THE COMPOSITES
IACMI
INSTITUTE

Institute for Advanced Composites Manufacturing Innovation

Preliminary Technology Roadmap: **PHASE ONE**

February 2016

Prepared by NEXIGHT GROUP

Background

In January 2015, President Obama announced the award of the **Institute for Advanced Composites Manufacturing Innovation (IACMI)**, a $259 million public-private partnership focused on lowering the cost and energy required to produce carbon fiber-reinforced polymer composites while increasing the material's recyclability. IACMI held its Inaugural Members Meeting to officially launch the Institute in June 2015.

The Institute is initially focused on three applications where advanced composites manufacturing can have significant national benefits: vehicles, compressed gas storage, and wind. To ensure IACMI conduct research aimed at solving industry's needs in these areas, IACMI leadership will solicit industry input as it further develops the IACMI Technology Roadmap in the months ahead. The IACMI Roadmap must also build upon other relevant roadmapping activities, maintaining focus on achieving the 5- and 10-year technical and economic objectives of the Institute, and provide a sound technical basis for future IACMI projects.

As articulated by DOE in the Funding Opportunity Announcement, the quantitative technical objectives of the R&D work of IACMI are to:

1) Reduce production cost of finished carbon fiber composites for targeted applications (vehicles, wind, high-pressure gas storage at a minimum) by >25% in five years, on a pathway to a reduction of cost >50% over ten years;

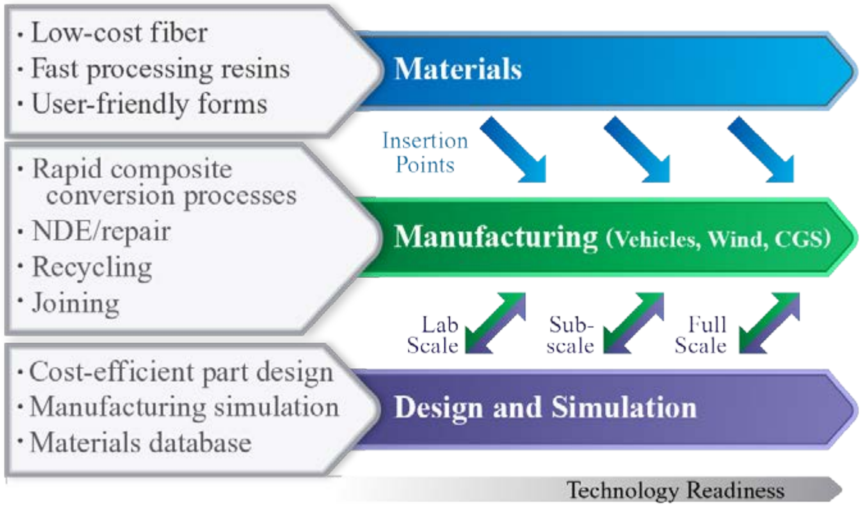
2) Demonstrate production of fiber reinforced polymer composites with cost and embodied energy parity to today's glass fiber technology and performance of today's carbon fiber composites for target application areas and relevant production speed in five years;

3) Demonstrate technologies, at sufficient scale, that reduce the embodied energy (and associated greenhouse gas emissions) of carbon fiber composites by 50% compared to today's technology on a pathway to 75% reduction in ten years; and

4) Demonstrate technologies, at sufficient scale, for >80% recyclability or reuse of fiber reinforced polymer composites in five years into useful components with projected cost and quality at commercial scale competitive with virgin materials on a pathway to >95% recyclability or reuse starting in ten years.

These targets are aggressive compared to today's state of the art, and will require parallel efforts from multiple perspectives, including materials development, improvement in composites manufacturing, and increased confidence and accuracy of design, modeling and simulation tools. Furthermore, such efforts must be integrated and able to take advantage of advances in all streams. This strategy is reflected in Figure 1.

Figure 1. Strategy for Integrating Activities across IACMI's Technical Focus Areas



Given IACMI's budgeting cycles, IACMI required preliminary roadmap results in an accelerated timeframe, to be followed by more thorough stakeholder consultation and roadmap development in 2016 and ongoing roadmap monitoring and updating thereafter. Accordingly, the roadmap development approach has been described in three Phases:

- **Phase 1:** Accelerated roadmap priority identification (2015)
- **Phase 2:** Full roadmap process development, stakeholder engagement, and roadmap development (2016)
- **Phase 3:** Roadmap monitoring and updating (2017 and beyond)

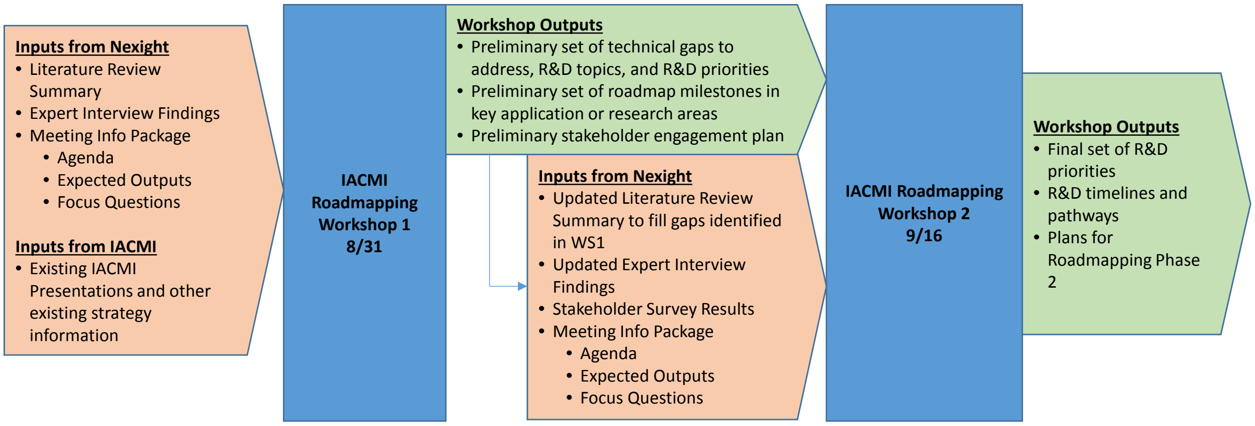
This document is the Phase 1 IACMI Technology Roadmap.

