

NEW GENERATION TECHNOLOGIES FUEL SAFE AND EFFICIENT EV BATTERY MANUFACTURING

Honeywell

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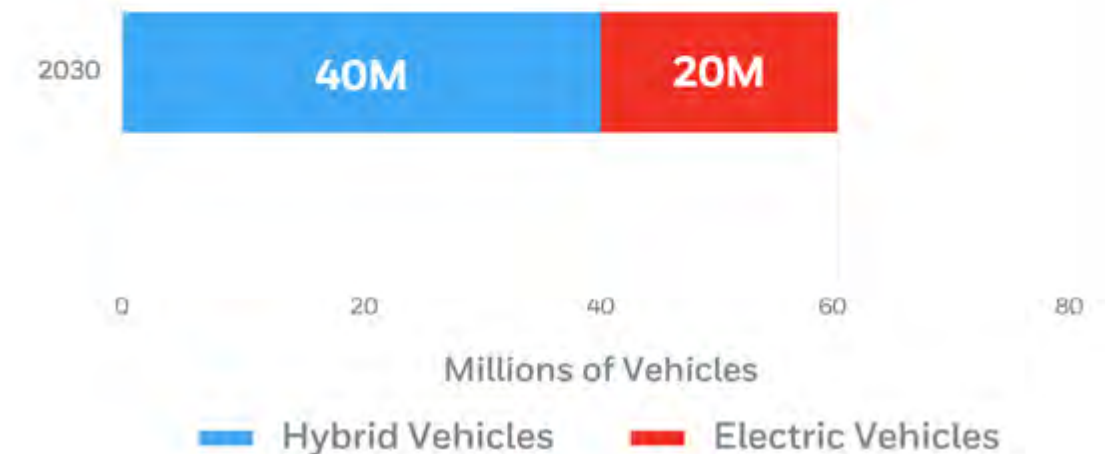
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MARKET DEMAND IS ACCELERATING

For the automobile industry and its suppliers, the migration to electric vehicles (EV) and hybrids presents both significant challenges and opportunities. From the production plant point of view, manufacturers must retool their core infrastructure and minimize risk while achieving their business goals of faster time-to-market, lower CapEx and OpEx, reduced carbon footprint, and heightened cybersecurity.

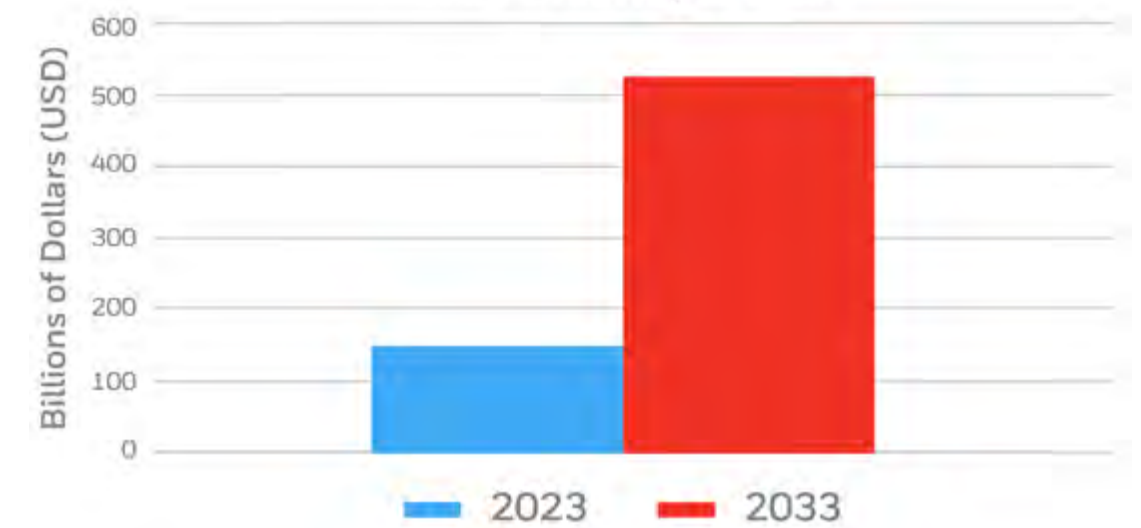
Market demand is accelerating, which represents a potential for additional business growth. EVs will account for **40% of global auto sales by 2030**. These vehicles will be equipped with critical battery systems. Governments are also driving EV growth. **Nine European countries** are issuing mandates to phase out sales of conventional internal combustion engine (ICE) vehicles by 2040 – at the latest – with battery electric vehicles (BEVs) and hydrogen fuel cell electric vehicles (FCEVs) as the recommended replacements.

