

Final report

1.1 Project details

Project title	Etablering af ny arbejdsgruppe (Task 38) om batteri elektrisk skibsfart samt fortsat dansk deltagelse i IEA TCP HEV 2017-2020
Project identification (program abbrev. and file)	Jnr: 64017-05154 Pulje: EUDP 2018-I Energieffektivitet
Name of the programme which has funded the project	EUDP
Project managing company/institution (name and address)	Raskgreentech ApS, Michael Rask, Gammel Lundtoftevej 34 D, 2800 Lyngby
Project partners	None
CVR (central business register)	38297988
Date for submission	20/10 2020

1.2 Short description of project objective and results

English summary

The purpose of a new IEA Task 38 on e-ships was to strengthen the focus on a new climate-friendly transport technology with strong Danish and global perspectives and to ensure Danish competences at the forefront of this promising new sector application of batteries and electrical drivetrains and propulsion.

The purpose of continued Danish participation in the IEA's collaboration on hybrid and electric transport was to ensure Danish access to the latest insights into e-mobility and to bring Danish insights to the HEV TCP table, including on the interplay between electric mobility and green energy systems, where Denmark has several strongholds.

After the start of the project, the scope was reduced to not include working on the new Task 38. This was due to challenges with recruiting new active Danish and international participants into Task 38, also financially supporting the activities, including from the IEA HEV working group, where only Denmark, US and Norway were participants in Task 38. After Norway's takeover of Task 38, it has also still been difficult for them to get the necessary participation and funding in place, and Task 38 has so far been paused.

Work on continued Danish participation in the IEA's collaboration on hybrid and electric transport was performed according to plan.

Results has generally been the following:

- Starting up of the new task 38 focusing on electric maritime applications, which in time are expected to develop into a very relevant sector of electrification both globally, regionally, and nationally. Experiences from Denmark, including Aeoro e-Ferry and Movia tendering and changing all Copenhagen harbor busses from diesel to fully electric was met with great interest. Norway are aiming at building a full blown electric maritime industry and will run the task in the future.

- Very active Danish participation in the HEV TCP with a focus on modernization, reaching out, more user friendly and policy relevant communication, with faster updates. Furthermore, Danish experiences on integration and synergies between electric mobility and energy systems with large shares of fluctuating RE has been shared. Contacts has been made between Danish and foreign companies and stakeholders on a range of areas, including batteries and battery production, Battery Management Systems, Vehicle Grid Integration, electric taxis as well as ministry to ministry contacts and securing validation of conclusions and publications from tasks, e.g. on life cycle assessment. Denmark has also supported focus in the TCP on the role of charging infrastructure, interoperability and roaming. Denmark has actively participated in 10 of 21 Tasks running in the EUDP project period.
- In relation to HEV TCP governance, work content and meeting schedule, activities were according to plan and with these major results (detailed in sections below):
 - Norway became in January 2019 a new member of the HEV TCP
 - China became in January 2020 a new member of the HEV TCP
 - Successful HEV TCP review and CERT approval of extension 1/3 2020 to 28/2 2025
 - Positive approval of new HEV TCP Strategic Work Plan for this next phase
 - The HEV TCP has a sound economy
 - The handing over to the new Canadian chair have been successful
 - New contractor for HEV TCP homepage, annual report, and Task 1 dissemination
 - Annual report on country vehicle- and infrastructure sales and policies, Tasks etc.
 - Facilitation through bilateral contacts and meetings with Danish stakeholders
 - Task 38 was initiated by DK (Chair) and US, N joined and became chair later

Dansk sammendrag

Formålet med en ny IEA Task 38 om e-skibe var at styrke fokus på en ny klimavenlig teknologi med globale perspektiver samt at udnytte de særlige "grønne og blå" danske forudsætninger til at sikre stærke danske kompetencer i den absolutte front på dette nye teknologiområde.

Formålet med fortsat dansk deltagelse i IEA's samarbejde om hybrid- og eltransport var at sikre dansk adgang til den viden om e-mobilitet og at bringe danske indsigter til HEV TCP-bordet, herunder om samspillet mellem elektrisk mobilitet og grønne energisystemer, hvor Danmark har flere styrkepositioner.

