



PATHWAYS TO A CO2 CYCLE ECONOMY

IN THE ENERGY AND TRANSPORT SECTOR



Closed Carbon Cycle

# MOBILITY

Klimaneutrale Kraftstoffe  
für den Verkehr der Zukunft

## Objectives

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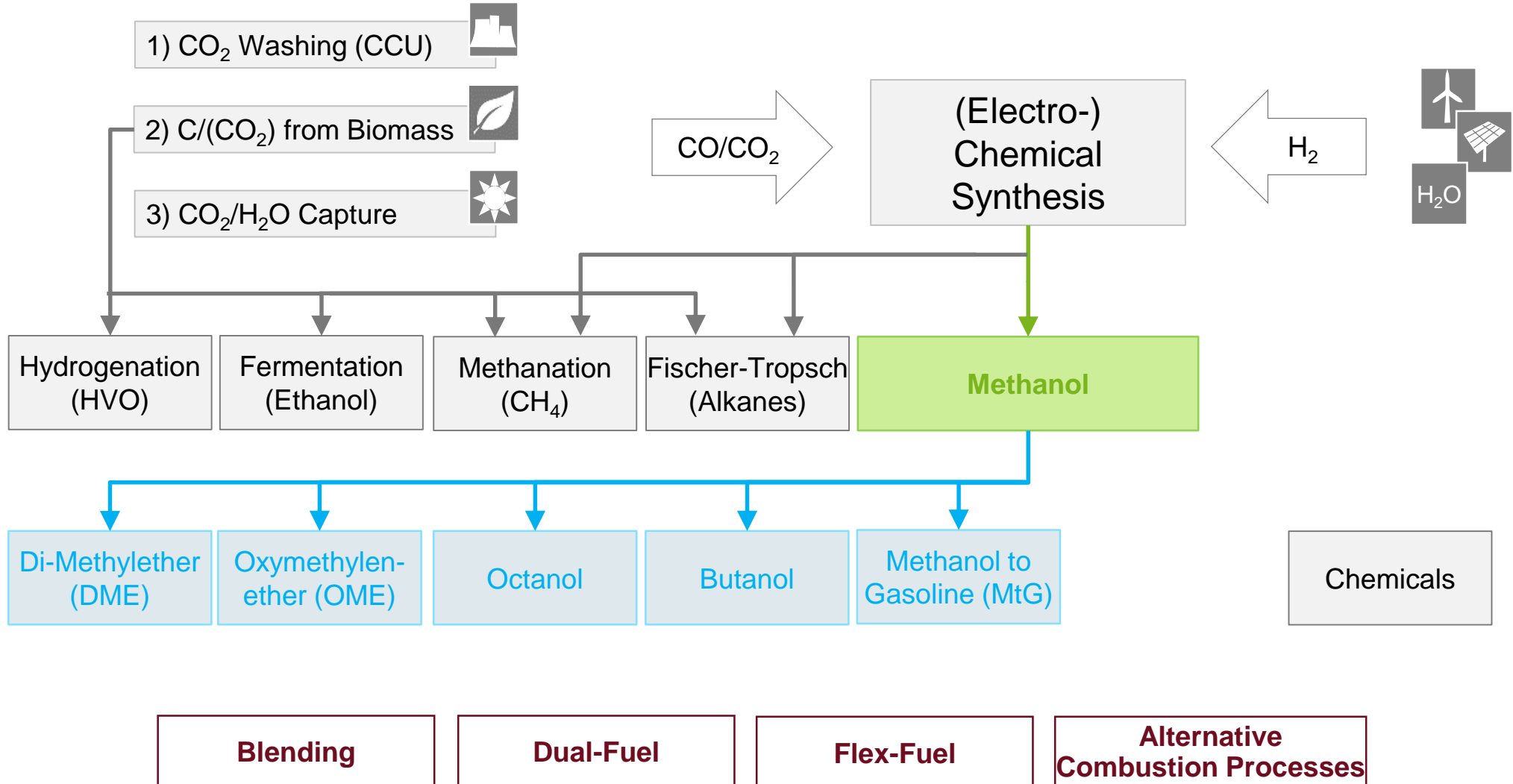
### VALUATION OF ELECTRICITY-BASED FUELS BASED ON MULTIPLE QUESTIONS

- Which pathways to which electricity-based fuels (based on Methanol) are possible?
- Which optimizations of efficiency do engines enable that are optimized for these fuels?  
Which technologies or adjustments are required?
- What overall efficiency does the utilization path have from Well-to-Wheel/ Production-to-Wheel?
- Which fuels allow a backwards compatibility to existing fleets?
- How does a market launch of new or adapted engines or fuels into existing fleets work?
- What are the differences compared to a BEV or fuel cell vehicle also regarding costs and infrastructure?