Global EV Sales by 2030



EVs will account for **40% of global auto sales by 2030**, five times the number of EVs sold in 2022. This translates to 40 million vehicles. By that time, an additional 20 million vehicles will be hybrids.

The EV Battery Market



Analyst firm **MarketsandMarkets** predicts that the EV battery market, valued at USD \$132.6 Billion in 2023, will reach \$508.8 Billion by 2033.

QUALITY, SAFETY, AND TRACEABILITY AS CRITICAL SUCCESS FACTORS

Automotive OEMs and their battery manufacturing partners play a crucial role in driving the transition to EVs. By building and commissioning new battery gigafactories, the industry is positioning itself to better accommodate escalating demand. Producing high-quality lithium-ion batteries will prove critical in establishing the safety and reliability of the new generation of EVs.

For plant owners and the technology firms that supply them, quality control, safety, and traceability emerge as critical success factors. Safety incidents surrounding lithium-ion batteries both in the manufacturing environment and in vehicles on the road are well publicized, while the millions of batteries that function without problems draw scant attention. However, in the battery and automotive industry, quality equals safety. If factory owners produce a high-quality cell, the battery will be safe for the end-use application. Producing defective batteries will result in increased warranty claims, slowed adoption of EVs, lost sales, and damaged reputation.

THE KEY ROLE OF DATA CAPTURE AND ANALYSIS



Battery manufacturers who manually manage quality and safety control are at a decided disadvantage because their process introduces additional complexity and more opportunity for human error. Recent breakthroughs in battery plant technology and digitalization, however, now open the door to a variety of new options that assure EV battery manufacturers a higher degree of quality, safety, and traceability. Automating and digitizing the quality and safety processes help ensure the capture of any event automatically, without relying on manual input.

When interfacing with their EV battery manufacturing partners, automotive OEMs must understand how they can achieve high quality standards. Critical questions such as “How is the cell made?”, “How can you demonstrate that an electrode is on-spec?”, “How do we know the process fix we requested two weeks ago has been implemented?” and “What would a product recall look like?” must be answered.

New generation software platforms now automatically aggregate the data coming in from all phases of the production operation and analyze that data against pre-set quality and safety parameters. This represents a huge step forward in reducing potential product failures and defects. When software management platforms notify operators and their supervisors of anomalies, they can adjust their systems to limit materials waste and avoid costly future recalls.

HOW TECHNOLOGY ENABLES WASTE REDUCTION AND COST SAVINGS

Consider a technology provider like Honeywell who, for over 20 years, has implemented quality control and safety solutions across both battery and automotive manufacturing sites.

Honeywell solutions such as the **Battery Manufacturing Excellence Platform (MXP)**, an AI-enabled software solution designed to optimize battery manufacturing operation by improving battery cell yields and expediting facility startups, **TrackWise Digital® Quality Management System (QMS)** and **battery electrode scanning measurement systems** help plant operators and engineers quickly identify the cause of quality issues. Such tools can track all production cycle phases—from raw materials at the beginning of the production cycle to the final EV batteries shipped to the automotive manufacturers—while managing quality end-to-end. Let's take a closer look at how such technologies add value to the EV battery production process.