EUDP-projektet blev efter projektstart reduceret til alene at omfatte opgaven i relation til HEV TCP og ikke Task 38. Dette skyldes udfordringer med at rekruttere nye aktive danske og internationale deltagere til Task 38, som også finansielt kunne understøtte aktiviteterne, herunder i IEA HEV-arbejdsgruppen, hvor kun Danmark, USA og Norge indtil nu er deltagere i Task 38. Efter Norges overtagelse af ledelsen af Task 38, er det fortsat heller ikke lykkedes for Norge at få den nødvendige deltagelse og finansiering på plads og Task 38 er indtil videre sat på pause.

Arbejdet med fortsat dansk deltagelse i IEA's samarbejde om hybrid og elektrisk transport er gået efter planen. Fokus har været på aktiv deltagelse i HEV TCP, herunder på modernisering og opdatering af formidling og kommunikation samt, at anbefalinger udover at være tekniske også bør være policy relevante.

Resultaterne har generelt været følgende:

- Opstart af Task 38 med fokus på elektriske maritime applikationer, som med tiden forventes at udvikle sig til en meget relevant elektrificeringssektor både globalt, regionalt og nationalt. Elektriske erfaringer fra Danmark, herunder Helsingør-Helsingborg, Aeoro e-Ferry og Movia, der har udskiftet de københavnske havnebusser fra diesel til fuldt el-

elektriske, blev mødt med stor interesse. Norge sigter mod at opbygge en batteri elektrisk maritim industri og vil varetage formandskabet for Task 38 fremover.

- Aktiv dansk deltagelse i HEV TCP og tilhørende Tasks, herunder også med vægt på mere fokuseret, brugervenlig og policy relevant kommunikation med hurtigere opdateringer. Samt desuden danske erfaringer med integration og synergier mellem elektrisk transport og energisystemer med store andele af fluktuerende vedvarende energi. Der er formidlet kontakter mellem danske og udenlandske interessenter på en række områder, herunder batterier, batteriproduktion og Battery Management Systems, Vehicle Grid Integration, elektriske taxier, myndighedskontakter mellem deltagerlande, studieture, validering af analyser, konklusioner og publikationer fra Tasks, fx på livscyklusvurdering. Danmark har også støttet fokus i HEV TCP på den rolle, som lade infrastruktur, interoperabilitet og roaming spiller. Danmark har aktivt deltaget i 10 ud af 21 Tasks, der har arbejdet i EUDP-projektperioden.
- Med hensyn til HEV TCP management, arbejdsindhold og mødeplan er aktiviteterne gennemført efter planen og med disse vigtigste resultater (beskrevet i afsnittene nedenfor):
 - Norge blev i januar 2019 nyt medlem af HEV TCP
 - Kina blev i januar 2020 nyt medlem af HEV TCP
 - Positivt HEV TCP review og CERT-godkendelse af ny fase 1/3 2020 til 28/2 2025
 - Godkendelse af ny strategisk HEV TCP-arbejdsplan for denne næste fase
 - HEV TCP har en sund økonomi
 - Overdragelsen til det nye canadiske formandskab er forløbet vellykket
 - Udbud og ny operatør af HEV TCP's hjemmeside, årsrapport og Task 1 arbejde
 - Årlig rapport med landeafsnit, cases, politikker og data køretøjer og infrastruktur
 - Facilitering gennem bilaterale kontakter og møder med danske interessenter
 - Task 38 igangsat af DK (formand) og USA, N tiltrådte og blev senere ny formand

1.3 Executive summary

Task 38 originated from Denmark clearly being one of the world class leaders in both maritime industry and green energy production. A leading maritime nation with long traditions, deep knowledge and major industries in designing, building, supplying, and using ships for transport logistics. While maintaining a record breaking strong, stable and flexible energy system, a major transition to become independent of fossil energy with increasing shares of fluctuating and distributed renewable energy production must be balanced towards changes in consumption over the day and year.

Also with the exciting ongoing e-Ships projects, the blue maritime Denmark and the green energy Denmark would be well positioned to an early, active and joined effort, which could make a difference when e-Ships technology develops, potentially into a large global market.

E-Ships is especially useful for shorter routes and near traffic in harbors, harbor cities and Islands, which Denmark and other countries and regions in the world have so richly. Commercial players have estimated the potential within e-ferries in the Nordic countries to more than 200 ferries and in Europe to more than 1.000.

In addition, there could be exciting applications, where Denmark could have special and early opportunities, for example service ships for offshore activities, windfarms, underwater and drone service units for offshore inspection, and not least if development and synergies towards autonomous ships are taken into account.

