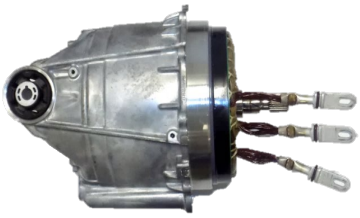
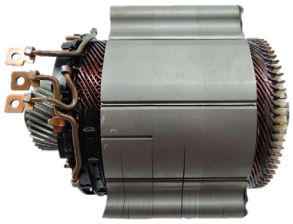
MUNRO & ASSOCIATES, INC.

Motor Teardown and Benchmarking Study

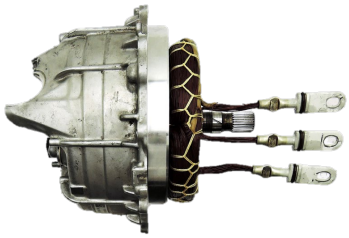


Tesla Model 3 Rear Motor

BMW i3

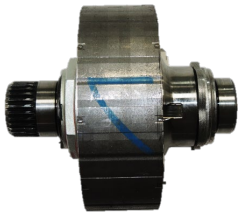


Chevrolet Bolt



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

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INTERNATIONAL engine + POWERTRAIN of the year awards 2019

Presented by engine + powertrain technology international *magazine*

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

Results

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

MUNRO & ASSOCIATES, INC.

Motor Report

Description of the Motor Analysis

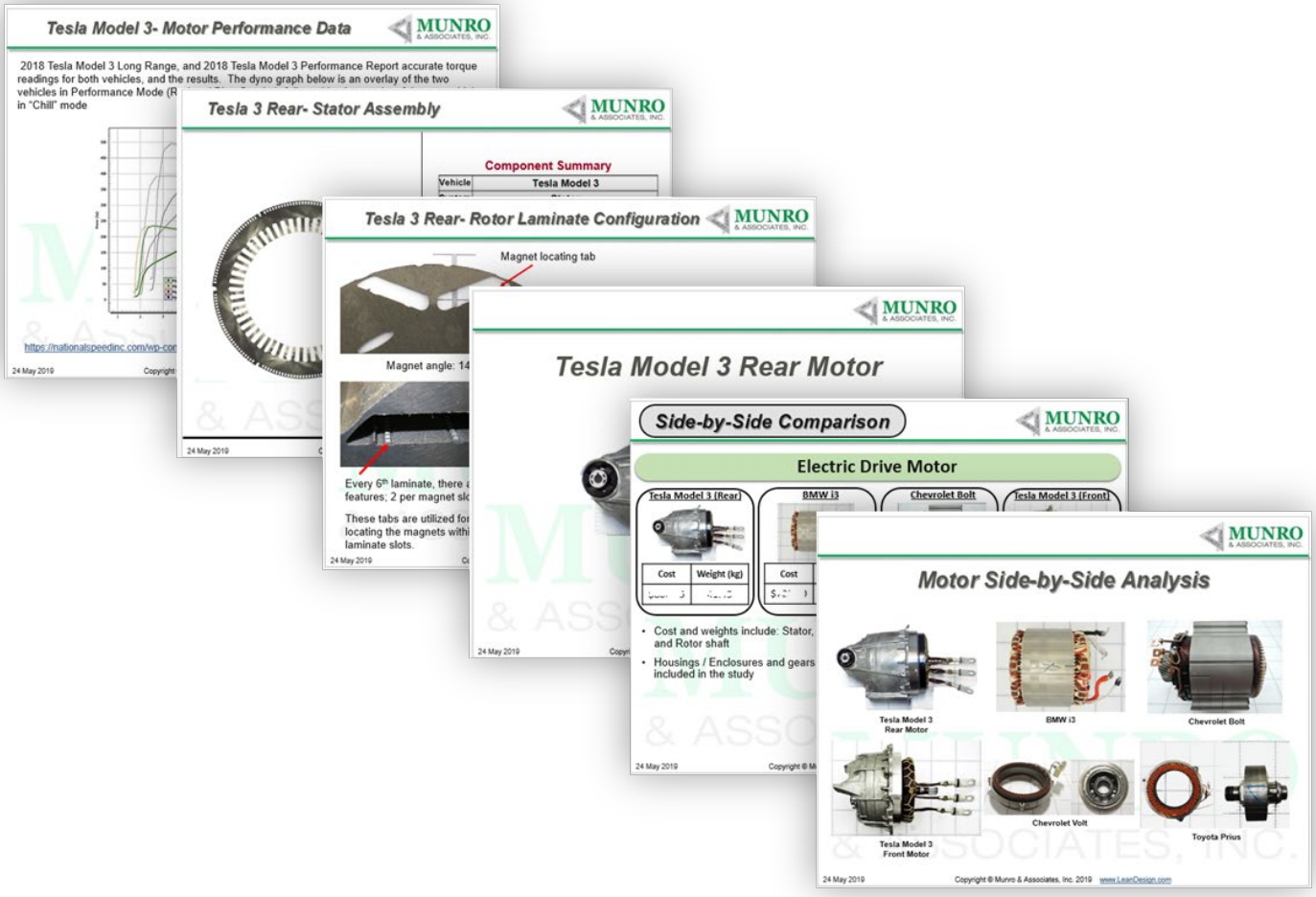
A. Side by side motor comparing torque, power ratings, motor types, application, part count, cost and weight
B. Each motor has a dedicated report section providing detailed dimensional data such as:
   - Over all dimensions and weights
   - Discreet part dimensions i.e. laminate thicknesses and counts
   - 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



