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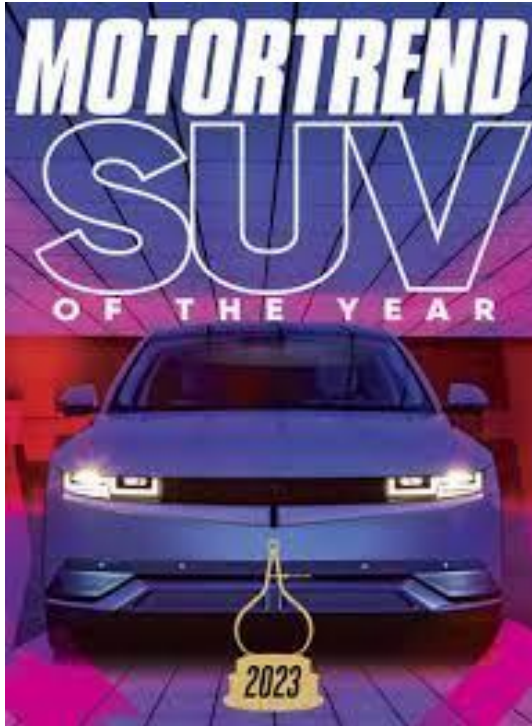


2023 HYUNDAI IONIQ 5



COST & BENCHMARKING ASSESSMENT

MUNRO & ASSOCIATES
1140 Centre Rd, Auburn Hills, MI 48326 USA
Phone: 1-248-362-5110



"[The 2023 Hyundai Ioniq 5](#)—the first fully electric vehicle to win our SUV of the Year award—is [a game-changing rethink](#) of what an SUV can be. The Ioniq 5 is approachably modern with a form factor and controls that are familiar to anyone trading in a conventionally powered SUV or crossover for their first electric one.

Yet its packaging and performance are only possible thanks to its small, energy-dense motors. More important, the Ioniq 5 offers bleeding-edge 800-volt electric architecture, making it among the quickest-charging EVs on the market (with charge times rivaling road trip rest stops). At just more than \$40,000 to start, it's also the cheapest vehicle with such technology on the market today. Simply put, no SUV in our incredibly diverse 33-vehicle field more faithfully lives up to our six key SUV of the Year criteria than does the new Hyundai Ioniq 5."

Quoted from:

MOTORTREND | AWARDS



IONIQ 5 LIMITED EDITION DESCRIPTION

- The 2023 Hyundai IONIQ 5 with 800-volt architecture is MotorTrend's SUV of the Year. Since its launch in 2022 minor upgrades have been made including battery preconditioning capability, increased range on AWD models (255 to 266 miles) and improved towing capacity (1,650 pounds to 2,300 pounds).
- Hyundai offers four trim levels: SE Standard Range, SE, SEL and Limited.
- A 77.4Wh battery is available on the SE, SEL and Limited trim levels with Ultra-fast charging capability (up to 800V / 350kW) standard on all models.
- The IONIQ 5 is equipped with Highway Driving Assist Level I and II. Level II (on SLE, Limited) provides semi-autonomous driving with auto lane change.

| General Specifications | 2023 IONIQ 5 |
|-----------------------------------|-------------------------|
| | Limited Edition |
| Seating | 5 |
| Highway Driving Assist II (HDAII) | Standard |
| Height | 63 inches |
| Length | 182.5inches |
| Wheelbase | 118.1 inches |
| Width | 74.4 inches |
| Power Output AWD (Dual Motor) | 74 kW + 165 kW (320 hp) |
| Battery | 77.4 kWh |
| Curb Weight (AWD) | 4663 |
| Min. Ground Clearance | 6.1 inches |
| Driving Range (Limited AWD) | 266 |

IONIQ 5 LIMITED EDITION MUNRONEY LABEL



2023 IONIQ 5 LIMITED AWD

SOLD TO: MI056 **SHIPPED TO:** MI056
 ELDER HYUNDAI
 19077 HALL ROAD
 MACOMB MI 48044

VIN: KM8KRDAF7PU155751
MODEL: 50462AEZ
ENGINE: EM17NBP1432D
PORT OF ENTRY: TC
EXTERIOR COLOR: ATLAS WHITE
INTERIOR/SEAT COLOR: BLACK/BLACK
TRANSPORT: TRUCK
ACCESSORY WEIGHT: 20 lbs / 9 kgs.
EMISSIONS: This vehicle meets emissions requirements in all 50 states and is a CARB certified Zero Emission Vehicle (ZEV)