In addition to continued active Danish participation in the IEA's TCP on electric vehicles, the main activities related to Task 38 on e-Ships were to be the following:

- Development and implementation of method and concept for yearly data collection on e-Ships in Denmark, regionally and globally for use in EU, IEA etc statistics
- At least 3 international workshops on e-ships, at least 1 of those in Denmark

- Developing first and second edition of Task 38 and IEA e-Ship Casebook
- Production and distribution of Task 38 and e-Ships newsletter every 6 month
- Global e-Ships analysis work and reports on technology, environmental and climate performance, market potentials and economy
- Development of key figures and standard values for e-Ships in terms of energy efficiency, emissions reductions, economy for use in Alternative Fuels analysis models nationally and internationally
- A Danish Advisory Board to the project with Dansk with participation of among others the Danish Maritime Authority, the 3 Danish national Shipping organizations and Danish Maritime, who all has declared support and interest in the project
- Synergies with other IEA Tasks will be explored including the autonomous vehicles

After the revised budget and scope excluded Task 38, the main objective was reduced to continue active Danish participation and representation in IEA TCP HEV 2017-2020 with the focus and main activities mentioned in sections below.

1.4 Project objectives

In relation to Task 38, it was an objective, that the project led to or supported:

- Danish e-ships competences, companies and knowledge engaged and placed in the forefront of the technology and its development towards the market
- More Danish and international e-Ships projects with Danish participation
- Visibility of Danish strengths in technology, development-, and demonstration activities
- A deeper understanding of the relation between e-Ships and autonomous ships, e.g. in concrete projects
- A further understanding and segmentation of market potentials for types of e-Ships across regions, countries, capitals, e.g. enhanced serial production and upscaling
- That e-Ships will be a new technological category in IEA publications on electric transport including with global data on market potential, market penetration etc.
- That e-Ships is incorporated in transport models used nationally and internationally
- That the case work on e-Ships in Task 38 will be continued as an IEA work afterwards

After the revision of the project, the focus of Task 38 was reduced to secure that the Task was continued by US and Norway, and with Norway as a new and active chair. The project objective related to the HEV TCP, was not changed, and included:

- Active participation in the IEA TCP HEV ExCo meetings, Task 1 Country information dissemination meetings and related meetings as the Danish representative. These meetings are clustered in 2 main events per year
- Give a presentation at the Task 1 meetings on a Danish status on HEV transport
- Write and coordinate the Danish chapter to the HEV TCP Annual Report, including reporting data on stock and new sales of vehicles, charging infrastructure, bicycles etc.
- Update and maintain the Danish part of the HEV TCP webpage
- Facilitate Danish industry and academia dialogue and participation in relevant running tasks

- Distribute presentations and information from the meetings to Danish stakeholders, including on 2 Danish meetings per year

1.5 Project results and dissemination of results

I relation to Task 38 a lot of work was done on defining, preparing, and presenting the new Task and attracting Danish stakeholder participation. The Task was approved by the HEV TCP and US joined with several countries expressing interest. The Task was presented at a range of meetings, including at all HEV TCP ExCo meetings. There was a good dialogue with the relevant EU Commission staff wanting to join Task 38. Chile also wanted to join, but this was difficult, not being a HEV TCP member. Meetings were held with more than 20 Danish maritime stakeholders, including authorities, industry, and academia. Timeslot was reserved and a 2-day programme developed for the first Task 38 global workshop to be held in Denmark at the Maritime Museum by Kronborg (the 2nd workshop should to be held in the Americas and the 3rd workshop in Asia). Methodologies and technology characterisation, segmentation, cases for e-ships Casebook etc. was developed.

The first review of the Task 38 done by the HEV TCP Technical Committee had the following comments and recommendations:

“Task is in its initial stages. Contribution to Annual Report is very nice and substantial. The website is okay. The OA [Operating Agent – Michael Rask] is very active in seeking members. The OA should start a substantial working group and start the work according to plan. Overall, a good job”.

But funding was scarce, and there was no budget for workshop and not enough budget for casebooks and data development. With Danish stakeholders and HEV TCP countries being hesitant to join the Task before seeing more developed activities and products, the budget for workshops and other activities was inadequate and the scope of the Task 38 part of the EUDP project could not be fulfilled within a reasonable timeframe.

Due to lack of funding and country participation, the EUDP project scope had to be reduced to focus only on work done in relation to the HEV TCP and to Norway taking over Task 38 Chair. Hence, objectives mentioned in section 1.4 was not fulfilled in relation to Task 38.

Task 38 is expected to be up and running under Norway from within a year or two due to e-ships technology maturing and more countries and stakeholders see the relevance more clearly.

I relation to HEV TCP the following activities were performed, and results achieved:

- Active participation in all 5 two-day meetings of the HEV TCP:

Meeting	Date	Host Country
47 th	13-14 Nov 2017	Austria
48 th	12-13 April 2018	Ireland
49 th	10-11 October 2018	Switzerland
50 th	16-18 May 2019	France
51 st	17-18 October 2019	Italy

- Active participation in all 5 Task 1 country dissemination meetings, presenting DK status
- Writing and coordinating the Danish chapter to the HEV TCP Annual Report, including reporting data on stock and new sales of vehicles, charging infrastructure, bicycles etc.

Both annually writing the Danish chapter as well as well as collecting and presenting data for DK vehicles and charging infrastructure are extensive work.

- Denmark has actively participated in 10 Tasks in the project period, these are
 - Task 1 – Information Sharing
 - Task 24 – Economic Impact Assessment of e-Mobility
 - Task 26 – Wireless Power Transfer for Electric Vehicle
 - Task 28 – Home Grids and V2X Technologies / Vehicle-Grid Integration
 - Task 31 – Fuels and Energy Carriers for Transport
 - Task 32 – Small Electric Vehicles
 - Task 36 – EV Consumer Adoption and Use
 - Task 38 – Marine Applications (e-Ships)
 - Task 42 – Scaling Up EV Markets and EV City Casebook
 - Task 43 – Vehicle/Grid Integration

- These 21 Tasks has been running in the project period:
 - Task 1 – Information Exchange
 - Task 23 - Light-Electric-Vehicle Infrastructure
 - Task 24 – Economic Impact Assessment of e-Mobility
 - Task 25 - Plug-in Electric Vehicles
 - Task 26 – Wireless Power Transfer for Electric Vehicle
 - Task 28 - Home grids and V2X technologies
 - Task 29 - Connected and automated E-vehicles
 - Task 30 - Environmental effects of EVs
 - Task 31 – Fuels and Energy Carriers for Transport
 - Task 32 – Small electric vehicles
 - Task 33 – Electric buses
 - Task 34 – Batteries
 - Task 35 – Fuel Cell Electric Vehicles
 - Task 36 – EV adoption/use
 - Task 37 – Extreme Fast Charging
 - Task 38 – Marine Applications of Hybrid & Electric Systems (e-Ships)
 - Task 39 – Interoperability of e-Mobility Services
 - Task 40 – Critical Raw Materials for EVs
 - Task 41 – Electric Freight Vehicles
 - Task 42 – EV Cities Casebook
 - Task 43 – Vehicle/Grid Integration

- These 9 Tasks has been initiated in the project period:
 - Task 35 – Fuel Cell Electric Vehicles
 - Task 36 – EV adoption/use
 - Task 37 – Extreme Fast Charging
 - Task 38 – Marine Applications of Hybrid & Electric Systems (e-Ships)
 - Task 39 – Interoperability of e-Mobility Services
 - Task 40 – Critical Raw Materials for EVs
 - Task 41 – Electric Freight Vehicles
 - Task 42 – EV Cities Casebook
 - Task 43 – Vehicle/Grid Integration

- These 9 Tasks has been finalized in the project period:
 - Task 24 – Economic Impact Assessment of e-Mobility
 - Task 25 - Plug-in Electric Vehicles
 - Task 26 – Wireless Power Transfer for Electric Vehicle
 - Task 28 - Home grids and V2X technologies
 - Task 31 – Fuels and Energy Carriers for Transport
 - Task 33 – Electric buses
 - Task 35 – Fuel Cell Electric Vehicles
 - Task 36 – EV adoption/use

