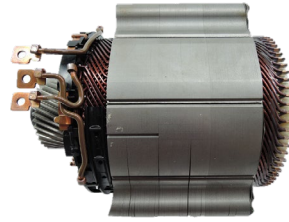


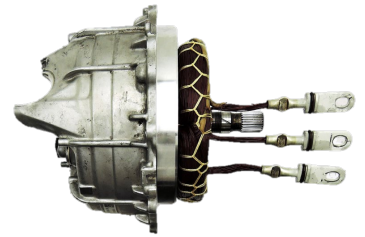
**Tesla Model 3
Rear Motor**



BMW i3



Chevrolet Bolt



**Tesla Model 3
Front Motor**



Chevrolet Volt



Toyota Prius



Jaguar I-PACE

Motor Cost and Benchmarking Report **\$25,000 USD**

Munro conducted a side by side motor comparison capturing detailed cost and component data

Purchasers of this report will receive a 302 page benchmark report for seven motors at a cost of \$25,000 US dollars compared to an estimated value of \$170,000 if purchased individually.

- A. Top level side by side comparisons
- B. Detailed section for each motor with I-PACE motor teaser
- C. Motor technical cost analysis
- D. Appendix with additional motor information



Four of the motors analyzed made it into the top six receiving recognition in Engine and Powertrain Technology International Magazine engine & powertrain of the year awards!

Best Electric Powertrain

Results	Video	Cars	Review
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Results

ENGINE	POINTS
WINNER! - Jaguar Land Rover full-electric powertrain <i>(Jaguar I-Pace)</i>	367
Tesla full-electric powertrain <i>(Tesla Model S, Model X, Model 3)</i>	363
BMW full-electric powertrain <i>(BMW i3, i3S)</i>	172
Hyundai-Kia full-electric powertrain <i>(Hyundai Kona, Kia Soul EV)</i>	148
Renault / Nissan full-electric powertrain <i>(Nissan Leaf)</i>	126
General Motors full-electric powertrain <i>(Chevrolet Bolt, Opel Ampera-e)</i>	89



Description of the Motor Analysis

- A. Side by side motor comparing torque, power ratings, motor types, application, part count, cost and weight
- B. Each motor has a dedicated report section providing detailed dimensional data such as:
 - Over all dimensions and weights
 - Discreet part dimensions i.e. laminate thicknesses and counts
 - Gauss values of magnets
 - Pole counts
 - Magnet configurations
- C. Complete technical cost analysis of each motor.
 - Includes the stator, rotor, rotor shaft and resolver target wheel.
 - Excludes motor housings, gear train and controls
- D. Appendix with supplemental technical performance data and material chemical analysis.

Report Delivery

- ❖ All reports and accompanying deliverables will be made available for easy access through a secure File Transfer Protocol (FTP) site.
- ❖ The report utilizes hyperlinks within a table of contents to facilitate the ability to easily navigate throughout the contents and quickly find specific data and information to meet user needs.



Motor Benchmark Report

- ❖ The Benchmark Report is highly advantageous for OEMs or suppliers looking to effectively expand and compete in new EV markets.
- ❖ The report is a comprehensive cost analysis of each motor.
- ❖ This report contains descriptive and pictorial detail on every facet of the motors dimensional data, manufacturing and cost analysis.
- ❖ Those who purchase the report will receive a single report containing:
 - a. Executive Summary
 - b. Side by Side Summary
 - c. Dimensional Data
 - d. Costed Bill of Material

Tesla Model 3- Motor Performance Data

2018 Tesla Model 3 Long Range, and 2018 Tesla Model 3 Performance Report accurate torque readings for both vehicles, and the results. The dyno graph below is an overlay of the two vehicles in Performance Mode (R in "Chill" mode

Tesla 3 Rear- Stator Assembly

Component Summary

Vehicle	Tesla Model 3
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Tesla 3 Rear- Rotor Laminate Configuration

Magnet locating tab

Magnet angle: 14

Every 6th laminate, there are 2 features; 2 per magnet slot. These tabs are utilized for locating the magnets with laminate slots.