GOVERNMENT 5-STAR SAFETY RATINGS

Overall Vehicle Score ★ ★ ★ ★ ★
 Based on the combined rating of frontal, side and rollover. Should ONLY be compared to other vehicles of similar size and weight.

| | | |
|--|-------------------|-----------|
| Frontal | Driver | ★ ★ ★ ★ |
| Crash | Passenger | ★ ★ ★ ★ |
| Based on the risk of injury in a frontal impact. Should ONLY be compared to other vehicles of similar size and weight. | | |
| Side | Front seat | ★ ★ ★ ★ |
| Crash | Rear seat | ★ ★ ★ ★ ★ |
| Based on the risk of injury in a side impact. | | |
| Rollover | | ★ ★ ★ ★ ★ |
| Based on the risk of rollover in a single-vehicle crash. | | |

Star ratings range from 1 to 5 stars (★★★★★) with 5 being the highest.
 Source: National Highway Traffic Safety Administration (NHTSA).
www.safercar.gov or 1-888-327-4236

STANDARD FEATURES:

AMERICA'S BEST WARRANTY
 5-year/60,000-mile New Vehicle Warranty*
 10-year/100,000-mile Powertrain Warranty*
 10-year/100,000-mile Electric Vehicle System Warranty*
 7-year/Unlimited-mile Anti-perforation Warranty*
 3-year/36,000-mile Complimentary Maintenance*
 5-year/Unlimited-mile Roadside Assistance
 *Limited warranties, see dealer for details

ADVANCED SAFETY TECHNOLOGY
 Forward Collision-avoidance Assist
 Blind-spot Collision-avoidance Assist
 Lane Keeping Assist; Lane Following Assist
 Rear Cross-traffic Collision-avoidance Assist
 Parking Collision-avoidance Assist - Reverse
 Parking Distance Warning - Forward/Reverse
 Driver Attention Warning
 Safe Exit Assist

POWERTRAIN TECHNOLOGY
 Dual Electric Motors; HTRAC AWD
 Long Range Lithium Ion Battery System
 Battery Pre-heating System
 DC Ultra-fast Charging Capability
 Shift-by-wire Gear Selector
 Regenerative Brake Level Control Paddles

EXTERIOR

20" Alloy Wheels
 Vision Panoramic Fixed-glass Sunroof w/ Power Sunshade
 Active Grille Shutters
 LED Projector Auto Headlights
 LED Daytime Running Lights
 LED Taillights
 Premium Front LED Accent Lighting
 Rain-sensing Front Windshield Wipers

COMFORT & CONVENIENCE

Proximity Key w/ Push Button Start
 Hands-free Smart Liftgate with Auto-open
 Premium Head-up Display
 Surround View Monitor; Blind-spot View Monitor
 Remote Smart Parking Assist
 Smart Cruise Control
 H-Tex(TM) Trimmed Seats; Heated and Ventilated Front Seats
 Memory Power Driver Seat w/ Relaxation Function
 Power Front Passenger Seat
 Ambient Interior Lighting

COMFORT & CONVENIENCE(cont.)

Premium Door Sill Plates
 Heated Leather-wrapped Steering Wheel
 Dual Auto Temperature Control w/ Heat Pump & Rear Air Vents
 Auto-dimming Rearview Mirror
 12.3-inch Digital Instrument Cluster
 Wireless Device Charging; Hyundai Digital Key
 Sliding Center Console
 Rear Side Window Sunshades
 Vehicle-to-load (V2L) 2nd-row Outlet
 Front & Rear USB Ports
 12.3-inch Navigation with Android Auto(TM) and Apple CarPlay(R)
 Bose® Premium Audio
 Bluetooth® Hands-free System
 SiriusXM® Radio w/ 90-day Platinum Trial subscription; Not Available in AK & HI
 Bluelink® Connected Services 3-years Standard (enrollment req)
 Bluelink Climate Control (3-year Complimentary Service)
 Bluelink Guidance Package (3-year Complimentary Service)
 Tire Mobility Kit (in lieu of spare tire)
Full Battery Charge

