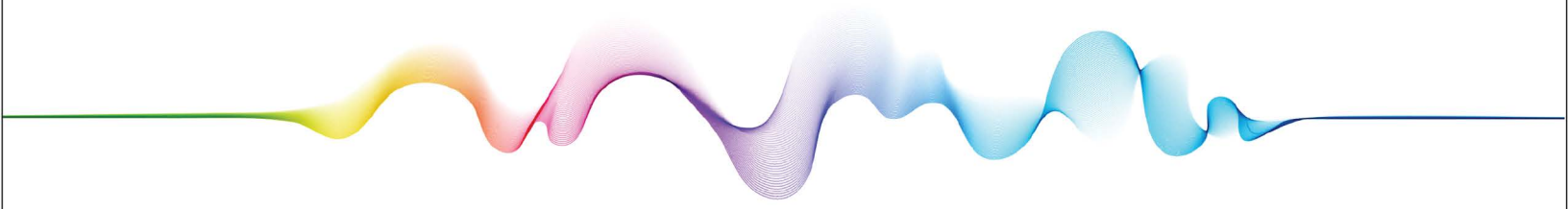
INSIGHT REPORT

AN OVERVIEW OF SUSTAINABLE TRANSPORTATION IN SUPPORT OF REDUCED CARBON EMISSIONS



TAG

CLIMATE SCIENCE

An Overview of Sustainable Transportation in Support of Reduced Carbon Emissions

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Introduction

This TAG Insights Report focuses on sustainable transportation with an overview of the prospects in the most important areas of this major area of climate mitigation. It also includes a representative listing of startups, commercial vendors, and established companies working in each area, all with the goal if supporting reduced carbon emissions while also providing excellent value for customers.

It should go without saying that this report is predicated on the assumption that *all vehicles* are moving in the direction of electric operation and that this goal will eventually be reached. This implies that the question is not whether electric vehicles will be our primary means for transportation, but rather when this occurs. It is acknowledged that major political and business interests are not aligned with this assumption, but this is our view at TAG Infosphere.

As with all of our Insights Reports, this report is also intended for general use, but readers are welcomed to connect with TAG for information on the private Research as a Service (RaaS) community that covers these topics in more depth and includes a wider range of startups, vendors, and companies.

Overview of Sustainable Transportation

Sustainable transportation encompasses various strategies and technologies aimed at reducing global carbon emissions. This multifaceted approach involves EV charging infrastructure,

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sustainable urban mobility solutions, fleet electrification services, alternative fuel technologies, and EV battery recycling and repurposing, each playing a crucial role in achieving this goal.

1. Electric Vehicle (EV) Charging Infrastructure: The development of an extensive and efficient EV charging network is pivotal in promoting the adoption of electric vehicles. A well-distributed network ensures that EV owners can conveniently charge their vehicles, reducing reliance on fossil fuel-powered vehicles. As a result, this infrastructure facilitates the transition to lower-carbon transportation.
2. Sustainable Urban Mobility Solutions: Sustainable urban mobility solutions, such as public transportation, biking lanes, and pedestrian-friendly infrastructure, encourage alternatives to private car ownership. These options decrease the number of vehicles on the road and subsequently lower carbon emissions. Additionally, the integration of digital technologies in urban transportation systems enhances efficiency and reduces congestion, further mitigating emissions.
3. Fleet Electrification Services: Businesses and organizations operating vehicle fleets can significantly impact carbon emissions by transitioning to electric vehicles. Fleet electrification services offer solutions such as electric vehicle leasing, maintenance, and charging infrastructure management, making it easier for fleets to switch to cleaner transportation options.
4. Alternative Fuel Technologies: Beyond electric vehicles, alternative fuel technologies, like hydrogen fuel cells and compressed natural gas (CNG), provide alternatives to traditional gasoline and diesel. These technologies can be employed in various modes of transportation, including buses, trucks, and ships, reducing emissions from these sources.
5. EV Battery Recycling and Repurposing: Electric vehicle batteries have a finite lifespan, but their components can be recycled and repurposed, reducing waste and environmental impact. Recycling processes recover valuable materials like lithium, cobalt, and nickel, which can be used in the production of new batteries. Repurposing retired EV batteries for stationary energy storage applications prolongs their useful life and reduces the need for new battery production.