About the Roadmapping Process

IACMI partnered with Nexight Group, a technical and management consultancy specializing in technology roadmapping, in August 2015 to assist IACMI in building this Phase 1 Roadmap. To build this preliminary roadmap, Nexight Group conducted the following activities:

- **Literature Review—**Conduct an accelerated literature review, with emphasis on recently published roadmaps and literature sources of relevance to IACMI's scope and focus. In total, 66 literature sources were identified, including eight roadmaps with direct relevance. See Appendix A for a summary of the literature findings.
- **Expert Interviews—**Conduct one-on-one telephone interviews with experts both within and outside the IACMI domain. Appendix B provides a general summary from the Phase I interviews.
- **Online Survey—**Prepare and conduct an online survey of IACMI members to solicit views on the relative priority of potential technical activities. In total, more than 800 IACMI partners and interested parties were invited to complete the survey; more than 100 individuals completed the survey. See Appendix C for summary of survey results.
- **In-Person Roadmapping Meetings—**Nexight Group facilitated two in-person working meetings in Knoxville at which the IACMI technical leadership team defined priorities and timelines for IACMI technical activities. The output of this exercise is captured in Figures 3 to 7.

Figure 2. IACMI Phase 1 Technology Roadmapping Process



IACMI Budget Periods (BP) were used in identifying the timing of specific activities. For clarification, IACMI budget periods are:

- Budget Period 1 (BP1): June 2015 – January 2016 (8 months)
- Budget Period 2 (BP2): February 2016 – January 2017 (12 months)
- Budget Period 3 (BP3): February 2017 – January 2018 (12 months)
- Budget Period 4 (BP4): February 2018 – January 2019 (12 months)
- Budget Period 5 (BP5): February 2019 – May 2020 (16 months)

The following figures show how the technical activities that were deemed to be high priorities for IACMI Budget Period 2 (2016) will develop over the coming five years. The figures are organized around major research focus area: vehicles, wind energy, compressed gas storage, materials development, and modeling and simulation. These timelines can guide near-term IACMI decisions regarding technology-specific R&D activities by identifying the highest-priority activities that require action in BP2. Further, these timelines also show how BP2 investments will lead to milestones and, ultimately, the five-year IACMI technical objectives:

- 25% reduction in carbon fiber reinforced polymer (CFRP) cost
- 50% reduction in CFRP embodied energy
- 80% recyclability of fiber-reinforced composites

It is important to note that while select R&D activities have been identified as priorities for BP2, the full list of technical needs is presented in the survey results in Appendix C. These activities, modified from the list provided in the draft IACMI five-year technical plan, represent activities that may be pursued by IACMI to accomplish the technical targets described above. Certain activities in the full list may not be identified as priorities for BP2 but may still be critical to IACMI's success in the medium term.

Figure 3. Timeline of Technical Activities and Milestones in Vehicles Application Area

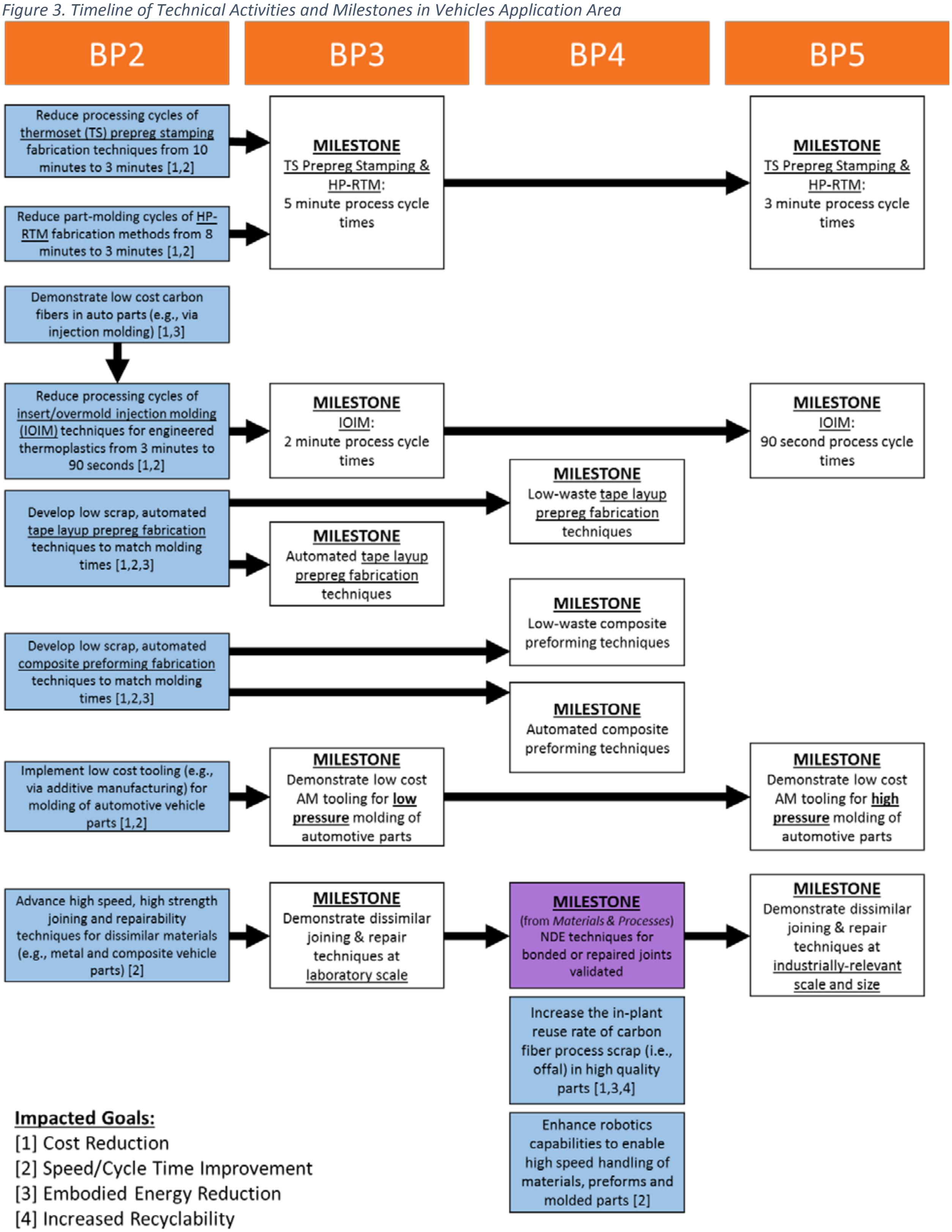


Figure 4. Timeline of Technical Activities and Milestones in Wind Turbines Application Area