- Task 37 – Extreme Fast Charging
- The key findings and lessons learned from the finalized Tasks are:
 - Task 24 – Economic Impact Assessment of e-Mobility
Manufacturing of electric vehicles, charging infrastructure, and charging energy has a significant economic impact on national employment, revenues, and exports. The economic impact of e-mobility can be considerable, both within and beyond the e-mobility sector itself: employment growth can be substantial when the local EV market really takes off. Spillover effects can be seen in other sectors like the energy sector. Ignoring e-mobility can lead to significant losses in terms of value added and employment opportunities for local industry. Task final report is available on TCP website.
 - Task 25 - Plug-in Electric Vehicles (PEVs)
PEVs are becoming well established due to fuel efficiency regulations and purchase incentives. PEVs are positioned for success in North America, Europe, and Asia markets, as levelized costs become competitive with conventional vehicles. Task final report is available on TCP website.
 - Task 26 – Wireless Power Transfer for Electric Vehicle
Alignment, component location, power transfer levels, center frequency operation, interoperability, communications, and data security are key issues affecting performance and safety of wireless power transfer systems. Global standards are lacking, and they will need to be developed and implemented.
 - Task 28 - Home grids and V2X technologies
Key outputs: Roadmap on V2G technology, Database on V2G international projects. Eight key issues identified to move the technology towards commercial readiness: (1) standardization and harmonization, (2) consensus on battery degradation, (3) Include V2X in grid codes, (4) Develop new tariffs and contracts for flexibility, (5) Redesign TSO system services markets, (6) Develop DSO system services market, (7) Improve public awareness of V2X technology and (8) Develop customer centered business models.
 - Task 31 – Fuels and Energy Carriers for Transport
For a standard car, the lifetime GHG emissions of a battery electric vehicle (BEV) is approximately 50% lower than those of an average internal combustion engine vehicle (ICEV) using the EU electricity mix. A BEV using renewable energy for recharging has close to 90% lower life cycle GHG emissions than its ICEV equivalent. Task final report is available on TCP website.
 - Task 33 – Electric buses
Battery electric buses are seeing steady sales growth driven by clean air legislation, government incentives, and infrastructure investments. The rate of adoption varies greatly across member countries and is strongly influence by local policies.
 - Task 35 – Fuel Cell Electric Vehicles
An analysis of FCEV current technology and future research needs, including hydrogen station concepts; and market conditions for FCEVs and hydrogen stations.
 - Task 36 – EV adoption/use
The analysis confirms that both financial and non-financial incentives are very effective in promoting consumer adoption of EVs. Education and outreach also enhance public awareness of EVs and stimulate adoption. Model availability and charging infrastructure are key enablers.
 - Task 37 – Extreme Fast Charging
Key factors affecting the business case for extreme fast charging include station siting factors, cost of installation, power supply and grid connection. Extreme fast charging has implications for battery design and cost, pay structures, and consumer education. Development of standards for extreme fast charging are needed and will be critical to the deployment and market uptake of the technology.

From 2015-2020 HEV TCP produced 23 studies, 3 databases (EV-sales, emissions, LCA), 55 publications, 7 scientific journal articles and 27 workshops.

- HEV TCP products in 2019 only
 - Completed 9 task workshops
 - Conducted 2 cross-cutting workshops on country updates and information exchange
 - Best Paper Award at 32nd International Electric Vehicle Symposium for Task 32 work
 - HEV Annual Report disseminated at major EV conferences and on HEV-TCP website
 - Final Reports on Task 25, Task 26, and Task 28 made available on HEV-TCP website
 - Papers presented at the 32nd International Electric Vehicle Symposium (EVS32)
 - V2X Roadmap completed and made available on HEV-TCP website
- Country Membership
 - Membership currently is 19 countries
 - Norway joined in January 2019
 - China joined in January 2020
 - South Africa and EU Commission participated in 2019 ExCo meetings as observers
 - Invitations currently to Brazil, Japan, Latvia, Morocco, South Africa, and Thailand
- HEV TCP Management
 - Completed 5th year of current Phase 5 (Mar 2015 – Feb 2020)
 - Successfully obtained CERT approval for Phase 6 (Mar 2020 – Feb 2025)
 - Strategic Planning Committee meets twice per year to discuss HEV-TCP strategy
 - Technical Committee meets semiannually to develop and evaluate ideas for new tasks, and to conduct a progress assessment of ongoing tasks (Task Audits)

Collaboration with the IEA Secretariat

The HEV-TCP has supported joint data collection efforts for IEA's Global Electric Vehicle Outlook (GEVO) report and has supported IEA's Energy Technology Perspectives (ETP) publication. The HEV TCP participated in all three Universal TCP meetings organized by IEA and regularly participates in the EUWP meetings. The HEV-TCP Co-Chair served as the EUWP Vice Chair for Transport and chaired the IEA EUWP Transport Coordination Group (TCG), allowing for additional exchanges of information. The HEV TCP delegates participated in various IEA workshops: "Batteries for Electric Mobility" in March 2018; "Workshop on Electrofuels" in September 2018; "Behaviour Change for Energy Efficiency" in September 2018; "Gaps and barriers for energy technology development and deployment" in March 2017; "The future role of trucks for energy and environment".

Collaboration with Electric Vehicles Initiative, other TCPs, and IEA working groups

The HEV TCP has collaborated with EVI on several fronts. When possible, HEV and EVI have coordinated ExCo and Advisory Board meetings to be held in conjunction with each other, allowing HEV and EVI to hold joint Task 1 Information Exchange workshops. HEV also collaborated with EVI on data gathering of EV statistics from member countries. The HEV TCP conducted a joint workshop with Photovoltaic Power System TCP (PVPS) on the topic of "PV for EVs" in October 2018. HEV TCP collaborates with the Advanced Motor Fuels TCP for tasks on electric buses and electric freight vehicles. The HEV TCP has coordinated with the Advanced Fuel Cells TCP regarding activities on fuel cell electric vehicles. The HEV TCP has collaborated with the Working Group on Cities and Communities.

HEV TCP has ongoing collaborations with these other IEA TCPs and co-ordination groups

- Advanced Motor Fuels TCP for tasks on electric buses
- Photovoltaic Power System TCP on PV for EVs
- Advanced Fuel Cells TCP on annexes on fuel cell electric vehicles
- Advanced Motor Fuels TCP for tasks on freight vehicles
- IEA Working Group on Cities and Communities

Outreach

The HEV TCP produces substantial annual reports. The annual reports include up to date statistics on EV sales and populations in member countries, as well as on the deployment of EV charging infrastructure, member country chapters, and Task update chapters. The annual report is availability for download on the HEV TCP website. The HEV TCP website is a

strong means to disseminate the outputs/reports of the Tasks, the annual report, and to provide general information on the TCP (e.g. member country contacts, how to join the TCP, etc.). The TCP members have expressed a need to modernize the website. The TCP has been very present at the recurring International Electric Vehicle Symposium, which has provided opportunities to promote the work undertaken by the TCP. The HEV TCP has extended open invitations to various multilateral organizations to participate in ExCo meetings, including the International Partnership for Hydrogen and Fuel Cells in the Economy, the International Council on Clean Transportation, and the European Association for Electromobility.

The project objectives mentioned in section 1.4 has all been fulfilled, and there has been a successively dialogue with a range Danish stakeholders on specific topics and many concrete inquiries ranging from connecting companies, academia and organizations to facilitating government administration to government administration between countries. ExCo meetings has been reported on meetings with Danish stakeholders and Danish Energy Agency, including Danish Energy Agency. These meetings have been hosted by Danish Energy Agency and Lithium Balance. The Annual HEV TCP report is also a natural occasion for including and highlighting relevant new Danish cases and projects which represent new knowledge, technology, or insights in e-mobility. Cases presented has included e-busses, e-harbour ferries and e-ships, e-Vehicle Grid Integration, carsharing projects, charging infrastructure and fast charging solutions, electric garbage trucks, electric taxis etc.

One thing that is not implemented yet is the modernization and update of the IEA HEV webpage. Denmark has worked actively on renewal and update of different aspects of outreach and communication activities, including

- More frequently updated and focused homepage and products which also is more publicly available as soon as possible without requiring membership of tasks or TCP etc.
- More focus on dissemination which is well balanced between and includes both technical-ly and policy related products, insights, and recommendations
- Better coordination of data collection streams of yearly country stock of hybrid- and electric vehicles, infrastructure, charging stations etc., since several streams are running in different international fora feeding into different platforms in IEA HEV, EU, etc.

The contractor for homepage, annual report and facilitating Task 1 information and dissemination meetings has been tendered and changed from a German company to a UK company, and with a clear focus from the HEV TCP on a more updated, frequent, and modern profile for the website. The implementation is expected to be finalized in the beginning of 2021.

1.6 Project conclusion and perspective

The EUDP project (2017-2020) ends when HEV TCP is concluding a successful working period (2015-2020), where electric transport has moved from being in a project- and demonstration phase in 2015, to be in a deployment- and mainstream mode in 2020.