Manufacturer's Suggested Retail Price:

\$56,500.00

ADDED FEATURES:

| | |
|-------------------------|----------|
| *ATLAS WHITE(SAW) Paint | \$400.00 |
| *Carpeted Floor Mats | \$210.00 |
| *Cargo Net | \$55.00 |
| *Cargo Mat, Up Seatback | \$120.00 |
| *First Aid Kit | \$30.00 |
| *Mud Guards | \$120.00 |
| *Wheel Locks | \$70.00 |

Inland Freight & Handling :

\$1,295.00

Total Price :

\$58,800.00



IONIQ 5 COST ASSESSMENT REPORTS

These reports will provide a comprehensive vehicle cost analysis, which is highly advantageous for OEMs or Tier Suppliers looking to effectively compete in the EV marketplace.

Each report will be a consolidation of Munro's technical findings related to cost, features, performance, and technology implementation, including Executive Summaries, Eye-Catching Features and Directional Cost Estimates.

The following Hyundai IONIQ 5 reports will be available for purchase:

GENERAL SYSTEM REPORTS

- Body and Chassis
- Controlling Electronics (LV)
- Interiors and Safety Systems
- Powertrain, Battery Pack and HV Systems

FOCUSED REPORTS

- Electric Drive Module (Motors, Gearbox and Inverters)
- Thermal Systems (Cooling & Heating)
- Battery Cell (Physical & Chemical analysis)

NOTES

- Custom reports will be available upon
- Please direct purchase inquiries to reports@leandesign.com



REPORTS

Munro has purchased and will completely disassemble the IONIQ 5, to perform a system-by-system analysis. Each report will contain detailed cost information down to the component level, with supporting technical information as outlined below.

REPORT SECTION HIGHLIGHTS

- The Executive Summary pages condense and review the critical points within each report topic, including Munro’s observations and cost summaries.
- Side-by-Side comparisons highlight prominent EVs with their associated specifications, features, integration strategies and other relevant data.

EDM Side-by-Side Comparison

Battery Electric Vehicles (BEV)- Permanent Magnet (PM) Motors

| Parameters | Tesla Model 3 Rear | BMW i3 | Chevrolet Bolt | Jaguar I-PACE | Nissan Leaf | Tesla Model Y Rear | Tesla Model S Plaid |
|-------------------------|--------------------|--------|----------------|---------------|-------------|--------------------|---------------------|
| Motor Type | PM | PM | PM | PM | PM | PM | PM |
| Total Motor Weight (kg) | 14.45 | 10.25 | 15.35 | 18.55 | 14.25 | 14.95 | 15.2 |

Controlling Electronics Summary

2022 Ford Lightning

ADAS

The Lightning can be equipped with Ford Blue Cruise™ which allows hands-free driving on limited sections of divided highways. While Blue Cruise™ is active, it functionally couples both adaptive cruise control and lane centering at the same time. These designated highways are referred to as Blue Zones. As for the hands-free aspect, there is a driver monitoring camera positioned between the instrument cluster and infotainment screen which does require the driver to be alert and ready to take the wheel should the vehicle disengage from Blue Cruise™. It should be noted that Blue Cruise™ does NOT make the vehicle fully autonomous. As such, the driver should always be ready to take control of the vehicle. As with most ADAS (Advanced Driver Assistance Systems), Blue Cruise™ is more of a comfort feature than a safety feature. The system does illuminate certain parts of the instrument cluster with blue lights to indicate when the vehicle is in a Blue Zone. When not in a Blue Zone, the vehicle will only handle Adaptive Cruise Control.

The Lightning uses a conventional system:

- A forward-facing camera for adaptive cruise control
- A forward-facing radar for adaptive cruise control
- Two front corner radar for lane departure warning
- Two rear corner radar for blind spot monitoring
- Eight ultrasonic sensors on each side

2022 Ford F-150 Lightning Overview

- Ford's F-150 Lightning is an all-electric all-wheel drive full size pickup truck powered by either a 98 kWh (standard) or 131 kWh (extended) battery, delivering an EPA estimated range between 230 miles and 320 miles (depending on configuration) and standard seating for five passengers.
- The Lightning offers a 5.5' cargo bed with 52.8 ft³ of space. Dry storage of 14.1 ft³ is available under the hood.
- The Lightning is propelled by two permanent magnet electric motors with a combined 775 lb-ft of torque. Power is limited by the battery, with 452 hp for the standard and 580 hp with the extended range battery.
- The Lightning is equipped with "BlueCruise" Level 2 autonomous driver-assist technology.

| Interior Dimensions | | Weights | |
|-----------------------------------|------|------------------------------------|--------------|
| • Passenger Capacity | 5 | • Base Curb Weight (lbs) | 6,015 (est.) |
| • Cargo Volume (ft ³) | 14.1 | • Extended-Range Curb Weight (lbs) | 6,590 |
| • Front Head Room (in) | 40.8 | | |
| • Front Leg Room (in) | 43.9 | | |
| • Front Shoulder Room (in) | 66.7 | | |
| • Front Hip Room (in) | 62.5 | | |
| • Second Head Room (in) | 40.4 | | |
| • Second Leg Room (in) | 43.6 | | |
| • Second Shoulder Room (in) | 66.0 | | |
| • Second Hip Room (in) | 62.6 | | |

Exterior Dimensions

- Wheelbase (in) 145.5
- Length, Overall (in) 232.7
- Width, Max w/o mirrors (in) 80
- Height, Overall (in) 78.3
- Track Width, Front (in) 68.1
- Track Width, Rear (in) 68.3
- Drag Coefficient N/Avail

The model which this study is based on is the Mustang Mach-E Select Series

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*Example slide images from Ford F-150 Lightning Reports – also available from Munro




EYE-CATCHING FEATURES

- Munro will identify and document interesting observations, which are called "Eye-Catching Features." These observations represent advantages and/or disadvantages in cost, weight, feature content, or performance as related to design, material choices, assembly or manufacturing process selection.


2022 Ford Lightning Cantilevered Harness Eye-Catching Features



2022 Ford Lightning Symmetrical Chiller Bracket Eye-Catching Features



2022 Ford Lightning Two-Tone Seat Covers Eye-Catching Features



Description:

- The main wire harness clips
- The additional harness line clips rather than staples

Description:

- The chiller bracket has symmetrical fasteners
- The bracket is fastened with a U-nut on the other side
- The remaining fastener is located on the other side of the bracket

Description:

- The seat covers have a two-tone finish with an Alcantara strip down the center
- Even though the leather around the Alcantara is stitched in place, it is not hemmed, which exposes a portion of the leather's B-Surface

Advantages:

- Two-tone creates a unique look, especially for the vehicle's highest trim level to date
- Breaking up the leather into smaller panels allows greater flexibility in hide yield which in turn lowers material cost

Disadvantages:

- Un-hemmed leather edges appear frayed, which is further exacerbated on contrasting colors
- Additional cutting and sewing operations add cost

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*Example slide images from Ford F-150 Lightning Reports – also available from Munro



DIRECTIONAL COST ESTIMATES

- The IONIQ 5 will be broken down into systems and components for Directional Cost Estimating. Directional Cost Estimating is Munro's proprietary methodology developed in response to the need for speed-driven results and is quickly gaining popularity. Directional Cost Estimates rapidly provide the customer with approximate versus detailed costs, which are more expensive and time consuming to generate. This level of accuracy provides OEMs and Suppliers the ability to make sound comparisons and directional decisions.

FOCUSED REPORTS

ELECTRIC DRIVE MODULE (MOTOR, GEARBOX AND INVERTER) REPORT

- The Electric Drive Module (EDM) cost assessment will include the Front Motor, Rear Motor, Inverter, Front Gear Box, Rear Gear Box, Housing, and several technical details of the motor design.

The image displays three overlapping screenshots from Munro's reporting software. The top screenshot is titled "EDM Side-by-Side Comparison" and shows a table of motor specifications for various EV models including Tesla Model 3, BMW i3, Chevrolet Bolt, Jaguar I-PACE, Nissan Leaf, Tesla Model Y, and Tesla Model S. The middle screenshot is titled "Secondary Drive Unit (SDU) Asm" and lists parameters such as Motor Type, Total Weight, and Stock Configuration. The bottom screenshot is titled "Electric Drive Motor" and provides detailed technical information for the 2022 Ford F-150 Lightning, including torque (775 lb-ft), horsepower (563 hp), and charging capabilities (19.2 kW). It also features three images of the motor assembly.