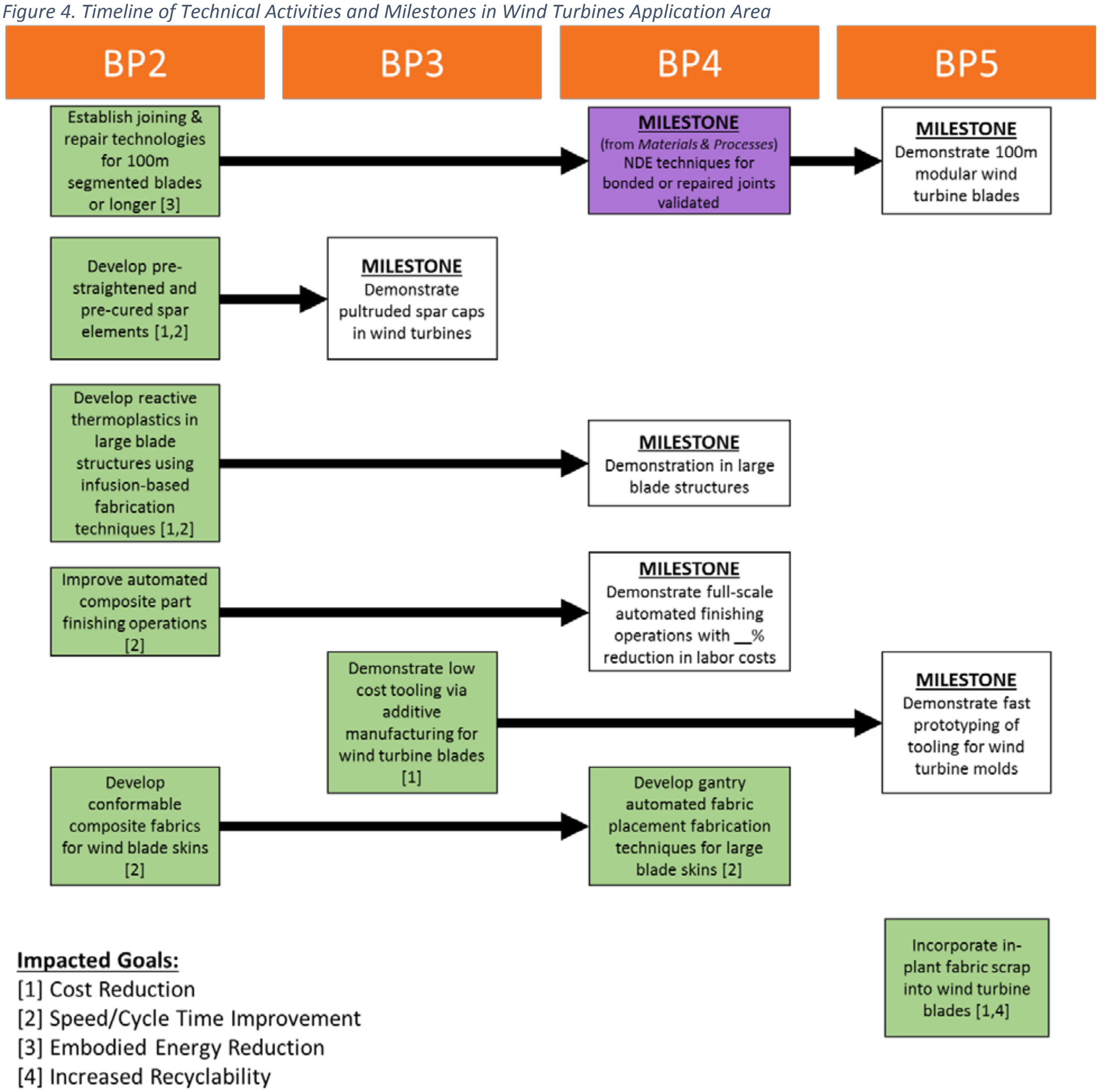
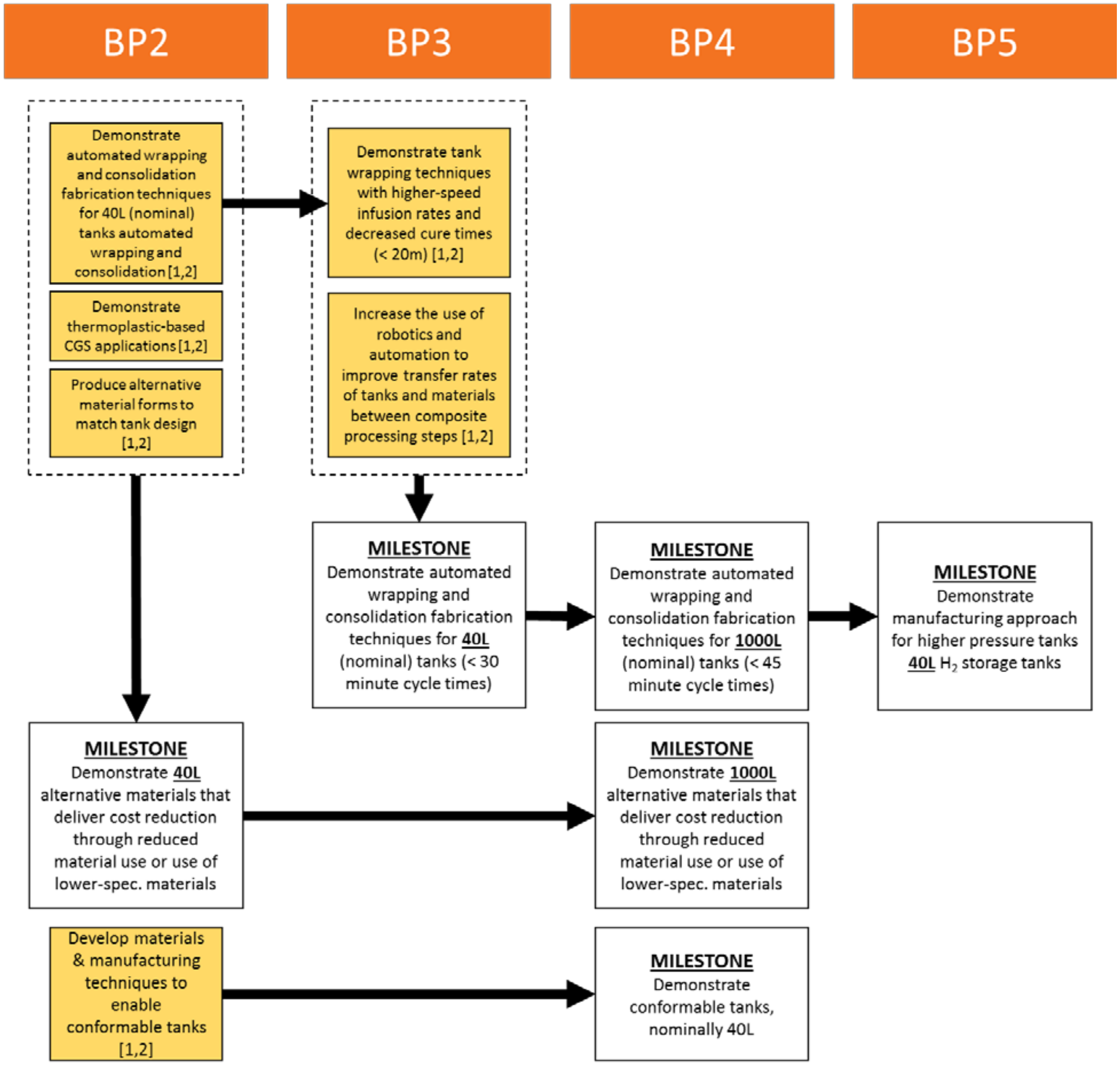


