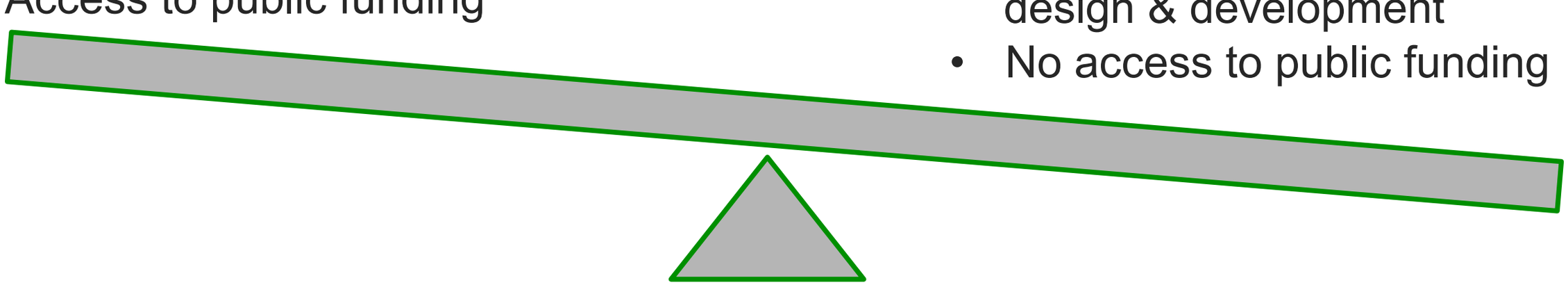
How will program participants manage IP and the tension between collaborative and competitive?

Pre-Competitive

- Collaboratively address shared challenges
- Limited info sharing and guarded discussion
- Access to public funding

Competitive

- Small teams focused on near-term commercialization
- IP protection and detailed design & development
- No access to public funding



Co-opetition

- At what point will the commercialization effort need to cross into the competitive space?
- What types of agreements will be needed in order to protect information while still driving innovation and progress?

How can we quickly bring an OEM or large Tier 1 on board?

Potential "Road Show" Campaign to recruit an OEM: