



Japanese
sister organisation
AICE



Umbrella organisation
for the internal combustion
machinery industry





Global cooperation is more vital than ever

Climate protection is a global task – as is the development of competitive products for the world market.

Whether for passenger cars or container ships, collaborating with international partners is both a sensible and inspiring way to bring new technologies to market more quickly. For this reason, FVV shares a long-standing partnership with the Japanese research association AICE and CIMAC, the umbrella organisation for the internal combustion machinery industry.

On an equal footing

Log on, switch on your microphone and upload your presentation // Video conferences were among the tools used by Christine Burkhardt and Yoshihiro Imaoka even before the COVID-19 pandemic. They coordinated the first joint project by FVV and the **Japanese research association AICE** predominantly via digital means. The project focussed on performing fundamental research with the objective of lowering exhaust emissions during real driving operation: which chemical mechanisms are executed in the exhaust manifold during post-oxidation? And is it possible to replicate these with a simple model? »In the past, we concentrated our research activities on the processes in the cylinder and did not know enough about post-oxidation,« comments Imaoka. He reports that his employer, Nissan, is now using the one-dimensional simulation model created as part of the research project which was completed in 2020.

Imaoka is convinced that further research on combustion engines is worth it. As such, the roadmap of AICE aims for efficiency to be increased to more than 50% by 2030 thanks to the use of innovative technologies – an objective comparable to that of the FVV project »ICE 2030«. The expert even believes that a figure of 60% is achievable in the future. In combination with electrification, synthetic fuels and carbon capture from the air, this should enable fully climate-neutral mobility by the middle of the 21st century. Even on-board carbon capture in vehicles should at least be explored as an option. »The cooperation with FVV is helping us solve complex problems more quickly,« comments Imaoka.



YOSHIHIRO IMAOKA
Research Manager
(Nissan Motor Corp)



CHRISTINE BURKHARDT
Managing Director
(EnginOS)

According to Burkhardt, the same also applies for suppliers and engineering service providers in Germany, many of which are SMEs. »Japan and Germany are on an equal technical footing in terms of engine research and development.

If we work together, we will achieve our goal more quickly.« The post-oxidation project clearly illustrates how the areas of expertise of the associations involved complement one another: the German side contributed its experience in one-dimensional simulation calculation, while the Japanese association possessed special measuring technology that could be used to verify the simulation results.

Alongside the scientific findings, AICE and FVV benefited from the joint project in another way: through the practical training of young engineers. »This allows young people to learn how to work together in global teams at an early stage of their training,« reports Imaoka, adding that many of those involved at the universities were from different cultural backgrounds: a young engineer born in India and based in Tokyo and an Italian research assistant located in Stuttgart regularly spoke in the video conferences for the post-oxidation project.

→ Inspired by FVV, the **»Research Association of Automotive Internal Combustion Engines«** (AICE) was founded by eight Japanese automotive manufacturers in 2014 in order to perform collective research.

→ aice.or.jp

→ The **»PostOxidation«** project (FVV project number 1336) mentioned above was initiated in 2017 and was supported by funds from **COLlective Research NETworking** (CORNET) (funding number 234 EN), which the German Federal Ministry for Economic Affairs and Energy uses to partially fund transnational Industrial Collective Research projects.



Research and regulation

Rotterdam – Shanghai // Around 11,000 nautical miles separate the two seaports of Rotterdam and Shanghai, one of the most heavily frequented routes in international merchant shipping. Dr. Dirk Bergmann, CTO Turbocharging at ABB, often uses this example to illustrate the challenges faced by the shipping sector. After all, a climate-neutral energy carrier must have a sufficient energy density to enable the more than 300-metre-long container ships to travel non-stop between the major hubs of world trade – and a global agreement must also be reached on this energy carrier. »The ship propulsion and tank system need to be designed differently depending on whether ammonia or methanol is used, for example,« explains Bergmann. »And the same applies for the entire infrastructure at the port.« For this reason, he is Chair of the Greenhouse Gas Strategy Group at **CIMAC**, a global association that represents the interests of manufacturers and operators of large engines. Shipping is just one of many applications, but is a particularly important one for climate protection: around three percent of global CO₂ emissions are caused by ships, and this share is growing.

The International Maritime Organization (IMO), a United Nations agency, is actually responsible for agreeing global standards in the maritime sector. However, its regulations only encompass the years up to 2026; by then, the CO₂ emissions adjusted for the transport capacity of the ships are to fall by eleven percent. »We really need a far more long-term objective,« says Bergmann. »Most of the merchant vessels that will be launched in the coming years will still be traversing the oceans in 2050.« Therefore, considerably more climate-friendly propulsion systems that are to be fitted in 2030 must be the subject of intensive research today. However, the IMO's objectives are not to be revised again until 2025. In order to advance technological development despite this, the CIMAC Strategy Group is working on an outlook that illustrates and evaluates the technical options. An initial policy paper was published at the beginning of last year.

DR. DIRK BERGMANN
CTO Turbocharging
(ABB Switzerland)



»The scientific research of FVV is essential for this process,« comments Bergmann. For example, ammonia is deemed a highly promising energy carrier as it does not release carbon dioxide during combustion. However, the ignitability of ammonia is low. »It is like trying to make fire with wet wood,« adds Bergmann by way of comparison. Despite this, he believes that the problem can be solved

through further research that focuses intensively on the combustion process of ammonia. »With its research, FVV is laying the groundwork that will allow us at CIMAC to develop proposals for new regulations.« After all, climate-neutral energy carriers will have difficulty establishing themselves without binding rules for all market participants – and not just in shipping. //

→ CIMAC represents the global interests of the large engine sector vis-à-vis regulatory authorities and standardisation bodies. Its members include both the producers and operators of large engines – either directly as corporate members, or via national member associations.

→ cimac.com

→ The Central Secretariat of the association has been located at the **Engines and Systems** trade association of VDMA for 25 years.