## PROJECT OVERVIEW

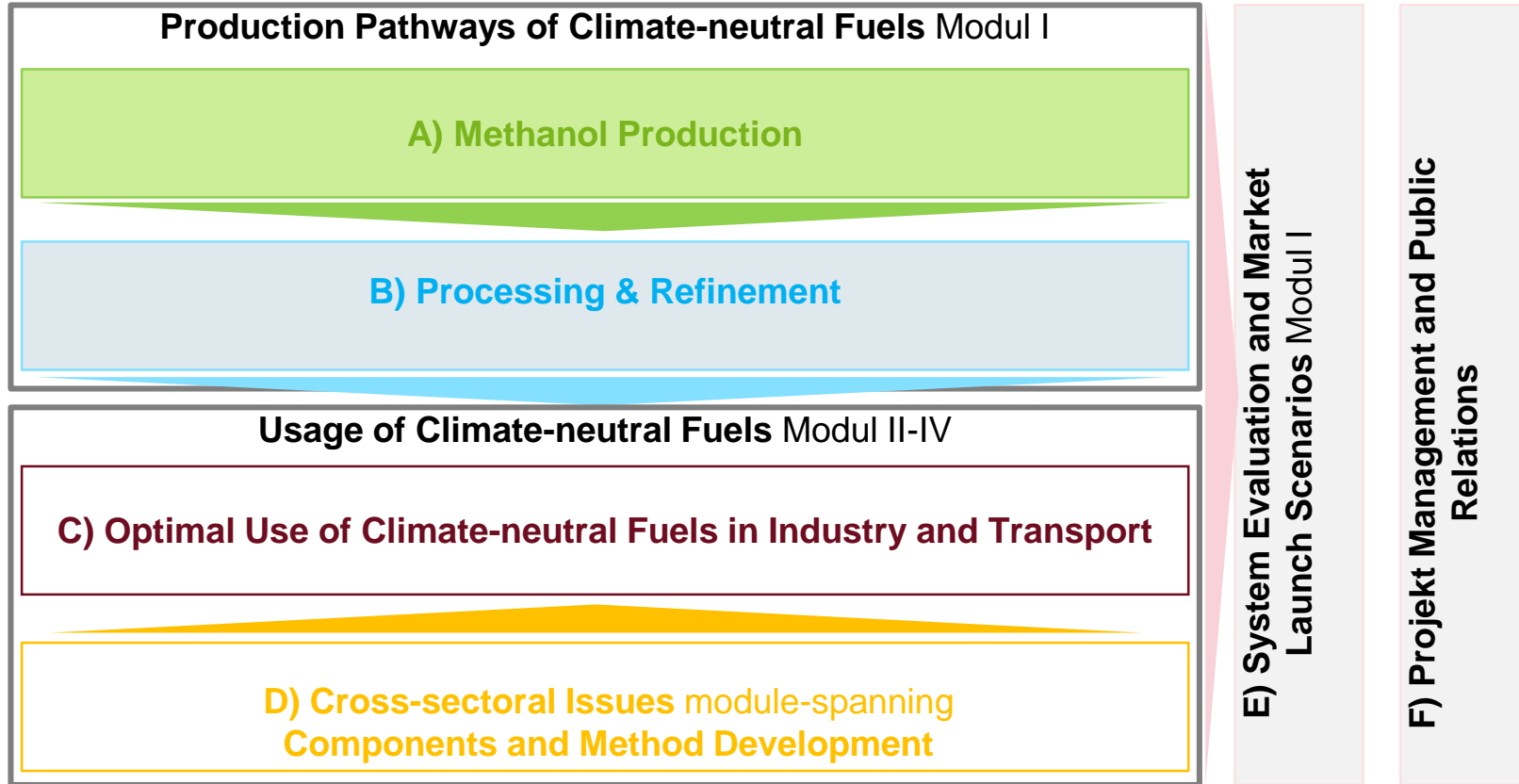
- Funding initiative „Energy Transition in the Transport Sector“ by the Federal Ministry for Economic Affairs and Energy
- 34 Partners (\*associated partners; \*\*subcontracting)
  - Automotive:  
Opel, Ford, Daimler, Deutz\*, Liebherr-Components, Continental Automotive, Continental Components, Hyundai, Umicore\*, AVL, Denso, AVL qpunkt, Weissgerber Engineering\*\*, VW\*, BMW, FEV, Porsche\*, KTM\*
  - Mineral oil industry, power suppliers, process engineering:
  - innogy\*, RWE\*, Chemieanlagenbau Chemnitz, Grillo\*, TEC4FUELS\*\*, Shell, bse engineering\*, ERC Additiv\*
  - Oel-Waerme-Institut, Forschungszentrum Jülich, Fraunhofer ISE, TU Darmstadt, TU Freiberg, RWTH Aachen, FH Aachen, TU Dresden
- Total volume: 23.274 k€, Funding 16.429 k€
- Project duration: August 1<sup>st</sup> 2018 – July 31<sup>st</sup> 2021

