



**Leading Automotive Supplier
Explored Waste Heat Recovery
Technologies, Innovations, Trends
and the Ecosystem**

Client	A leading automotive supplier
Industry	Automotive
Products	Waste Heat Recovery Systems

Background

- The Client wanted to understand current state-of-art in waste heat recovery technologies, along with future trends and innovations in order to maintain the leadership position in this field

Key Business Questions

- Which are the novel / emerging technologies / possibilities in this area?
- Which are the centers of innovation in these technologies (US, Europe, Asia-pacific)?
- Who are the key players operating in this space (OEMs | Suppliers | New emerging entities)?
- Who are the key technology developers / providers along with their development stage?
- What are the possible future trends, white spaces and hot research areas?

Engagement Scope

1	Technology Landscape	2	Ecosystem Analysis & Competitive Intelligence	3	Technology Benchmarking	4	Industry Perspective and Future Trends
<ul style="list-style-type: none"> ▪ What are the current state-of-art /under exploration technologies? ▪ Are there any new technology developments being done by Universities / industry outsiders? ▪ Where are these developments taking place? 	<ul style="list-style-type: none"> ▪ Who are the key technology developers / providers in this domain (OEMs, suppliers)? ▪ What is the approach & strategy of vehicle manufacturers towards technologies' adoption? ▪ Who can be potential partners for joint developments? 	<ul style="list-style-type: none"> ▪ Which are the best available series production technologies? ▪ Which are the top under exploration technologies for early investment? ▪ How these technologies compare on various parameters? 	<ul style="list-style-type: none"> ▪ Where are the opportunity areas / white spaces? ▪ What is the industry (OEMs, Tier 1, Tier2) inclination? ▪ What are the future possibilities on technologies' adoption / successfulness? ▪ Which are the hot research areas? 				

Research Methodology

Secondary Research

- Conducted desk research (including commercial/free patent databases and meta search engines for scientific papers) to evaluate heat recovery technologies

Primary Research

- 20+ Telephonic interviews with stake holders such as OEMs, Tier 1 / Tier 2 Suppliers, Industry experts / consultants, etc.

Sample Analysis

1 Technology Landscape

What is a Thermoelectric Generator? How does it work?

Advantages

- Thermoelectric devices are maintenance free - Do not generate any harmful chemical byproducts
- Recycle waste heat energy
- Reliability - Devices can be easily built in various sizes, making it applicable across sectors
- Visible source of energy - the device are very robust, have a long life and low-maintenance requirements

Safety Concerns & Limitations

Technology Assessment Details

Technology Development Status	Technology Maturity	Challenges / Future Perspective
Commercial/Proven	High	Highly mature, widely used in various applications
Advanced/Pre-Prod	Medium	Significant progress, but still facing challenges
Concept/Pre-Prod	Low	Early stage development, high potential
Research/Development	Low	Highly experimental, high risk

2 System Analysis & Competitive Intelligence

OEMs Active in Thermoelectric Generators, Turbo-compounding, Rankine / ORC Systems

OEM Players - WMC Technologies

Thermoelectric Generators

Turbo-compounding

Rankine / ORC Systems

Market Concentration - Heat Recovery among various technologies

Bar chart showing market concentration for various technologies across OEMs.

Benefits to Client

- The study formed the base for the technology development team to direct its investment in the shortlisted technologies
- It also formed the basis for exploring the identified entities for a collaborative development
- It helped in identifying white spaces through identified emerging and promising technologies early in the development phase

3 Technology Benchmarking

Key OEMs - Approach Towards Turbocharging Technology

OEMs	Feasibility Study	R&D Research Projects	Products	Product Status	Heat Source (T)	Efficiency of Heat Recovery (%)	Collaborate - OEM	Collaborate - ODM	Automotive Application
TOYOTA	Yes	Yes	Commercial	Enhance	Supercharging	-	-	-	Passenger car, Light CV, Heavy CV
DAEWOO	Yes	Yes	Commercial	Enhance	Supercharging	-	-	-	Passenger car, Light CV, Heavy CV
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Comparative Benchmarking - Heat Recovery Technologies

Technologies	Investment Intensity	Security	Integration	Research Lead	Market Adoption	Feasibility (L1)	Feasibility (L2)	Performance	Cost
Thermoelectric	High	High	High	High	High	High	High	High	High
Turbo-compounding	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Rankine / ORC	Low	Low	Low	Low	Low	Low	Low	Low	Low

4 Industry Perspective and Future Trends

Technology Summary - Needs / Challenges / Future Perspective

Technologies	Strength/Advantage	Market Industry	Challenges	Market Industry	Future Perspective	Preferred Approach
Thermoelectric	High efficiency, low maintenance	Automotive, Industrial	High cost, low efficiency	Automotive, Industrial	High efficiency, low maintenance	High efficiency, low maintenance
Turbo-compounding	High efficiency, low maintenance	Automotive, Industrial	High cost, low efficiency	Automotive, Industrial	High efficiency, low maintenance	High efficiency, low maintenance
Rankine / ORC	High efficiency, low maintenance	Automotive, Industrial	High cost, low efficiency	Automotive, Industrial	High efficiency, low maintenance	High efficiency, low maintenance

Market Share - Heat Recovery Technologies

Stacked bar chart showing market share for various technologies.

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Stacked bar chart showing market share for various technologies.

Thank you

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