Sustainable transportation strategies collectively contribute to the global goal of reducing carbon emissions. The establishment of an extensive EV charging infrastructure supports the transition to electric vehicles, while sustainable urban mobility solutions and fleet electrification services offer alternatives to conventional transportation modes. Alternative fuel technologies expand the options for cleaner transportation, and EV battery recycling and repurposing minimize the environmental impact of battery disposal.

Market Prospects for Sustainable Transportation

The market prospects for startups and vendors in the field of sustainable transportation, encompassing EV charging infrastructure, sustainable urban mobility solutions, fleet electrification services, alternative fuel technologies, and EV battery recycling and repurposing, are promising. These businesses must align their strategies to contribute to reduced global

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carbon emissions while simultaneously offering a compelling value proposition to customers, independent of their sustainability objectives.

1. EV Charging Infrastructure: The market for EV charging infrastructure is growing rapidly as electric vehicle adoption continues to rise. Startups and vendors in this space can capitalize on the increasing demand for charging solutions by providing scalable and efficient charging networks. A focus on fast-charging technology, user-friendly interfaces, and network reliability can attract customers seeking convenient and reliable charging options, irrespective of their commitment to carbon reduction.
2. Sustainable Urban Mobility Solutions: In the realm of sustainable urban mobility solutions, startups and vendors can cater to the growing need for efficient transportation within cities. By offering advanced mobility platforms, ride-sharing services, and integrated ticketing systems, they can enhance the overall transportation experience for users. Providing seamless, cost-effective, and time-saving solutions appeals to urban dwellers, irrespective of their environmental concerns.
3. Fleet Electrification Services: Businesses specializing in fleet electrification services have a substantial market opportunity, especially as commercial fleets seek to reduce operational costs and emissions. Offering comprehensive fleet management solutions, including vehicle maintenance, charging infrastructure installation, and data-driven optimization, can attract fleet operators looking to transition to electric vehicles for financial and environmental benefits.
4. Alternative Fuel Technologies: Startups and vendors in the alternative fuel technologies sector can target industries beyond transportation, such as power generation and industrial processes. Hydrogen fuel cells and CNG technologies, for example, can be positioned as reliable, efficient, and cost-effective energy sources, appealing to a broader range of customers looking for sustainable energy solutions.
5. EV Battery Recycling and Repurposing: The market for EV battery recycling and repurposing is gaining momentum as the number of retired electric vehicle batteries increases. Companies in this space can offer battery refurbishment services, repurposing old batteries for stationary energy storage or grid support. This approach not only supports sustainability goals but also provides economical energy storage solutions for utilities and businesses.

Startups and vendors in sustainable transportation have significant growth prospects. To succeed, they must develop technical solutions that align with the global carbon emissions reduction agenda while also creating value propositions for customers independent of sustainability objectives. By focusing on technological innovation, cost efficiency, convenience, and reliability, these businesses can tap into a broader customer base, driving both environmental and economic benefits.

Focus Area: EV Charging Infrastructure

EV charging infrastructure comprises a network of devices and systems designed to supply electric power to electric vehicles (EVs). It serves as the crucial interface between the power

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grid and EVs, enabling their efficient charging. Charging infrastructure typically consists of three main components:

1. Charging Stations: Charging stations, also known as Electric Vehicle Supply Equipment (EVSE), are the physical units where EVs connect to receive electrical power. These stations come in various forms, including Level 1, Level 2, and DC fast chargers. Level 1 chargers use standard household outlets, Level 2 chargers provide higher power through dedicated installations, and DC fast chargers offer rapid charging at higher voltages.
2. Power Electronics: Power electronics devices, such as inverters and rectifiers, play a vital role in converting the alternating current (AC) from the grid to direct current (DC) suitable for charging EV batteries. DC fast chargers have more sophisticated power electronics to deliver high-power charging.
3. Communication and Control Systems: These systems manage the interaction between the charging station and the EV. They authenticate users, monitor charging status, control power delivery, and facilitate payment processing.