THERMAL SYSTEMS (COOLING & HEATING) REPORT

- Cost and description of thermal system components, such as heat exchangers, coolant and AC lines, cold plates, heat pump components, and AC compressor.
- Includes coolant tube diagram(s), flow diagram, AC diagram and flow paths for all control valves.
- Electrical diagrams to showcase the following components: heat pump regulating components (solenoids / sensors / pumps), cabin sensors, component temperature sensors (ADAS, motors, batteries etc.), and network communications

2022 Ford Lightning Ford F-150 Lightning Gateway Module

2022 Ford Lightning Ford F-150 Lightning Electromechanical

2022 Ford F-150 Lightning Powertrain & HV Battery Summary

2022 Ford Lightning 2022 F-150 Lightning Refrigerant Flow

2022 Ford Lightning Refrigeration External Line Diagram

2022 Ford Lightning 2022 F-150 Lightning Heat Exchangers

| System / Component | Heat Exchanger Type |
|--|---------------------|
| ACM | Cold Plate |
| Battery Management Module (BMC/DIC DC Charger) | Cold Plate |
| Motor Inverters/Converters | Plate and Blade |
| Battery Packs | Cold Plate |
| Radiator | Tube & Fin |

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*Example slide images from Ford F-150 Lightning Reports – also available from Munro



BATTERY CELL REPORT OVERVIEW

This report will be an in-depth analysis of the physical, chemical and electrical aspects of the battery cell as outlined below:

Observations & Summary

Physical

- Cell Weight and Cross Section
- Disassembly Weights and Dimensions
- Images of Anode and Cathode
- CT Scan of Interesting Parts (Current Collectors)
- Measurements of Welds

Chemical

- Composition of Separator
- Composition of Anode and Cathode

Electrical

- Charge Capacity (Ah) and Efficiency
- Voltage vs Time and Voltage vs Current Curve on Charge/Discharge
- ΔT on Capacity Check
- Hybrid Pulse Power Characterization (HPPC)
- Pulse at 3 States of Charge Tests
- Cell Summary
 - Capacity
 - Energy
 - Nominal Voltage
 - Energy Density Volumetric vs Gravimetric
 - Cathode Areal Capacity
 - Cathode Gravimetric Capacity



REPORT DELIVERY

- All reports and accompanying deliverables will be made available for easy access through a secure File Transfer Protocol (FTP) site.
- A PDF format ensures that subscribers can easily locate a wide range of materials in addition to the reports.
- Munro's large reports each feature a linked table of contents, allowing users to easily navigate the report contents and quickly locate specific data.

FREQUENTLY ASKED QUESTIONS

■ **Is Hyundai involved in the study?**

No. Neither Hyundai's proprietary costs nor any of Hyundai's suppliers' quoted costs will be used in this study.

■ **Is there any Hyundai proprietary IP in this report?**

No. All data will be developed through Munro's proven methodologies, analyzing Munro's purchased production-version Hyundai IONIQ 5

■ **Are the components to be costed using country-specific costing centers?**

Yes. Munro uses country-specific labor rates, factory floor costs, utilities, taxes, and SG&A for OEM and Tier Suppliers, wherever manufacturing location is identifiable.

■ **Is this a Costing or Pricing report?**

This is a Costing Report. Pricing has too many variables.



LEGAL DISCLAIMERS & SALES CONDITION

- **How can I see the sample report before purchasing?**

Please contact reports@leandesign.com and we will provide sample information in digital PDF format. NOTE: Critical data will be blurred in the sample.

- **Is purchaser allowed to reproduce, distribute, disseminate, photocopy, fax, or transmit report content internally within the purchaser's organization?**

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- **If questions arise, is a Munro expert able to visit and explain the report's details?**

Munro will visit customers, if the customer pays for the travel and a daily fee.

- **If there are limited specific questions on the content of the report, is it possible for a Munro representative to support a phone call or e-mail communication?**

Yes, please contact reports@leandesign.com and we will respond with our answers.