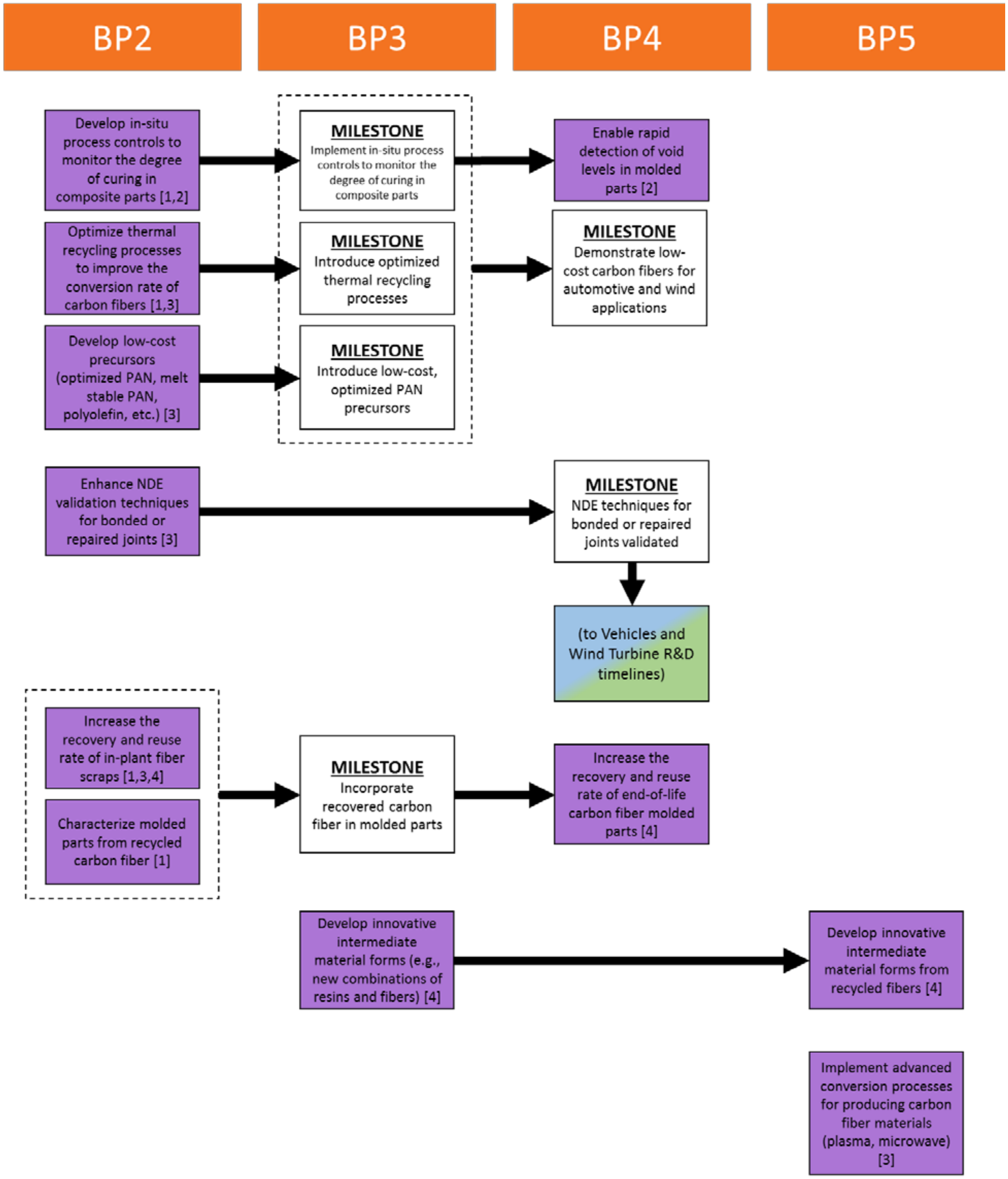
Figure 5. Timeline of Technical Activities and Milestones in Compressed Gas Storage Application Area