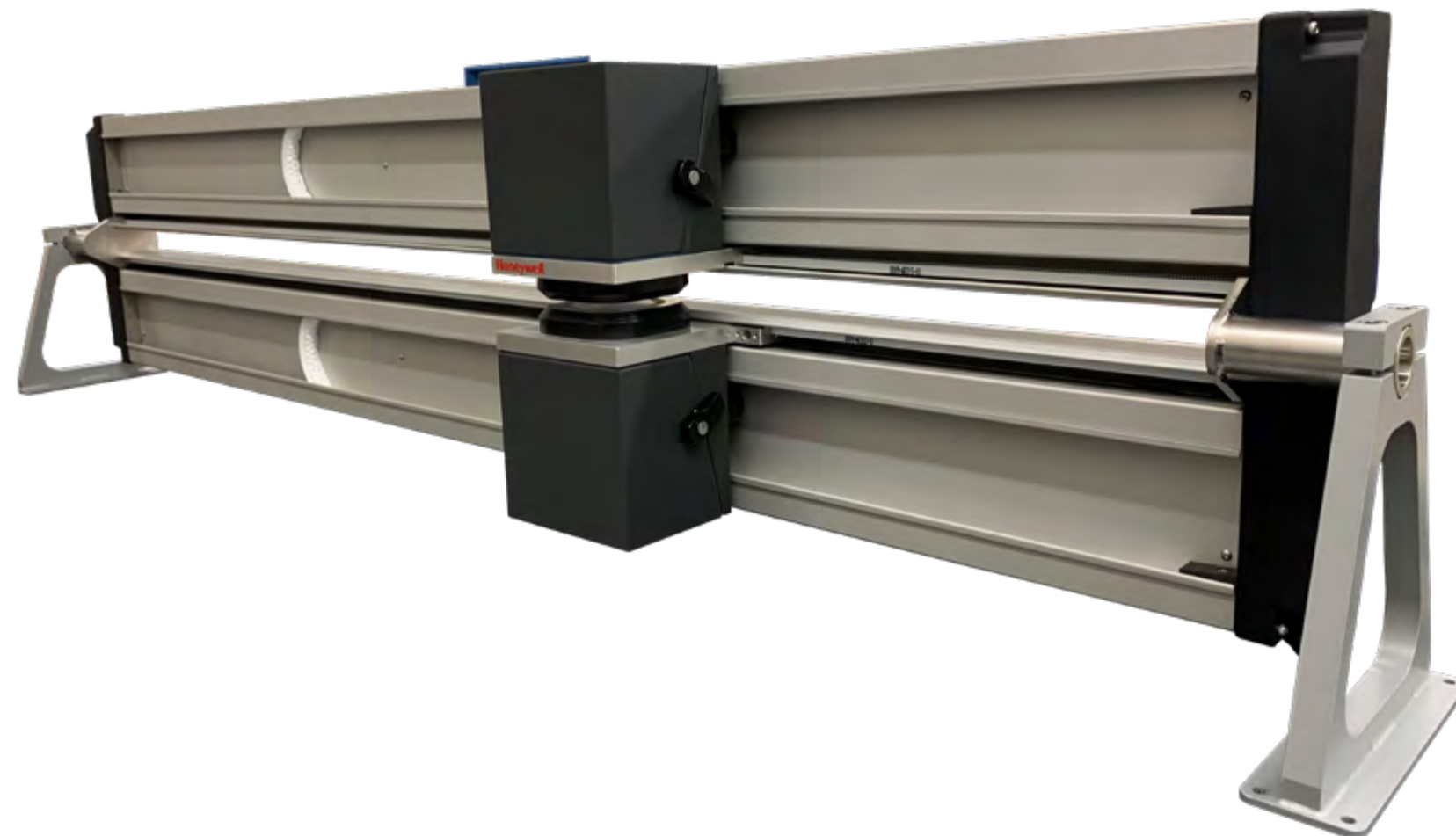
TECHNOLOGY: ELECTRODE MEASUREMENT PLATFORMS FOR QUALITY CONTROL IN EARLY PRODUCTION STAGES

Scanners – On a daily basis, plant operators wrestle with quality control and ensuring that the batteries they produce meet specifications. Honeywell electrode scanners function as in-line measurement systems and are involved early in the mixing and electrode coating processes. They measure upstream quality before an out-of-spec product makes it to the final assembly process further downstream.