Startups and vendors can enter the EV charging infrastructure business by following these technical steps:

1. Site Selection: Identify strategic locations for charging stations based on factors such as population density, EV adoption rates, and proximity to major highways and urban centers.
2. Station Deployment: Install charging stations with the appropriate power levels, considering the target user base. Level 2 stations are suitable for urban and residential areas, while DC fast chargers are ideal for highways and high-traffic locations.
3. Network Connectivity: Implement communication and control systems to enable users to access and interact with charging stations. This includes user authentication, payment processing, and real-time monitoring. It is worth reinforcing the security aspect of this network of stations. EVs are increasingly just computers, so EV infrastructure networks involve basically hooking up these large powerful EV computers to a massively distributed network with many nodes. The security implications are significant.
4. Grid Connection: Ensure a reliable connection to the electrical grid, considering factors like power capacity and grid stability. Implement smart grid integration to optimize energy usage.
5. Maintenance and Support: Develop maintenance protocols and provide customer support to ensure the reliability and usability of charging stations.
6. Business Models: Establish revenue models, such as pay-per-use, subscription-based, or partnerships with businesses, to generate income from charging services.

By addressing these technical aspects, startups and vendors can enter the EV charging infrastructure market, contributing to the expansion of sustainable transportation and the adoption of electric vehicles.

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Focus Area: Sustainable Urban Mobility Solutions

Sustainable urban mobility solutions encompass a range of technical strategies aimed at optimizing transportation within urban areas while minimizing environmental impact and congestion. These solutions involve the integration of various modes of transportation and advanced technologies. Key components of sustainable urban mobility solutions include:

1. Public Transportation Systems: Developing efficient and eco-friendly public transportation systems, such as buses, trams, subways, and commuter trains, to move a large number of passengers within cities.
2. Biking and Walking Infrastructure: Creating dedicated lanes and pathways for cyclists and pedestrians, reducing the reliance on cars for short-distance travel.
3. Ridesharing and Carpooling: Facilitating platforms and services that encourage ridesharing and carpooling, optimizing vehicle usage and reducing the number of vehicles on the road.
4. Micro-Mobility Solutions: Introducing electric scooters, shared bikes, and other small-scale transportation options to provide flexible and sustainable urban mobility.
5. Smart Traffic Management: Implementing advanced traffic management systems that use real-time data and algorithms to optimize traffic flow and reduce congestion.
6. Digital Platforms: Developing mobile apps and digital platforms that enable users to plan and pay for multi-modal transportation options seamlessly.
7. Startups and vendors can enter the sustainable urban mobility solutions market through several technical avenues:
8. Transportation-as-a-Service (TaaS) Platforms: Create platforms that aggregate various transportation options (public transit, ridesharing, micro-mobility) into a single, integrated service, allowing users to plan and pay for their entire journey.
9. Last-Mile Solutions: Develop technologies and services that address the "last mile" problem, enabling users to reach their destinations from transit hubs efficiently. This can include electric scooters, e-bikes, or on-demand shuttles.
10. Data Analytics and Predictive Models: Provide data-driven solutions to municipalities and transportation authorities for optimizing traffic management, route planning, and resource allocation.
11. Smart Parking Solutions: Create systems that help drivers find available parking spaces, reducing the time spent searching for parking and, consequently, traffic congestion.
12. Charging Infrastructure for Electric Micro-Mobility: Develop charging solutions for electric scooters and bikes to ensure they are always ready for use.

By addressing these technical aspects and collaborating with urban planners and authorities, and it should be acknowledged that officials from smaller municipalities, townships, and even more rural areas might be just as interested, startups and vendors can contribute to the realization of sustainable urban mobility solutions that enhance transportation efficiency and reduce the environmental impact of urban travel.

Focus Area: Fleet Electrification Services

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Fleet electrification services involve the transition of commercial vehicle fleets from traditional internal combustion engine (ICE) vehicles to electric vehicles (EVs) or hybrid electric vehicles (HEVs). This technical shift aims to reduce operational costs and environmental impact while maintaining or improving the overall performance and functionality of fleet operations. Fleet electrification services typically cover the following areas:

1. Vehicle Selection and Integration: Startups and vendors assist fleet operators in selecting appropriate EV or HEV models based on operational requirements and routes. They ensure seamless integration of electric vehicles into existing fleets.
2. Charging Infrastructure Deployment: Fleet electrification requires the establishment of charging infrastructure tailored to the specific needs of the fleet. This involves designing and deploying charging stations at depots or strategic locations.
3. Fleet Management Systems: Implementing fleet management systems that monitor vehicle performance, location, battery health, and charging status. These systems optimize routes and schedules to maximize efficiency and minimize downtime.
4. Battery Management: Managing the health and maintenance of EV batteries to ensure longevity and performance. This includes battery monitoring, diagnostics, and, if needed, replacement or recycling.
5. Financial Modeling: Developing financial models that analyze the total cost of ownership (TCO) for electric vehicles compared to ICE vehicles, considering factors such as purchase costs, fuel savings, maintenance, and incentives.
6. Maintenance and Support: Offering maintenance and support services that address the unique requirements of electric vehicles, including software updates, battery maintenance, and repairs.

Startups and vendors can enter the fleet electrification services market by focusing on these aspects:

1. Vehicle Consultation and Procurement: Help fleet operators assess their needs, select suitable EVs or HEVs, and negotiate vehicle procurement contracts.
2. Charging Infrastructure Solutions: Provide turnkey solutions for charging infrastructure deployment, including station installation, grid integration, and maintenance.
3. Fleet Management Software: Develop or offer fleet management software that optimizes EV fleet operations, tracks performance, and offers predictive maintenance capabilities.
4. Battery Services: Specialize in battery monitoring, maintenance, and replacement services, ensuring the longevity and reliability of EV batteries.
5. Training and Education: Offer training and educational programs for fleet operators and drivers to maximize the benefits of EVs and ensure safe and efficient operation.

By addressing these technical considerations, startups and vendors can enter the fleet electrification services market, assisting commercial fleet operators in transitioning to electric vehicles and contributing to reduced emissions and operational cost savings.

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Focus Area: Alternative Fuel Technologies

Alternative fuel technologies involve the development and utilization of non-conventional energy sources and fuels to power various modes of transportation. These technologies aim to reduce greenhouse gas emissions and dependence on fossil fuels. Alternative fuels typically include hydrogen, natural gas, propane, and biofuels. Key aspects of alternative fuel technologies include:

1. Fuel Production: Startups and vendors can focus on producing alternative fuels through processes such as steam methane reforming for hydrogen, biomethane production from organic waste, or biofuel production from crops or waste materials.
2. Fuel Storage and Transportation: Developing infrastructure for the safe storage and transportation of alternative fuels is critical. This includes high-pressure hydrogen storage systems, natural gas pipelines, or specialized tanks for propane and biofuels.
3. Engine and Vehicle Conversion: Retrofitting or manufacturing vehicles that are compatible with alternative fuels is essential. This involves modifying internal combustion engines or designing fuel cells for hydrogen-powered vehicles.
4. Refueling Infrastructure: Establishing refueling stations or filling stations for alternative fuels, ensuring accessibility for users and efficient fuel delivery.
5. Fuel Distribution: Creating distribution networks to supply alternative fuels to end-users, including commercial fleets, transit agencies, and individual consumers.
6. Emission Control and Compliance: Ensuring that vehicles using alternative fuels meet emission standards and regulatory requirements.