Impacted Goals:

[1] Cost Reduction
[2] Speed/Cycle Time Improvement
[3] Embodied Energy Reduction
[4] Increased Recyclability

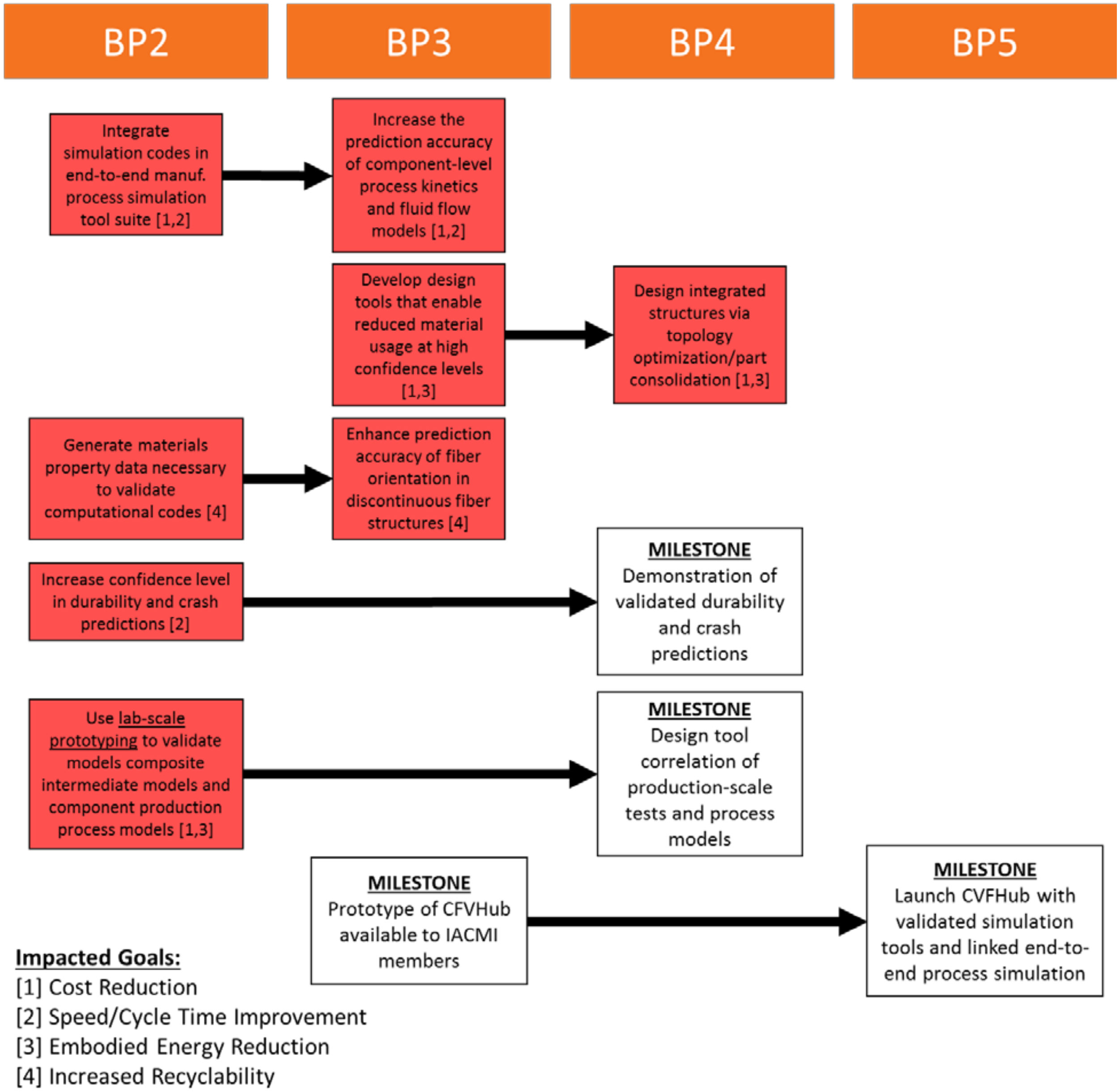
Figure 6. Timeline of Technical Activities and Milestones in Materials & Processes Application Area



<u>Impacted Goals:</u>

[1] Cost Reduction
[2] Speed/Cycle Time Improvement
[3] Embodied Energy Reduction
[4] Increased Recyclability

Figure 7. Timeline of Technical Activities and Milestones in Modeling & Simulation Application Area



Appendix A: Literature Review

The following table summarizes the findings of the accelerated Phase 1 literature review in which 8 of the 66 literature sources with direct relevance to IACMI's scope and focus are cross-referenced to IACMI's Phase 1 potential technical activities. Each row—organized by technology area—portrays the literature sources that have identified similar technical activities as IACMI.

Table 1. Comparison of IACMI Technical Activities with Relevant Literature Sources

IACMI Technology Area and Innovation	ACC Roadmap	DOE VTO Trucks and Heavy Duty	DOE VTO Light Duty	DOE MTT Roadmap	DOE VTO Annual Report	DOE FRPC Workshop Report	[WIND] DOE: 20% BY 2030	[WIND] UMASS: Wind Workshop Report
Vehicles Technology Area								
Generate fast-processing resins with internal mold release for RTM and stamping						X		X
Develop low scrap, automated composite preforming fabrication techniques to match molding times						X		X
Develop low scrap, automated tape layup prepreg fabrication techniques to match molding times								
Reduce part-molding cycles of RTM fabrication methods from 8 minutes to 3 minutes	X					X		
Reduce processing cycles of thermoset prepreg stamping fabrication techniques from 10 minutes to 3 minutes	X					X		
Reduce processing cycles of thermoplastic prepreg stamping fabrication techniques from 7 minutes to 3 minutes	X					X		
Reduce processing cycles of injection overmolding fabrication techniques for engineered thermoplastics from 3 minutes to 90 seconds	X				X	X		
Demonstrate low cost carbon fibers in automotive part applications	X		X	X				
Increase the in-plant reuse rate of carbon fiber process scrap in high quality parts	X			X				
Advance high speed, high strength joining techniques for dissimilar materials (e.g., metal and composite vehicle parts)	X	X	X	X		X		
Enhance robotics capabilities to enable high speed handling of materials, preforms and molded parts			X			X		
Implement low cost tooling (e.g., via additive manufacturing) for molding of automotive vehicle parts			X					
Increase recovery and reuse rates of end-of-life carbon fiber parts	X	X		X				
Develop discontinuous carbon fiber reinforced thermoset/thermoplastic processing	X							
Develop NDE validation techniques for fiber-based architectures (vehicles, wind, CGS)	X			X				X