Two types of Honeywell scanners help to facilitate quality control in the early production stages. The first type, used during the **coating/drying** process, allows operators to identify whether the correct amount of wet or dry coating has been applied to the current collector.

The second type of scanner is located within the calender **pressing process**. Operators run electrodes through a dual set of rollers, which compress the electrodes to their final thickness. The scanner measures the total thickness of the electrode in real-time to determine whether the electrode thickness meets the specification.

Honeywell scanners are unique in the way the sensors within function, and how they measure parameters, display data and interface with software. The design is durable, reproducible, and produces reliable results all while having a small physical footprint. The Honeywell scanners also go beyond simple measurement – an automated closed-loop control feedback algorithm provides automated coating / drying / pressing control – a differentiating capability from Honeywell.



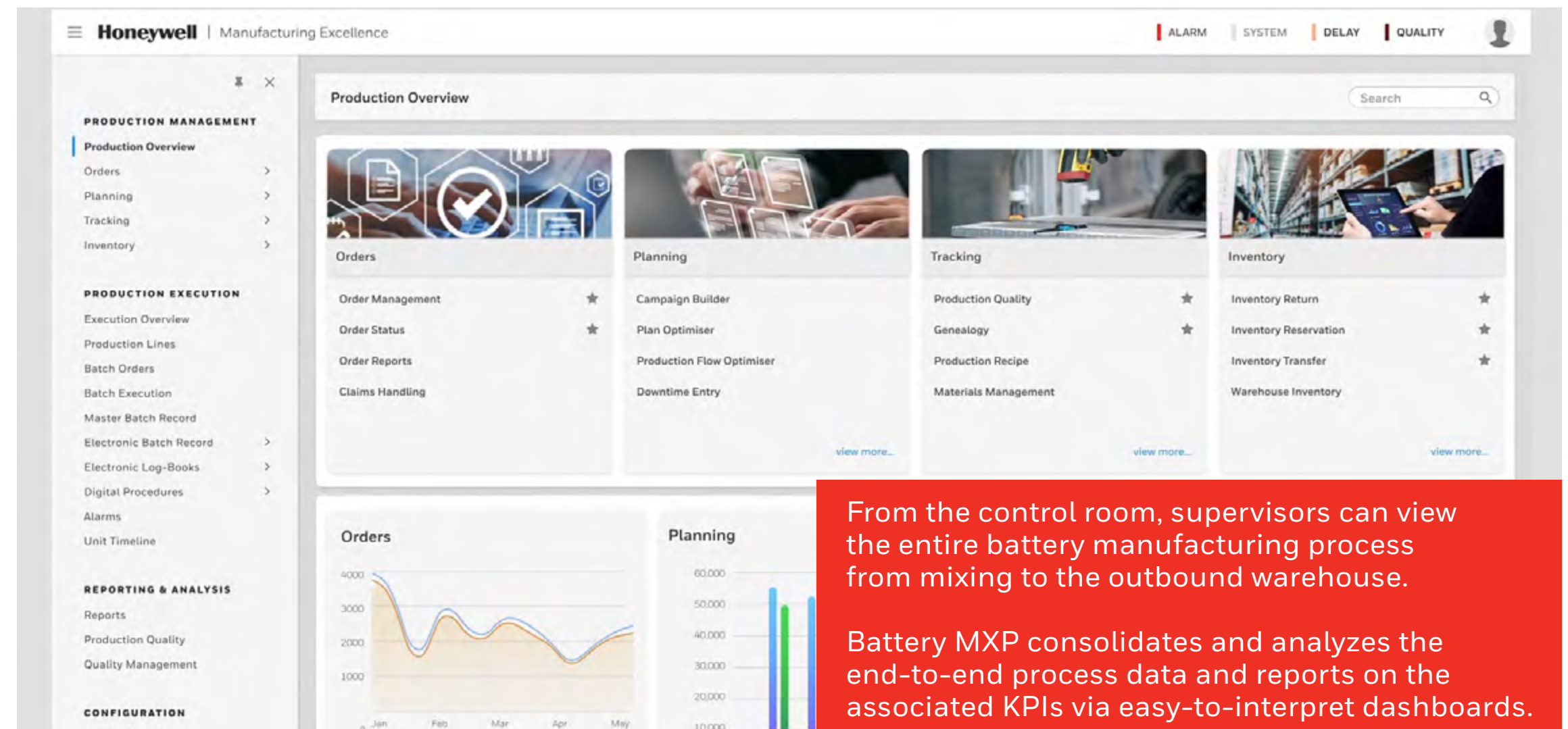
TECHNOLOGY: INTEGRATED SOFTWARE PLATFORM AS THE CENTRAL BRAIN OF MODERN BATTERY MANUFACTURING