Startups and vendors can enter the alternative fuel technology market by focusing on the following technical areas:

1. Fuel Production Technologies: Develop innovative processes for producing alternative fuels that are cost-effective, sustainable, and scalable.
2. Fuel Conversion and Engine Technology: Design or retrofit engines and vehicles to utilize alternative fuels efficiently, optimizing performance and emissions.
3. Fueling Infrastructure: Develop and deploy infrastructure solutions such as refueling stations, pipelines, or charging networks for alternative fuels.
4. Vehicle Manufacturing: Produce or retrofit vehicles that are compatible with alternative fuels and meet market demand for various transportation applications.
5. Emission Control Systems: Design and manufacture emission control systems that ensure compliance with environmental regulations for vehicles using alternative fuels.

By addressing these technical considerations, startups and vendors can enter the alternative fuel technology market, providing sustainable and environmentally friendly transportation solutions while reducing reliance on traditional fossil fuels.

Focus Area: EV Battery Recycling and Repurposing

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EV battery recycling and repurposing involve the collection and processing of end-of-life electric vehicle (EV) batteries to extract valuable materials and extend their useful life in secondary applications. This process supports sustainability by reducing waste and the environmental impact of EV battery disposal. Key aspects of EV battery recycling and repurposing include:

1. Battery Collection: Startups and vendors establish collection points to gather used EV batteries from various sources, including scrapped EVs, battery manufacturers, and recycling centers.
2. Battery Disassembly: Batteries are disassembled to access individual battery cells. This may involve removing the outer casing and other components.
3. Cell Testing and Sorting: Battery cells are tested to determine their health and performance characteristics. Cells with remaining capacity are sorted for repurposing, while degraded cells are earmarked for recycling.
4. Repurposing: Healthy battery cells are repurposed for secondary applications such as stationary energy storage systems. These cells are grouped into packs for reuse.
5. Recycling: Cells deemed unsuitable for repurposing are subjected to recycling processes. These processes involve breaking down cells, separating materials (e.g., lithium, cobalt, nickel), and preparing them for reuse in battery production or other industries.
6. Environmental Compliance: Compliance with environmental regulations is essential throughout the recycling process to minimize the environmental impact and ensure safe handling of hazardous materials.

Startups and vendors can enter the EV battery recycling and repurposing business by focusing on the following technical aspects:

1. Battery Assessment and Testing: Develop methods and tools for accurate assessment and testing of battery cells to determine their suitability for repurposing or recycling.
2. Repurposing Technologies: Innovate repurposing technologies that enable the efficient and reliable reuse of healthy battery cells in secondary applications.
3. Recycling Processes: Implement advanced recycling processes that maximize the recovery of valuable materials from degraded battery cells.
4. Circular Economy Solutions: Develop strategies and systems to integrate repurposed and recycled materials back into the EV battery supply chain, promoting a circular economy.
5. Regulatory Compliance: Establish robust protocols for complying with environmental and safety regulations associated with battery recycling and repurposing.

By addressing these technical considerations, startups and vendors can participate in the growing EV battery recycling and repurposing industry, contributing to the sustainability of electric transportation while harnessing the value of end-of-life EV batteries.

Companies and Contributions

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The companies listed below emerged as part of our research at TAG Climate. Our goal in listing these fine firms is to provide a starting point for buyers, advocates, stakeholders, and researchers trying to make sense of the commercial landscape for sustainable transportation as a means for driving toward a more sustainable energy future.

Note that we choose to *not* include the major electric vehicle (EV) manufacturers in this listing because we see that sector as providing the underlying fabric in which these new businesses will operate. Obviously, major manufacturers such as Tesla, Toyota, Ford, General Motors, Mercedes-Benz, Volvo, and many others play a crucial role in the success of the sustainable transportation market.