IACMI Technology Area and Innovation	ACC Roadmap	DOE VTO Trucks and Heavy Duty	DOE VTO Light Duty	DOE MTT Roadmap	DOE VTO Annual Report	DOE FRPC Workshop Report	[WIND] DOE: 20% BY 2030	[WIND] UMASS: Wind Workshop Report
Implement in-situ process controls to monitor the degree of curing in composite parts (vehicles, wind, CGS)								
Enable rapid detection of void levels in molded parts (vehicles, wind, CGS)								X
Enhance NDE validation techniques for bonded joints (vehicles, wind)	X	X	X	X		X		X
High volume manufacturing	X	X	X	X				
Supplier capability/supply chain alignment	X			X				
Wind Turbine Technology Area								
Develop low temperature reactive thermoplastic chemistries								
Demonstrate reactive thermoplastics in large blade structures using infusion-based fabrication techniques								
Introduce pre-straightened and pre-cured spar elements including spar caps								
Develop conformable composite fabrics for wind blade skins								
Develop gantry automated fabric placement fabrication techniques for large blade skins								X
Integrate automated NDE techniques into large, in-mold processed wind turbine blade skins								X
Demonstrate automated composite part finishing operations								X
Demonstrate improved control of bond gaps in composites to increase the reliability of wind turbine blades								
Establish joining technologies for 100m segmented blades or longer								
Incorporate in-plant fabric scrap into wind turbine blades								
Improve the recycling rate of end-of-life composite wind blades in useful product applications								X
Demonstrate low cost tooling via additive manufacturing for wind turbine blades								
Pursue weight and cost reductions for other wind turbine components via composites							X	
Develop NDE validation techniques for fiber-based architectures (vehicles, wind, CGS)								X
Implement in-situ process controls to monitor the degree of curing in composite parts (vehicles, wind, CGS)								

IACMI Technology Area and Innovation	ACC Roadmap	DOE VTO Trucks and Heavy Duty	DOE VTO Light Duty	DOE MTT Roadmap	DOE VTO Annual Report	DOE FRPC Workshop Report	[WIND] DOE: 20% BY 2030	[WIND] UMASS: Wind Workshop Report
Enable rapid detection of void levels in molded parts (vehicles, wind, CGS)								X
Enhance NDE validation techniques for bonded joints (vehicles, wind)						X		X
CGS Technology Area								
Generate fast-cure resins that are suitable for compressed gas storage (CGS) vessels						X		X
Produce alternative material forms (e.g., braided composite fabrics) to match tank design requirements								
Demonstrate automated wrapping and consolidation fabrication techniques for 40L (nominal) tanks automated wrapping and consolidation								
Demonstrate tank wrapping techniques with higher-speed infusion rates and decreased cure times (<20 minutes)								
Demonstrate automated wrapping and consolidation techniques for 1000L (nominal) tanks								
Increase the use of robotics and automation to improve transfer rates of tanks and materials between composite processing steps								
Introduce low cost carbon fiber with high tensile strength								
Develop low cost H2 storage tanks design for pressures of 700 bar								
Advance filament winding fabrication methods to increase the manufacturing cycle time of CGS tanks								
Develop manufacturing techniques/materials to enable conformable tanks								
Demonstrate thermoplastic-based CGS applications								
Develop NDE validation techniques for fiber-based architectures (vehicles, wind, CGS)								X
Implement in-situ process controls to monitor the degree of curing in composite parts (vehicles, wind, CGS)								
Enable rapid detection of void levels in molded parts (vehicles, wind, CGS)								X
Materials and Processes Technology Area								
Develop low-cost precursors (optimized PAN, melt stable PAN, polyolefin, etc.)		X	X	X	X			
Lab-scale prototyping of composite intermediates and component production processes								
Optimized thermal recycling processes to improve the conversion rate of carbon fibers	X			X				

IACMI Technology Area and Innovation	ACC Roadmap	DOE VTO Trucks and Heavy Duty	DOE VTO Light Duty	DOE MTT Roadmap	DOE VTO Annual Report	DOE FRPC Workshop Report	[WIND] DOE: 20% BY 2030	[WIND] UMASS: Wind Workshop Report
Implement advanced conversion processes for producing carbon fiber materials (plasma, microwave)	X	X	X	X	X			
Increase the recovery and reuse rate of in-plant fiber scraps	X			X				
Increase the recovery and reuse rate of end-of-life carbon fiber parts	X			X				
Develop NDE validation techniques for fiber-based architectures (vehicles, wind, CGS)	X			X				X
Implement in-situ process controls to monitor the degree of curing in composite parts (vehicles, wind, CGS)								
Enable rapid detection of void levels in molded parts (vehicles, wind, CGS)								X
Enhance NDE validation techniques for bonded joints (vehicles, wind)	X		X	X		X		X
Characterize molded parts made from recycled carbon fiber								
Develop innovative intermediate material forms (e.g., new combinations of resins and fibers)	X					X		
Develop external/alternative thermal cure (e.g., microwave, magnetic field, induction heating, spot/in-situ with fiber steering)						X		
Develop non-thermal cures (e.g., photodynamic, ultraviolet, moisture) for carbon fiber composites						X		
Develop CF/glass hybrid systems	X		X					
Develop novel glass fibers (e.g. nano)			X					
Develop improved interface bonding	X	X						
Modeling and Simulation Technology Area								
Design integrated structures via topology optimization/part consolidation	X			X				
Develop design tools that enable reduced material usage at high confidence levels				X		X		
Increase the prediction accuracy of computationally modeled reaction kinetics to reduce cycle times	X							
Enhance prediction accuracy of fiber orientation in continuous fiber structures	X				X			X
Enhance prediction accuracy of fiber orientation in discontinuous fiber structures	X							X
Increase confidence in correlation of durability and crash performance predictions	X	X		X	X	X		
Integrate simulation codes in an end-to-end manufacturing process simulation tool suite	X							

