Thermoelectric Generators (TEG) for Waste Heat Usage in the Industry: Technologies, Applications, Future Challenges

Innovation Roundtable

of the GJETC (German-Japanese Energy Transition Council)

Date: November 5th 2021
(day after the annual German conference on "Industrial Waste Heat Utilization")

Time: 8:30 – 11:30 CET / 16:30 – 19:30 JST

Format: online (Zoom)

Language: German and Japanese (with simultaneous translation)

Organisation: German-Japanese Energy Transition Council (GJETC)

Supported by: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)

Voluntary cooperation: New Energy and Industrial Technology Development Organization (NEDO)

Participants:

- Producers of TEG and related materials in Germany and Japan
- Potential users of TEG, e.g. in the steel industry, cement industry, glass industry in Germany and Japan
- Research Institutes concerned with waste heat usage technology
- Associations, Institutions, e.g.: NEDO, Waste Heat Recovery Technology Consortium of Japan, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), Federal Ministry for Economic Affairs and Energy (BMWi), Ministry of Economy, Trade and Industry (METI), Japan External Trade Organization (JETRO)
- GJETC Council Members

Background

GHG gas neutrality cannot be achieved in Japan or Germany simply by replacing fossil fuels with renewable energies. “Efficiency First” is equally important, also in the industry. Even if production processes are changed on the way to “net zero”, process temperatures will mostly be the same, and waste heat at different temperature levels can be made usable to save energy and to cut CO_2 emissions.

Energy efficiency in the industry and – more concretely – the further development of technologies for waste heat usage has been identified as a key issue of common interest and competences on both sides in an analysis carried out by the GJETC.

In a German-Japanese online workshop on “Industrial Waste Heat Utilization” from 19-22 April 2021, German and Japanese experts from industry, research and administration exchanged information on policy frameworks, available technologies and exemplary projects in the field of industrial waste heat utilization. Thermoelectric generators (TEG) was one of the technologies which have been identified in the workshop as possible fruitful fields for joint R&D and demonstration projects.

Thermoelectric generators and thermoelectric materials are currently primarily used in niche applications, but are becoming more popular with the efforts to exploit waste-heat-recovery technologies. The industrial segment is projected to record the highest growth during the forecast period owing to the adoption of TEGs in smelters & blast furnaces, and other chemical processing applications. The European region is estimated to account for the highest CAGR (Compound Annual Growth Rate) of thermoelectric generators market in 2021.

However, the TEG module costs are still very high, and efficiency needs to be improved. The replacement of problematic materials such as lead and tellurium is also an issue. Further R&D and demonstration of use cases are needed.

Objective of the Innovation Roundtable

- bring together suppliers and users as well as research institutes and supporting bodies from both sides
- exchange of information on the current state and new developments of technology, pros and cons in comparison to other waste heat use technologies such as ORC, possibilities for cost reduction (material, production process etc.) and experiences of use cases
- develop ideas, concepts and research impulses in close cooperation with companies and research institutes on the German and Japanese side
- define contents for joint R&D projects for further improvement of TEGs (efficiency, costs) or for joint demonstration projects for industrial applications

Program

Moderator: Johanna Schilling, ECOS

Time (CET)	Time (JST)	Program
8:30	16.30	Welcome by the GJETC Co-Chairs: *Tatsuya Terazawa (Chairman & CEO of the Institute of Energy Economics Japan)* *Prof. Peter Hennicke (Former President of the Wuppertal Institute)*
8:35	16:35	Greeting addresses: *Ann-Sophie Weihe-Feijó, Division IK III 5 (Climate Protection and Energy Efficiency), Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)* *Masanori Kobayashi, Director General, Energy Conservation Department, New Energy and Industrial Technology Development Organization (NEDO)* *Dr. Hartmut Versen, Division IIB2, Federal Ministry for Economic Affairs and Energy (BMWi)*
8:50	16:50	Short summary of the conference "Industrial Waste Heat Use" of the previous day *Patrick Hoffmann, IZES gGmbH*
9:00	17:00	Current research activities of the GJETC on decarbonization of the industry *Dr. Stefan Thomas, Wuppertal Institute, Council Member of the GJETC*
9:05	17:05	Introductory speech: Recent Developments of Thermoelectric Generators for Waste Heat Recovery and their Application *Julian Schwab, Institute of Vehicle Concepts, German Aerospace Center (DLR)*
9:15	17:15	R&D activities and future perspectives for TEGs in Japan (title tbc) *Atsushi Yamamoto, Principal Research Manager of GZR (Global Zero Emission Research Center), AIST (National Institute of Advanced Industrial Science and Technology)*
9:25	17:25	R&D activities and future perspectives for TEGs in Germany: *Dr. Heiko Reith, Leibnitz Institute for Solid State and Material Research (IFW), Dresden*
9:35	17:35	Q&A / Discussion on opportunities and further challenges regarding TEGs
9:55	17:55	Break
10:05	18:05	R&D project/technology/application examples (Germany): • Thermoelectric Generators (TEG) for Waste Heat Usage in the Industry: Technologies, Applications, Future Challenges, *Dr. Frank Mintus, VDEh Betriebsforschungsinstitut GmbH* • Thermoelectric Generators: Previously Common Approaches, Market Entry Barriers and New Approach of Fraunhofer IPM, *Dr. Olaf Schäfer-Welsen, Fraunhofer Institute for Physical Measurement Techniques (IPM)* • Thermoelectric Generators Manufactured by Printing Technology, *Andres Rösch, KIT Karlsruhe Institute of Technology*
10:20	18:20	Q&A
10:30	18:30	R&D project/technology/application examples (Japan): • Sustainable Thermoelectric Module - TEG System with latent heat of condensation recovery *Kentaro Uchida, Director of R&D Department, Hakusan Inc.* • Introduction of the Self-sustaining Power Supply equipped with the flexible TEG module 'Flexina' *Michio Okajima, Chief Operation Officer, E-ThermoGentek Co., Ltd* • Efforts to recover waste heat by KELK *Takahiro Murase, General Manager, TEG Business Dept.KELK Ltd.*
10:45	18:45	Q&A

10:55	18:55	Discussion: possible contents for joint R&D projects for further improvement of TEGs (efficiency, costs) or for joint demonstration projects for industrial applications
11:30	19:30	Closure