EV Charging Infrastructure Vendors

1. ABB: ABB offers a range of EV charging solutions, including fast chargers and charging infrastructure management software.
2. Blink Charging: Blink Charging provides EV charging equipment and services, including Level 2 and DC fast charging solutions.
3. ChargePoint: ChargePoint offers a network of electric vehicle charging stations and software solutions for EV charging management.
4. Delta Electronics: Delta Electronics manufactures EV charging infrastructure and energy management solutions.
5. Efacec: Efacec specializes in the development of EV charging infrastructure, including fast chargers and electric vehicle management systems.
6. Electrify America: Electrify America is building a network of high-speed charging stations across the United States.
7. Enel X: Enel X offers a wide range of EV charging solutions and smart grid integration services.
8. EVBox: EVBox offers EV charging stations, software, and services for businesses and municipalities worldwide.
9. EVgo: EVgo provides fast-charging solutions and an extensive network of EV charging stations across the United States.
10. Shell Recharge by Shell: Shell Recharge is building a fast and reliable charging experience for electric vehicle drivers.
11. InductEV: InductEV specializes in wireless charging solutions for electric vehicles, particularly for public transit and commercial fleets.
12. ChargeHub: ChargeHub offers commercial and residential EV charging solutions, including Level 2 chargers and software.
13. Tritium: Founded in 2001, Tritium (NASDAQ: $DCFC) designs and manufactures proprietary hardware and software to create advanced and reliable DC fast chargers for electric vehicles.
14. Volta Charging: Volta Charging focuses on providing free EV charging at its network of stations supported by advertising revenue.
15. Webasto Charging Systems: Webasto provides a range of EV charging solutions, including home chargers and commercial charging infrastructure.

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Sustainable Urban Mobility Solution Vendors

1. Bird: Bird provides electric scooters for short-distance urban mobility, available for rent through a mobile app.
2. BlaBlaCar: BlaBlaCar is a long-distance carpooling service connecting drivers with passengers traveling in the same direction.
3. Citymapper: Citymapper provides a multimodal urban mobility app that helps users plan their journeys using various transportation modes.
4. Free2Move: Free2Move is a mobility platform that aggregates various transportation options, including car-sharing and ridesharing, into a single app.
5. Gogoro: Gogoro provides electric scooters and battery-swapping infrastructure in select urban areas.
6. JUMP by Uber: JUMP offers electric bikes and scooters available for rent through the Uber app for short urban trips.
7. Lime: Lime offers electric scooters and e-bikes for urban transportation through a mobile app.
8. Moovit: Moovit offers a comprehensive urban mobility app with real-time transit data, trip planning, and multimodal transportation options.
9. Populus: Populus offers mobility data analytics and management solutions to cities and transportation providers to optimize urban mobility.
10. Ridecell: Ridecell offers a platform for mobility service providers, enabling car-sharing, ride-sharing, and autonomous vehicle services.
11. Transit: Transit offers a public transportation app that provides real-time transit information and trip planning in cities around the world.
12. Via: Via offers on-demand shared rides and transportation solutions for cities and public transit agencies.
13. Whim: Whim is a mobility-as-a-service platform that combines public transit, taxis, car rentals, and other transportation options into a single app.
14. Zipcar: Zipcar is a car-sharing service that allows users to rent vehicles by the hour or day in urban areas.

Fleet Electrification Service Vendors

1. Charge Enterprises: Charge Enterprises offers electric vehicle charging and fleet management solutions for commercial and government fleets.
2. Endera: Endera provides electric commercial vehicles, charging solutions, and fleet management services to support electrification efforts.
3. Green Commuter: Green Commuter offers electric vanpool and car-sharing programs for fleet operators and commuters.
4. GreenPower Motor Company: GreenPower develops and manufactures electric buses and commercial vehicles for fleet operators.
5. Lightning eMotors: Lightning eMotors converts commercial vehicles into electric vehicles and provides charging solutions for fleet operators.