Integrated software platform – From a data gathering and sharing perspective, devices such as scanners were historically isolated. But now integrated software platforms such as Battery MXP – with powerful cell/module/pack genealogy, reporting, and dashboard capabilities – can connect to plant floor devices, including scanners, to enable a highly granular level of traceability. Such platforms function as the central brain of the modern battery manufacturing facility. The Honeywell platform is unique in that it goes beyond traceability of a particular object (like a nut, bolt, or body panel) but involves the genealogy of a process.

For example, Battery MXP interfaces with the scanner software platform and the captured data integrates downstream with all the other data correlating to a particular

production lot. Interfacing with Battery MXP, operators and supervisors know which coated electrodes correlate with which batch of slurry and where within

the individual cells those new electrodes reside. The software platform builds the product information family tree with all the data associated to each of the branches.



THE VALUE OF PROCESS TRACEABILITY

As automotive companies continue to manufacture more EVs, they understand the need to adhere to traceability regulations. They look to their EV battery suppliers to provide them with any details should their vehicles experience EV battery-related problems. With the proper automation in place, those suppliers can offer traceability and genealogy down to the individual cell level.

The Battery MXP platform captures the data associated with the raw material at the start of the manufacturing process all the way through to the finished cell and even the finished battery pack (depending on the capabilities of the facility).

The ability to track product quality through all stages of the process allows for surgical removal of any defects. Should a recall occur, whether it involves a simple software fix, or a more severe hardware defect, manufacturers have the luxury of

fixing only the defective sub-components (instead of discarding entire lots of goods, where 90% of the remaining product may be perfectly fine). This minimizes both cost and time-to-market of new product.

Possessing the entirety of data associated with the battery on the assembly line – before it releases to the marketplace – serves as a significant business benefit for manufacturers who wish to reduce risk while improving quality.

EXPERTS PROVIDE INTEGRATION AND TRAINING

When battery manufacturers design, construct, and upgrade their gigafactories, Honeywell experts build the interfaces with both Honeywell solutions and third-party controllers and software. Honeywell experts also train the battery manufacturing staff, so that once the software platform integrates throughout the plant, users have the flexibility to modify it as their processes change over time.

Honeywell understands the threat landscape posed to Operational Technology (OT) software environments. The Battery Manufacturing Excellence Platform (MXP) also meets Honeywell cybersecurity specifications. As experts in OT controls and cybersecurity, Honeywell ensures operational continuity with the proper firewalls and boundaries in place to ensure your network is protected.

To learn more, visit: [hwll.co/batterygigafactories](https://hwl.co/batterygigafactories)

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