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."

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 Bolts	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
M8-1.25x36 Class 10.9 Hex Extra Big Flange Bolt	Commodity Item	-	$0.08	0.0244	4	$0.32	0.0976
M10-1.5x33 Class 10.9 Hex 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**	**0.0000**
Rear Cradle Assy with Swaybar	**Multiple**	-	**$114.71**	**26.1172**	1	**$114.71**	**26.1000**
Rear Cradle Assy without Swaybar	**Multiple**	-	**$102.15**	**23.0000**	1	**$102.15**	**23.0000**
Rear Stabilizer Bar Assembly	**Multiple**	-	**$11.82**	**3.0360**	1	**$11.82**	**3.0360**
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**	**18.8255**	1	**$149.44**	**0.0000**
Rear Knuckle	**Al - A356**	-	**$45.13**	**4.6160**	1	**$45.13**	**4.6160**
Rear Lwr Track Bar Aft	**Multiple**	-	**$5.94**	**0.9460**	1	**$5.94**	**0.9460**
M12-1.75x75 Hex Hd. Shoulder Screw	Commodity Item	-	$0.31	0.0863	3	$0.93	0.2589
M12-1.75 Hex Nut	Commodity Item	-	$0.06	0.0213	3	$0.18	0.0639
Rear LTB-Fore	**Multiple**	-	**$6.36**	**0.7060**	1	**$6.36**	**0.7060**
Rear Link Bar	**Multiple**	-	**$7.87**	**0.3261**	1	**$7.87**	**0.3261**
M10-1.5 HEX NUT	Commodity Item	-	$0.05	0.0147	1	$0.05	0.0147
Rear UTB-Fore	**Multiple**	-	**$5.90**	**0.7460**	1	**$5.90**	**0.7460**
REAR UTB-Aft	**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**	**3.0397**	1	**$7.22**	**0.0000**
Rear Spring Seat	**Steel 1018 - 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**
M8x19 Hex Screw w/washer, Front Aero Shield	Commodity Item	-	$0.12	0.0117	1	$0.12	0.0117
Rear Shock Assembly	**Multiple**	Mando	**$25.50**	**2.8940**	1	**$25.50**	**2.8940**
Rear Coil Spring Assembly	**Commodity Item**	-	**$14.53**	**3.7530**	1	**$14.53**	**3.7530**
Rear Spring Bottom Pad	NSR	-	$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

- How can I see the sample report before purchasing?

  Please contact your regional Munro sales person. They can provide sample information in digital PDF format NOTE: critical data will be hidden in the sample.

- Is this report allowed to Reproduce, Distribute, Disseminate, Photocopy, Fax, Transmit in the same organization when a company purchases the report?

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- If there is a request for someone from Munro to visit and to explain in detail the report, is It possible to do or is it included in the price of report?

  No, it is not included in the price of report.

  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.