IACMI Technology Area and Innovation	ACC Roadmap	DOE VTO Trucks and Heavy Duty	DOE VTO Light Duty	DOE MTT Roadmap	DOE VTO Annual Report	DOE FRPC Workshop Report	[WIND] DOE: 20% BY 2030	[WIND] UMASS: Wind Workshop Report
Incorporate an optimization routine in an end-to-end manufacturing process simulation tool suite								
Generate materials property data necessary to validate computational codes	X	X				X		
Develop product life-cycle models	X					X		
Use lab-scale prototyping to validate models composite intermediate models and component production process models								

Representative Roadmaps Analyzed

1. ACC (American Chemistry Council). March 2014. *Plastics and Polymer Composites Technology Roadmap for Automotive Markets*.
2. DOE EERE (U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy). 2013. *WORKSHOP REPORT: Trucks and Heavy-Duty Vehicles Technical Requirements and Gaps for Lightweight and Propulsion Materials*.
3. DOE EERE (U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy). 2013. *WORKSHOP REPORT: Light-Duty Vehicles Technical Requirements and Gaps for Lightweight and Propulsion Materials*.
4. DOE USCAR (U.S. Department of Energy, United States Council for Automotive Research). 2013. *U.S. DRIVE Materials Technical Team Roadmap*.
5. DOE VTO (U.S. Department of Energy, Vehicle Technologies Office). 2014. *2014 Annual Merit Review*.
6. DOE EERE (U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy). January 13, 2014. *Fiber Reinforced Polymer Composite Manufacturing Workshop: Summary Report*.
7. DOE (U.S. Department of Energy). 2008. *20% Wind Energy by 2030*.
8. University of Massachusetts, Lowell. September 22-23, 2011. *Wind Energy Research Workshop Final Report: Identifying Research Gaps and Future Directions*.

An exhaustive list of references (not shown) were sourced within each technology area.

Appendix B: Expert Interviews

IACMI technical leadership identified relevant global experts in the respective markets and in related composites activities. In the time frame allotted, Nexight Group conducted one-on-one telephone interviews with IACMI and non-IACMI experts in a broad range of composites technologies.

Phase 1 General Interview Findings

1. Interviewees generally agreed IACMI is focused on the right technical gap and R&D activities needed to achieve its five-year technical targets.
2. Interviewees agreed that the IACMI's five-year technical goals are intimately linked.
3. Regarding technology readiness level, several interviewees thought
    - 3.1. 25% lower carbon fiber-reinforced polymer (CFRP) cost is a reasonable target.
    - 3.2. The target of 50% reduction in CFRP embodied energy is achievable but aggressive in general.
    - 3.3. There is concern about the reality of the goal 80% composite recyclability into useful products.
4. Interviewees were split when asked whether achieving the five-year targets would result in significant changes in end-user adoption of fiber-reinforced composites.
5. Several interviewees emphasized the important role of IACMI can play in building a U.S.-based network, infrastructure, and supply chain of companies in the composite manufacturing sector.

Appendix C: Online Survey

Nexight Group prepared a survey asking IACMI members and interested parties to assess the impact IACMI could make if successful in addressing the R&D needs outlined in the IACMI Five-Year Technical Plan. The survey was sent to more than 800 email addresses on September 8, 2015. The findings below represent feedback from 109 responses. The survey used a sliding scale with "5" being the highest value assigned. Table 2 provides a summary of the IACMI survey respondents. Tables 3 to 7 summarize the impact ratings of the technical activities on IACMI goals in the vehicles, wind, compressed gas storage, materials & processes, and the modeling & simulation area.

Table 2. Summary of IACMI Survey Respondents

	Respondents by Area of Work
Vehicles	49%
Wind Turbines	25%
Compressed Gas Storage	24%
Materials and Processes	87%
Modeling and Simulation	36%
Total Respondents	**109**

Table 3. Impact Ratings of Activities on IACMI Goals: Vehicles

Vehicles	Average Rating	Total Responses
Demonstrate low cost carbon fibers in automotive part applications	4.49	70
Advance high speed, high strength joining techniques for dissimilar materials (e.g., metal and composite vehicle parts)	4.10	73
Develop low scrap, automated composite preforming fabrication techniques to match molding times	4.04	70
Reduce part-molding cycles of RTM fabrication methods from 8 minutes to 3 minutes	3.91	64
Reduce processing cycles of thermoplastic prepreg stamping fabrication techniques from 7 minutes to 3 minutes	3.88	66
Develop discontinuous carbon fiber reinforced thermoset/thermoplastic processing	3.84	68
Generate fast-processing resins with internal mold release for RTM and stamping	3.83	66
Reduce processing cycles of thermoset prepreg stamping fabrication techniques from 10 minutes to 3 minutes	3.78	65
Reduce processing cycles of injection overmolding fabrication techniques for engineered thermoplastics from 3 minutes to 90 seconds	3.76	66
Increase the in-plant reuse rate of carbon fiber process scrap in high quality parts	3.64	69
Develop low scrap, automated tape layup prepreg fabrication techniques to match molding times	3.62	71
Develop NDE validation techniques for fiber-based architectures	3.52	67
Enhance NDE validation techniques for bonded joints	3.51	68
Increase recovery and reuse rates of end-of-life carbon fiber parts	3.47	73
Enable rapid detection of void levels in molded parts	3.42	69
Enhance robotics capabilities to enable high speed handling of materials, preforms and molded parts	3.41	70
Implement low cost tooling (e.g., via additive manufacturing) for molding of automotive vehicle parts	3.37	71
Implement in-situ process controls to monitor the degree of curing in composite parts	3.21	67