Tesla Model 3 Rear Motor

Side-by-Side Comparison

Electric Drive Motor

Motor	Cost	Weight (kg)
Tesla Model 3 (Rear)	\$1,200	12.5
BMW i3	\$1,500	15.0
Chevrolet Bolt	\$1,800	18.0
Tesla Model 3 (Front)	\$1,000	10.0

Motor Side-by-Side Analysis

Images of: Tesla Model 3 Rear Motor, BMW i3, Chevrolet Bolt, Tesla Model 3 Front Motor, Chevrolet Volt, Toyota Prius.



Cost Estimates

The costs of the motors are broke up into two buckets stator and rotor. Munro used their proprietary software and methodologies to establish a should cost to manufacture the various parts found in each of the motors. An overview of the costing methods is provided in the report. The costing methodologies have been developed by Munro over the last 15 to 20 years supporting numerous OEM's and suppliers as well as government agencies for future rule making decisions in regards to fuel economy and safety standards.

[Richman from EPA]

“Munro is recognized as being technically competent, highly experienced, knowledgeable, and creative in benchmarking and lean engineering of automotive and non-automotive systems. Costing models are thorough, covering all elements of total production cost.”

Instrument Panel Trim

Assembly Summary

Zone	Zone 3 Interior & Safety
System	Instrument Panel Trim
Part	Passenger Footwell Substrate Assy

Task Model 3

Supplier Name/Code	Part Name	Material	Quantity	Unit Price	Total	Weight	Volume
	Steel		100	\$1.00	\$100.00	100	100
	Aluminum		50	\$2.00	\$100.00	50	50
	Plastic		200	\$0.50	\$100.00	200	200
	Other		10	\$10.00	\$100.00	10	10

Disclaimers

This cost analysis utilizes the Quick Cost Estimating method:

Quick Cost Estimating (QCE) is gaining popularity due to the need for speed driven and accurate results. In response, Munro has developed a proprietary methodology. The goal of QCE is to provide the customer with approximate, rather than technical costs which are much more expensive and time consuming to generate. A QCE's level of accuracy provides customers with the ability to make sound comparisons and directional decisions with confidence.

The QCE process starts with the disassembly of the vehicle and the creation of a bill of materials and a bill of process within Design Profit® Software, which is referred to as a cost map. For each component in the Design Profit® cost map, properties such as material, manufacturing process, complexity, weight, size, etc. are analyzed to determine how it should be costed. The QCE process relies on Munro's expertise, knowledge base, process calculators, and supporting labor, material, and manufacturing & machinery databases. The costs reported for this analysis will include material costs (raw material & purchased parts), process costs (manufacturing and assembly of components), and final assembly costs for the supplier and OEM.

Motor Report



Motor Costed Bill of Material

- ❖ The costed bill of material (CBOM) is a consolidated view of the cost information presented in the reports. A CBOM report is included for each motor analyzed.
- ❖ The bill of material is an indented format and includes:
 - Part name
 - Material
 - Total Cost
 - Weight
 - Quantity
 - Total Weight