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6. Lion Electric: Lion Electric designs and manufactures electric school buses and commercial vehicles for fleets.
7. Motiv Power Systems: Motiv Power Systems specializes in electrifying medium-duty commercial vehicles through all-electric powertrains.
8. Nuvve Corporation: Nuvve specializes in vehicle-to-grid (V2G) technology, enabling fleet operators to participate in grid services with their electric vehicles.
9. Phoenix Motorcars: Phoenix Motorcars produces electric shuttle buses and utility trucks for commercial and municipal fleets.
10. Proterra: Proterra manufactures electric buses and offers charging infrastructure solutions for electric transit fleets.
11. Ryder System, Inc.: Ryder offers fleet electrification services, including electric vehicle leasing, maintenance, and charging infrastructure solutions.

Alternative Fuel Technology Vendors

1. Air Liquide: Air Liquide provides hydrogen production, storage, and distribution solutions for fuel cell vehicles and industrial applications.
2. Ceres Power: Ceres Power designs and manufactures solid oxide fuel cell stacks for various applications, including transportation.
3. Echogen Power Systems: Echogen Power Systems develops waste heat recovery systems and thermal energy storage solutions.
4. Heliogen: Heliogen focuses on concentrated solar power technology to produce high-temperature heat for industrial processes and hydrogen production.
5. ITM Power: ITM Power manufactures hydrogen electrolyzers for on-site hydrogen production, including for transportation.
6. LanzaTech: LanzaTech converts industrial carbon emissions into sustainable fuels and chemicals.
7. Nikola: Nikola focuses on hydrogen fuel cell and battery-electric heavy-duty trucks and infrastructure.
8. Plug Power: Plug Power develops and manufactures hydrogen fuel cell systems for material handling equipment and commercial vehicles.
9. PowerCell Group: PowerCell develops proton exchange membrane (PEM) fuel cell systems for electric vehicles and stationary power generation.
10. Red Rock Biofuels: Red Rock Biofuels produces low-carbon, renewable jet and diesel fuels from woody biomass.
11. Sunfire: Sunfire develops power-to-gas and power-to-liquids technology for the production of synthetic fuels and hydrogen.
12. Topsoe: Topsoe specializes in catalysts and technologies for renewable fuel production from biomass and waste materials.
13. Velocys: Velocys specializes in converting waste biomass into sustainable aviation fuels and renewable diesel.

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EV Battery Recycling and Repurposing Vendors

1. AkkuSer: AkkuSer offers lithium-ion battery recycling solutions for electric vehicles and stationary energy storage systems.
2. American Battery Technology Company: American Battery Technology Company provides battery recycling and material extraction services for lithium-ion batteries.
3. Ascend Elements: Ascend Elements offers closed-loop recycling solutions for lithium-ion batteries, reclaiming metals and materials.
4. Battery Recyclers of America: Battery Recyclers of America provides recycling services for various battery chemistries, including lithium-ion batteries.
5. Battery Solutions: Battery Solutions provides recycling and disposal services for various battery types, including lithium-ion.
6. Fortum Recycling & Waste: Fortum Recycling & Waste provides recycling services for lithium-ion batteries, recovering valuable materials for reuse.
7. Glencore: Glencore is involved in the recycling of lead batteries and the production of lead.
8. Gopher Resource: Gopher Resource specializes in lead-acid battery recycling and resource recovery.
9. Li-Cycle: Li-Cycle offers lithium-ion battery recycling solutions to recover critical materials for reuse in new batteries.
10. Redwood Materials: Redwood Materials focuses on recycling lithium-ion batteries and repurposing materials for the battery supply chain.
11. Cirba Solutions: Cirba Solutions offers end-of-life battery recycling and repurposing solutions for various battery chemistries.
12. Umicore: Umicore specializes in recycling and refining precious and specialty metals, including those from lithium-ion batteries.

About TAG

TAG is a trusted next generation research and advisory company that utilizes an AI-powered SaaS platform to deliver on-demand insights, guidance, and recommendations in cybersecurity, artificial intelligence, and sustainability to enterprise teams, government agencies, and commercial vendors.

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