Table 4. Impact Ratings of Activities on IACMI Goals: Wind Turbines

Wind Turbines	Average Rating	Total Responses
Establish joining technologies for 100m segmented blades or longer	4.18	34
Pursue weight and cost reductions for other wind turbine components via composites	3.89	35
Demonstrate reactive thermoplastics in large blade structures using infusion-based fabrication techniques	3.67	33
Develop low temperature reactive thermoplastic chemistries	3.64	33
Introduce pre-straightened and pre-cured spar elements including spar caps	3.61	31
Develop NDE validation techniques for fiber-based architectures	3.58	33
Demonstrate improved control of bond gaps in composites to increase the reliability of wind turbine blades	3.54	35
Improve the recycling rate of end-of-life composite wind blades in useful product applications	3.53	36
Enhance NDE validation techniques for bonded joints	3.51	35
Implement in-situ process controls to monitor the degree of curing in composite parts	3.50	34
Develop conformable composite fabrics for wind blade skins	3.42	33
Demonstrate automated composite part finishing operations	3.41	34
Integrate automated NDE techniques into large, in-mold processed wind turbine blade skins	3.40	35
Enable rapid detection of void levels in molded parts	3.32	34
Demonstrate low cost tooling via additive manufacturing for wind turbine blades	3.29	35
Develop gantry automated fabric placement fabrication techniques for large blade skins	3.21	34
Incorporate in-plant fabric scrap into wind turbine blades	3.11	35

Table 5. Impact Ratings of Activities on IACMI Goals: Compressed Gas Storage

Compressed Gas Storage	Average Rating	Total Responses
Introduce low cost carbon fiber with high tensile strength	4.36	33
Produce alternative material forms (e.g., braided composite fabrics) to match tank design requirements	3.88	33
Advance filament winding fabrication methods to increase the manufacturing cycle time of CGS tanks	3.87	30
Demonstrate automated wrapping and consolidation fabrication techniques for 40L (nominal) tanks automated wrapping and consolidation	3.84	31
Demonstrate tank wrapping techniques with higher-speed infusion rates and decreased cure times (<20 minutes)	3.81	31
Develop manufacturing techniques/materials to enable conformable tanks	3.73	33
Develop low cost H2 storage tanks design for pressures of 700 bar	3.72	32
Generate fast-cure resins that are suitable for compressed gas storage (CGS) vessels	3.66	29
Develop NDE validation techniques for fiber-based architectures	3.59	32
Demonstrate automated wrapping and consolidation techniques for 1000L (nominal) tanks	3.59	29
Increase the use of robotics and automation to improve transfer rates of tanks and materials between composite processing steps	3.57	30
Enable rapid detection of void levels in molded parts	3.56	32
Demonstrate thermoplastic-based CGS applications	3.52	31
Implement in-situ process controls to monitor the degree of curing in composite parts	3.24	29

Table 6. Impact Ratings of Activities on IACMI Goals: Materials & Processes

Materials and Processes	Average Rating	Total Responses
Develop low-cost precursors (optimized PAN, melt stable PAN, polyolefin, etc.)	4.20	87
Develop innovative intermediate material forms (e.g., new combinations of resins and fibers)	4.13	92
Implement advanced conversion processes for producing carbon fiber materials (plasma, microwave)	3.74	86
Enhance NDE validation techniques for bonded joints	3.70	87
Lab-scale prototyping of composite intermediates and component production processes	3.62	90
Develop NDE validation techniques for fiber-based architectures	3.50	82
Enable rapid detection of void levels in molded parts	3.50	88
Increase the recovery and reuse rate of end-of-life carbon fiber parts	3.49	88
Increase the recovery and reuse rate of in-plant fiber scraps	3.47	86
Optimized thermal recycling processes to improve the conversion rate of carbon fibers	3.45	83
Implement in-situ process controls to monitor the degree of curing in composite parts	3.41	83
Characterize molded parts made from recycled carbon fiber	3.40	90

Table 7. Impact Ratings of Activities on IACMI Goals: Modeling & Simulation

Modeling and Simulation	Average Rating	Total Responses
Generate materials property data necessary to validate computational codes	4.38	61
Use lab-scale prototyping to validate models composite intermediate models and component production process models	4.23	60
Develop design tools that enable reduced material usage at high confidence levels	4.17	59
Increase confidence in correlation of durability and crash performance predictions	4.02	53
Increase the prediction accuracy of computationally modeled reaction kinetics to reduce cycle times	3.84	56
Design integrated structures via topology optimization/part consolidation	3.83	53
Enhance prediction accuracy of fiber orientation in discontinuous fiber structures	3.79	58
Enhance prediction accuracy of fiber orientation in continuous fiber structures	3.76	58
Integrate simulation codes in an end-to-end manufacturing process simulation tool suite	3.75	56
Develop product life-cycle models	3.75	60
Incorporate an optimization routine in an end-to-end manufacturing process simulation tool suite	3.62	55

IACMI Phase 2 Technology Roadmapping Update

An essential mechanism for gathering input to IACMI's technology roadmapping efforts involves a series of expert interviews with charter and premium IACMI members, and other thought leaders in the area of fiber-reinforced polymer composites manufacturing and application. These interviews inform technology roadmapping efforts by offering insight into the current the state of composites manufacturing, primary fiber production, composite formation, and end-product processing as well as design and modeling for polymer-matrix materials with either carbon- or glass-fiber reinforcement.

Nexight Group is actively conducting expert interviews in Phase 2 to ensure the IACMI Technology Roadmap satisfies industry's growing R&D needs in pursuit of the five-year technical objectives. These Phase 2 interviews not only provide an effective means of soliciting feedback on the results of the Phase 1 preliminary roadmap, but also help to identify technical activities or topics areas that are new or underemphasized.

IACMI will hold topic specific targeted workshops in March and May 2016. Please visit the www.iacmi.org site frequently for details.