



Expression of interest

Contact details

| | |
|--------------------------------------|--|
| Country | TURKEY |
| Name of the organisation | IDD Arge Inovasyon Muhendislik Ltd. Sti. |
| Name of the contact (with job title) | Assoc. Prof. Dr. Gamze GEDİZ ILİS |
| Phone | +90 532 311 30 86 |
| Email | ggedizilis@iddconsultancy.com ggediz@gtu.edu.tr |
| Website | www.iddconsultancy.com |
| Linkedin or Profile (optional) | https://www.linkedin.com/company/83528060 https://www.linkedin.com/in/gamze-gediz-ilis-phd-9691b356/ |

Short description of the organisation

Provide a short description of the equipment available, the relations with the industry, the profile of the main researchers

We have started our work on 4 main branches in IDD.

1) Electric Vehicles Thermal Projects:

- Air conditioning systems, battery, and synchronous motor thermal modeling
(Advantages: reduction in number of tests, reduction in test cost, component cost reduction, product development)
- Obtaining additional cooling by using the waste heat of electric vehicles
(first in the world and TR)

2) Batteries and Cooling Systems: Thermal analysis and new innovative battery module designs for the healthy operation of new generation battery systems. (first in the world and TR)

3) Cooling from Waste Heat: G&D converts unnecessary heat in your facility to cold water. You can use the generated chilled water wherever you want; Cooling your process or for your air conditioning purposes.

here is the link below: <https://www.youtube.com/watch?v=rLfsJ-lxZ1E&t=64s>

4) Risk, Energy and Sustainability Consultancy: Consultancy services on fire, natural disaster, process-related risks of companies and reduction of risks, energy efficiency and sustainability projects.

Specific skills related to the call topic(s) or project

The founder of IDD has academic background and we are working on the thermal enhancement of the battery electrochemical and thermal analysis on heat generation, cooling of the synchronous motor, and HVAC system of the electric vehicles. With our team,

- we have knowledge on electrochemical and thermal modelling of the battery cell and battery modules by using 1D and 3D modelling methods.
- we have knowledge on synchronous motor modelling on cooling strategy of the motor of an electric vehicle by using 1D and 3D modelling methods.



- c) we have knowledge on 1D modelling methods of HVAC system of an electric vehicle
- d) we have capability of coupled 1D models of each knowledge mentioned in a, b, and c.
- e) we developed a special design battery module which helps to reduce the heat generation due to charge/discharge processes and can increase the mileage of the electric vehicle by increasing the cooling performance of the battery pack.
- f) Besides, many national projects are finished and IDD is established to industrialize the know-how on adsorption technologies. After developing an adsorption chiller which is at TRL6 level, IDD team started to work on novel adsorption chiller which can be applicable to electric bus/trucks. This novel adsorption chiller is working with the waste heat of the electric vehicle and generates additional cooling. By this additional cooling effect, the HVAC system or the battery cooling system can be improved.
- g) We published many SCI and international papers on the studies of the battery cooling, synchronous motor cooling and the enhancement of the heat transfer problems of an electric vehicle.

Proposed activities for the project or the call topic(s)

Battery cooling is a very important topic for the mileage of the electric vehicle. The battery thermal management gets importance due to increasing the market rate of the electric vehicles but only battery thermal management of by using electric and electronic programming should not be only methods for improvement of the battery life and the battery thermal management systems. A special design should be developed to get over the heat generation of the battery cell thus the battery module temperature rise. Heat generation of the battery cells should be studied for different driving cycles of the vehicle. Due to that reason a special design and special materials should be studied for battery module designs.

HORIZON-CL5-2024-D5-01-03 : Advanced battery system integration for next generation vehicles (2ZERO Partnership)

IDD's novel electric vehicle battery pack design can be used for this call. This battery pack is novel due to its design which helps to transfer the heat from the cooling plate inside of a battery module. A coupled 1D and 3D electrochemical and thermal modelling of battery cell is developed. By using this model a battery module has designed which can easily transfer the heat from the cooling plate to the inner side of the battery module. This design is easily applicable and friendly to the weight of the battery module.