Assembly Name							
Symbol Name	Material Name	Supplier Name	Total Cost*	Weight (kg)	Item Qty	Total Cost* (Total)	Weight (kg) (Total)
Suspension Front Bolt	Commodity Item	-					
Suspension Middle Bolt	Commodity Item	-					
Suspension Front Cradle Bolt close to vehicle Rear	Commodity Item	-					
Suspension Rear Bolt close to vehicle Rear	Commodity Item	-	\$0.29	0.0673	2	\$0.58	0.1346
M10-1.25x35 Class 10 SHex Extra Big Flange Bolt	Commodity Item	-	\$0.06	0.0244	4	\$0.24	0.0976
M10-1.6x33 Class 10 SHex Flange Head Bolt	Commodity Item	-	\$0.11	0.0336	4	\$0.44	0.1344
Brake Line Clip Front Wheel	Commodity Item	-	\$0.05	0.0032	2	\$0.10	0.0064
Rear Suspension Assembly	Multiple	-	\$423.87	65.4512	1	\$423.87	65.4512
Rear Cradle Assy with Swaybar	Multiple	-	\$114.71	26.1172	1	\$114.71	26.1172
Rear Cradle Assy without Swaybar	Multiple	-	\$102.15	23.0000	1	\$102.15	23.0000
Rear Stabilizer Bar Assembly	Multiple	-	\$11.82	3.8360	1	\$11.82	3.8360
Bolt Swaybar Brackets to RR Cradle	Commodity Item	-	\$0.06	0.0203	4	\$0.24	0.0812
Bolt Motor Mount to RR Cradle Assy	Commodity Item	-	\$0.37	0.0974	3	\$1.11	0.2922
Rear Suspension Assembly LH	Multiple	-	\$149.44	15.8255	1	\$149.44	15.8255
Rear Knuckle	AI - A356	-	\$45.13	4.6160	1	\$45.13	4.6160
Rear Lwr Track Bar AR	Multiple	-	\$5.94	0.9460	1	\$5.94	0.9460
M12-1.75x75 Hex Hd. Shoulder Screw	Commodity Item	-	\$0.31	0.0653	3	\$0.93	0.2659
M12-1.75 Hex Nut	Commodity Item	-	\$0.06	0.0213	3	\$0.18	0.0639
Rear LTB-Fox	Multiple	-	\$6.36	0.7960	1	\$6.36	0.7960
Rear Link Bar	Multiple	-	\$7.87	0.3261	1	\$7.87	0.3261
M10-1.5 HEX NUT	Commodity Item	-	\$0.06	0.0147	1	\$0.06	0.0147
Rear UTB-Fox	Multiple	-	\$5.90	0.7460	1	\$5.90	0.7460
REAR UTB-AR	Multiple	-	\$6.24	0.9140	1	\$6.24	0.9140
M14-2 x 95 Hex Hd Bolt	Commodity Item	-	\$0.63	0.1497	3	\$1.89	0.4491
M14-2 Hex Nut	Commodity Item	-	\$0.10	0.0327	3	\$0.30	0.0981
Rear Spring Seat Assembly	Multiple	-	\$7.22	3.6397	1	\$7.22	3.6397
Rear Spring Seat	Steel 1015 - Coil	-	\$5.80	2.7980	1	\$5.80	2.7980
Rear Spring Seat Cover	PP-GF20	-	\$1.10	0.2300	1	\$1.10	0.2300
M16x19 Hex Screw/washer, Front Aero Shield	Commodity Item	-	\$0.12	0.0117	1	\$0.12	0.0117
Rear Shock Assembly	Multiple	Mando	\$28.50	2.8940	1	\$28.50	2.8940
Rear Coil Spring Assembly	Commodity Item	-	\$14.53	3.7530	1	\$14.53	3.7530
Rear Spring Bottom Pad	NBR	-	\$1.24	0.1390	1	\$1.24	0.1390

Cost Bill Of Material Example

Please note the costed bill of material is provided in pictorial / PDF format and will not be available in Excel.



FAQ (Frequently Asked Questions)

- ❖ Were Manufactures involved in the study?
No, OEM proprietary costs nor any suppliers quoted costs were used in this study.
- ❖ Is there any OEM propriety (stolen) IP in this report?
No. All data was developed through Munro's proven methodologies from the purchased production components
- ❖ Is the car costed using only NAFTA costing centers?
Yes, Munro includes labor, factory floor cost, taxes and SG&A for OEM or Tier Suppliers.
- ❖ Is this a Costing or Pricing report?
This is a Costing Report. Pricing has too many variables.

Legal Disclaimers & Sales Condition

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Munro will visit if the customer pays for the travel and daily fee.
- ❖ If there are a few but specific questions on the content of report, is it possible to support a phone or e-mail communication?
Yes, please contact the local area sales person and we will respond with our answers.