Minutes of MGT Meeting

08 October 2015, ETN office, Brussels, BE

Attendees:

Luc Prieels	ACTE
Enrico Bianchi	Ansaldo
Markus Hell	Berlin Partner
Stef Wezenbeek	Bosal
Jafar Alzaili	City University London
Mikael Swanteson	Compower
Mario Lehmann	Brandenburg University of Technology
Hamidreza G. Darabkhani	Cranfield University
Mark Wilksch	Delta Motorsport
Jan Terlingen	DGTA
Andreas Huber	DLR
Timo Zorbek	DLR
Giusseppe Messina	ENEA
Andre Mom	ETN
Christer Björkqvist	ETN
Ignacio Lescano	ETN
Ugo Simeoni	ETN
Peter Breuhaus	IRIS
Michel Delanaye	MITIS
Wilfried Visser	MTT / Delft University
Federico Cernuschi	RSE
Mario Ferrari	University of Genova
Pietro Zunino	University of Genova
David Sánchez	University of Seville
Ambra Giovannelli	University Roma TRE
Marina Montero Carrero	Vrije Universiteit Brussel
Ward De Paepe	Vrije Universiteit Brussel

1. Welcome and Introduction

C. Björkqvist opened the meeting and welcomed the participants. He presented the market forecast for micro gas turbines (MGT) in the world and introduced the three main challenges for MGT that were raised in the previous meeting in London:

- High costs related primarily to the recuperator and to the power electronics.
- Low efficiency if compared to competing technologies on the market.
- Fuel flexibility with the same MGT.

2. MGT Recuperator requirements

W. Visser presented the state of the art of recuperators and the key requirements needed to make MGT more competitive in the market. It was agreed that the main costs are related to the manufacturing process. W. Visser raised a 'chicken and egg' problem whereby the high manufacturing costs derive from low production volume that entails higher manufacturing cost.

L. Prieels stated that for ACTE the key issue would be the low volume of recuperators. He mentioned that a more flexible design with adaptability to a wider range of MGT power output would cut down costs as the production would increase. He also added that there might be hidden costs in the design process that could be tackled by a true integration of the recuperator and MGT design phases. L. Prieels expressed an interest to tackle these issues in a horizontal project cooperation.

3. MGT Efficiency

P. Breuhaus presented the key challenges regarding MGT efficiency and discussed the advantages and drawbacks for MGT against similar technologies, mainly Internal Combustion Engines (ICE). The ICE competitors have products and markets that are well developed and technologies that have been proven for some time. With an higher efficiency they are popular for primary and back-up power applications despite higher levels of emissions, noise and maintenance. L. Prieels suggested that emissions should be highlighted as a considerable advantage for MGT.

A. Mom stated that, according to a recent Capstone's press release, the efficiency of a one-stage MGT has increased up to 36% and asked the participants what was behind these increases. A. Huber highlighted that by modifying the recuperator and the combustor you could achieve important efficiency gains.

P. Zunino offered a presentation on UNIGE activities related to improving component performance to increase the overall efficiency.

F. Cernuschi introduced RSE research on ceramic material for MGT rotors as a solution to improve the MGT efficiency. M. Wilksch stated that he believed the cost of the material would be too high even though ceramic components have been already used to manufacture new components. W. Vissier stated that a ceramic wheel would require in parallel a redesign of the casing to overcome high temperatures and turbo-shock. A. Mom mentioned that ceramic wheel has been a recurrent topic for decades and there has never been a breakthrough.

To tackle MGT efficiency problem, W. Visser suggested turbomachinery optimisation projects. He mentioned that large improvement in efficiency would still be possible just by optimising the turbomachinery components. A. Mom asked if the OEMs would be willing to collaborate horizontally with research institutes. W. Visser and E. Bianchi stated that they would.

4. Fuel Flexibility with the same MGT

A. Huber gave a presentation regarding research activities on fuel flexibility with the same MGT. It was highlighted that MGT are more flexible than ICE but the fuel variability range is still limited. E. Bianchi stated that Ansaldo would have no interest in other fuels than biogas and natural gas, but there is a high interest in being able to burn both fuels in the same MGT. H. Darabkhani suggested external combustion systems as potential solutions to widen the fuel flexibility. In this scenario, the main challenges rely on the heat exchanger.

5. MGT vision and H2020 potential calls

U. Simeoni reported that there would be no specific MGT topic in the *2016-2017 calls in the H2020 Work Programme*. The only calls where MGT challenges potentially could be tackled would be the *H2020-NMBP-02-2016* for power electronics materials and SMEinst-2016-2017, which is suitable for different kind of projects. There was a general agreement that these calls where not specific enough on MGT. A. Mom also mentioned that the SME instrument has very low success rate (about 10%).

D. Sánchez proposed that we should target a specific market, define specifications, and create a business case. This would then be presented to the national institutions to try to get funding. ETN support would help to convince national institutions to invest in the technology.

A. Mom suggested highlighting to the EU the risk of losing competitiveness against US and Japan who both have funding schemes in place for MGT development.

W. Visser proposed that instead of focusing on one challenge, a large programme should be set as backbone of several parallel running projects.

C. Björkqvist insisted we should push for MGT development opportunities under both EU and national programmes by highlighting how the technology can help in reaching the energy policy targets. However, he pointed out that the effect of such strategy would come in years' time. In parallel, we should try to identify cooperation opportunities in the shorter term to tackle the current issues.

6. Conclusions and next steps

C. Björkqvist proposed to create working groups in order to define what R&D activities are needed for each current issue (Annex II). Chairs and co-chairs of the working groups were appointed among the members. It was agreed that each member of the working group would send to the chair and co-chair a short description of the challenges, the comparison with other technologies and the proposed research activities to tackle it. The drafts of the documents should be circulated among the members by the 16th of November for further comments.

Annex I: Action list

Action Owner	Description	Deadline date
All	To send a short description of the challenge, the comparison with other technologies and the proposed research activities to tackle it.	9th November 2015
Leaders & Co-Leaders	To prepare a draft document with the inputs received from the members	16th November 2015

Annex II: Working Groups

Challenge	Leader	Co-Leader	Members
MGT Recuperator	Luc Prieels	Mikael Swanteson	ACTE, UNIGE, DLR, Karlsruhe, Bosal, BTT, Brandenburg University of Technology, City University London, Compower, Ansaldo, Euro-K. MITIS, MTT, Karlsruhe University
MGT Efficiency	Wilfried Visser	Pietro Zunino	UNIGE, DLR, Delft University, VUB, City University, Ansaldo, RO3, Brandenburg University of Technology, MITIS, MTT, Ecole Centrale de Lyon, Gdansk Polish Academic of Sciences
MGT Fuel Flexibility	Andreas Huber	Hamidreza G. Darabkhani	Cranfield University, UNIGE, Ansaldo, DLR, RO3, VUB, University of Seville, RSE, MITIS, MTT, Karlsruhe University, Leeds University, ENEA
MGT Materials	Federico Cernuschi	Nigel Simms	University of Seville, UNIGE, Cranfield University, Ansaldo, Euro-K, MITIS
MGT Cycle	Peter Breuhaus	Mario Ferrari	IRIS, VUB, RO3, Cranfield University, Brandenburg University of Technology, DLR, UNIGE, MITIS, MTT, ENEA, University of Seville

*In red, names & organisations pending confirmation