HORIZON-CL5-2024-D2-02-03 : Size & weight reduction of cell and packaging of batteries system, integrating lightweight and functional materials, innovative thermal management and safe and sustainable by design approach (Batt4EU Partnership)

IDD has a very good knowledge on adsorption chillers thus the silica gel materials. IDD has very good knowledge on heat and mass transfer modelling in porous media. By using their skills, a hydrogel material is developed in IDD's laboratories. This novel hydrogel has high thermal conductivity and has low thermal resistance. Thanks to this developed hydrogel, it can be used inside of the battery modules instead silicon material. As known, silicon is used for get over the vibration of the battery cells inside of the battery modules. The application of the silicon material inside of the battery module is a very hard and long process. To dry the silicon material inside of the battery module, after applying it as a liquid form, a 100°C oven is used to dry the silicon material and 5 hours curing period should be applied. By using the developed hydrogel material, which is also not hazardous to the environment, this long period to avoid from the vibration can be changed. Also by changing the silicon which is hazardous to environment by an environmentally friendly material will be a very promising novelty to the project.



References

Previous research project

1. M. Mobedi, **G. Gediz Ilis**, "Fundamentals of Heat Transfer - An Interdisciplinary Analytical Approach", Springer, ISBN: 9789819909568
2. **G. Gediz Ilis**, M. Mobedi, B. Sunden, "Effect of aspect ratio on entropy generation
3. **G. Gediz Ilis**, "Influence of New Adsorbents with Isotherm Type V on Performance of an Adsorption Heat Pump", Energy, 119, 86-93, 2017.
4. R. Habash, **G. Gediz Ilis**, H. Demir, H. Öztıp "Analysis of Low-Grade Heat Driven Ethanol-Silica Gel Adsorption Chiller", Thermal Science and Engineering Progress, 26 (2021) 101125.
5. M. B. Genç, R. Habash, **G. Gediz Ilis**, A. Alkaya, H. F. Öztıp, Cooling Strategy Optimization of a Permanent Magnet Synchronous Motor, Propulsion and Power Research, Under Review.
6. Y. Gökmen, **G. Gediz Ilis**, Analysis of Parameters on Heat Generation of a Lithium-ion Battery, Energy, Under Review.
7. **G. Gediz Ilis**, "Thermal Investigation of Pouch Battery Cell with Different Discharge Rates", Dokuz Eylül Üniversitesi Mühendislik Fakültesi Fen Ve Mühendislik Dergisi, 2017, 19; 55; 238-246.
8. M. Bashjaweesh, O. Mansour, **G. Gediz Ilis**, "An Investigation on the Cooling System of Synchronous Motor for Electric Buses", Dokuz Eylül Üniversitesi Mühendislik Fakültesi Fen ve Mühendislik Dergisi, 2021, 23; 68; 567-573.
9. **G. Gediz Ilis**, H. Demir, M.Y. Akbas, M. Mobedi, "Recent Developments on Heat Pump Systems in Electric Vehicle and a Suggestion", Heat Powered Cycles Conference, June 2016, Nottingham, UK.
10. **G. Gediz Ilis**, "COP Improvement of Electric Vehicle Battery Thermal Management System with an Adsorption Heat Pump", Proceedings of the 2nd Thermal and Fluid Engineering Conference, TFEC2017 4th International Workshop on Heat Transfer, IWHT2017 April 2-5, 2017, Las Vegas, NV, USA.
11. R. Habash, **G. Gediz Ilis**, H. Demir, "Isotherm relations and COP analysis on silica gel RD with two different adsorptive; acetone and ethanol", International Sorption Heat Pump Conference, ISHPC2021 August 22-25, 2021, Berlin Germany, Virtual Conference.
12. M.B. Genç, R. Habash, **G. Gediz Ilis** "Optimization of the Cooling Parameters of a 250 kW PMSM by Taguchi Method" 8th International Conference on Engineering and Natural Science (ICENS'22), May 18 - 22, 2022, in Istanbul, Turkey.
13. Y. Gökmen, T. Gül, **G. Gediz Ilis** "Comparison of 1D and 3D Electrochemical-Thermal Model of Lithium-Ion Battery" Proceedings of the 8th World Congress on Momentum, Heat and Mass Transfer (MHMT'23), March 26 – 28, 2023, in Lisbon, Portugal.