In 2015-2020 HEV TCP has identified and addressed technological gaps and barriers to develop and deploy the new electric vehicle technologies. Key recommendations to decision makers have been developed in various technical Tasks. In addition, the HEV TCP has been successful in providing data, feedback and policy recommendation used by many, including in a range of IEA publications and as a basis for country's priorities and policy developments in e-mobility.

The main Technology Policy Messages and Recommendations from HEV TCP by the end of 2015-2020 working period were the following:

- Hybrid and electric vehicles contribute significantly to CO2 reductions, energy savings, and energy security because of high fuel economy and increasingly low-carbon electricity sources
- More than 18 mio hybrid electric vehicles have been sold worldwide
- Electric car deployment has been growing rapidly, with the global stock of electric passenger cars over 8 million. More than 2 mio electric cars were sold worldwide in 2019
- The number of charging points worldwide is approximately 6 mio, and rapidly growing
- Technology advances are delivering substantial cost reductions
- Policies play a critical role. Measures as increased fuel economy standards, incentives for zero- and low-emissions vehicles, and charging infrastructure are successfully employed
- Private sector response to public policy signals confirms the escalating momentum for electrification of transport
- Availability and price of critical materials, in particular cobalt and lithium, are an important issue for the future adoption rate of electric vehicles

The change towards a maturing and large-scale deployment technology naturally poses new and different challenges. This is also reflected in the new HEV TCP Strategic Work Plan related to the CERT approved extension of the IEA HEV for the period of 1/3 2020 to 28/2 2025.

In this it was recommended to the TCP that the new strategic work plan improved on 2 issues, which was policy relevance and membership. The comments given was that HEV TCP is a well-functioning TCP with a comprehensive work programme, is a very productive TCP, but with further opportunities for dissemination via website, webinars etc. In relation to policy relevance it is noted that the TCP is working with relevant topics but tracking of impact is needed. Membership could be broadened towards developing countries, which is being addressed. The need for improving on dissemination and on policy recommendations has been a Danish position which has been advocated frequently in the HEV TCP meetings.

On a national note, as one of the early first mover countries in e-mobility, hydrogen vehicles and infrastructure with a range of programmes and large projects, Denmark has historically had a very active role in the IEA HEV TCP with many experiences to share. From 2016 policies changed and consequently project diversity and penetration of electric vehicles into the Danish car fleet stock was highly slowed down. Focus for Danish HEV TCP participation shifted towards other Danish strongholds, including charging infrastructure, interoperability, standards and the interplay between electric mobility and a green energy system with very high shares of fluctuating renewable energy, still with a high security of energy supply, including V2G and V2X which today are called VGI (Vehicle Grid Integration). Danish stakeholders like DTU have participated in Tasks working on these issues as well as other Tasks, including standards for charging infrastructure.

Thus, today a range of countries have moved beyond Denmark in terms of EV deployment etc. On the other hand, these countries now represent a vast resource of experiences which Denmark could draw from, when looking into how e-mobility can help fulfilling a quite challenging 70 pct. CO2 reduction target in 2030. One Danish project have already benefitted from the experiences in Holland in Schiphol Airport, Amsterdam, and Den Haag, where electric taxis is dominating through a coordinated effort between the government, the airport, the two cities and the taxi industry. Through the Dutch representatives in the IEA HEV TCP, a 2-day study tour for the whole Danish taxi industry, Copenhagen City, Copenhagen Airport and Capital region of Copenhagen was organized to visit their counterparts in Holland. This has now resulted in an increase in electric taxis in Copenhagen area from 4 to 300 electric taxis presently and a total of 500 expected at the end of 2020. Hence, a much more ambitious national Danish effort on e-mobility in the future would be able to draw from the many interesting experiences of the countries in the IEA HEV TCP and its tasks.

At the same time, the Danish strongholds on large shares of fluctuating renewable energy in a yet still very flexible and very strong energy system will be very relevant for other countries as they move towards e-mobility and will have to supply their transport sector with electricity coming from their energy- and power systems. Furthermore, the Danish effort on

developing RE electro fuels for transport sectors hard to cover with battery electric solutions, like long range heavy trucks, deep sea container transport and long distance airplanes, will be globally relevant for a lot of countries and consequently also the HEV TCP.

Annex

<http://www.ieahev.org/>

<http://www.ieahev.org/by-country/denmark/>

<http://www.ieahev.org/news/annual-reports/>

<http://www.ieahev.org/tasks/task-38-marine-applications/>