# Fluctuating renewable energies as well as needed energy imports require chemical storages (Power-to-X)



# Project Structure

## Overall Structure

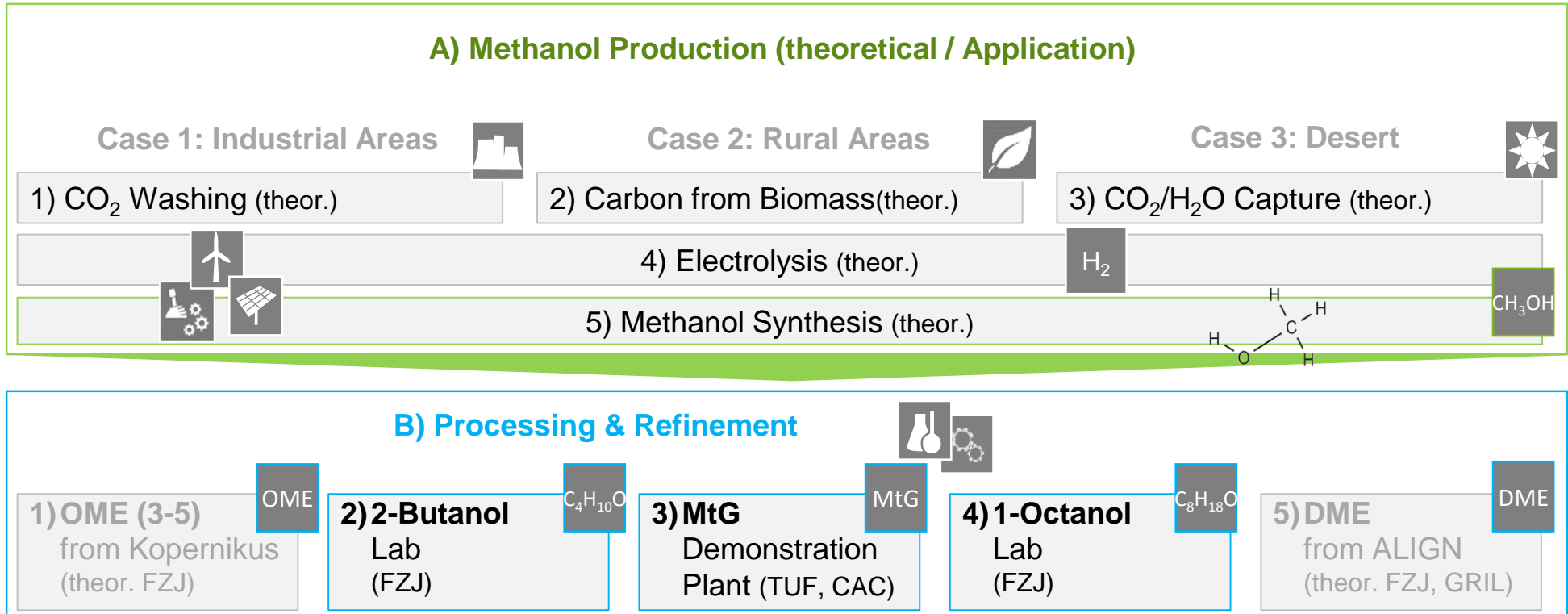


# Project Structure

## Produktion Pathways of Climate-neutral Fuels



### Production Pathways of Climate-neutral Fuels(FZJ, INO) Modul I (A)



# Project Structure

## Usage of Climate-neutral Fuels



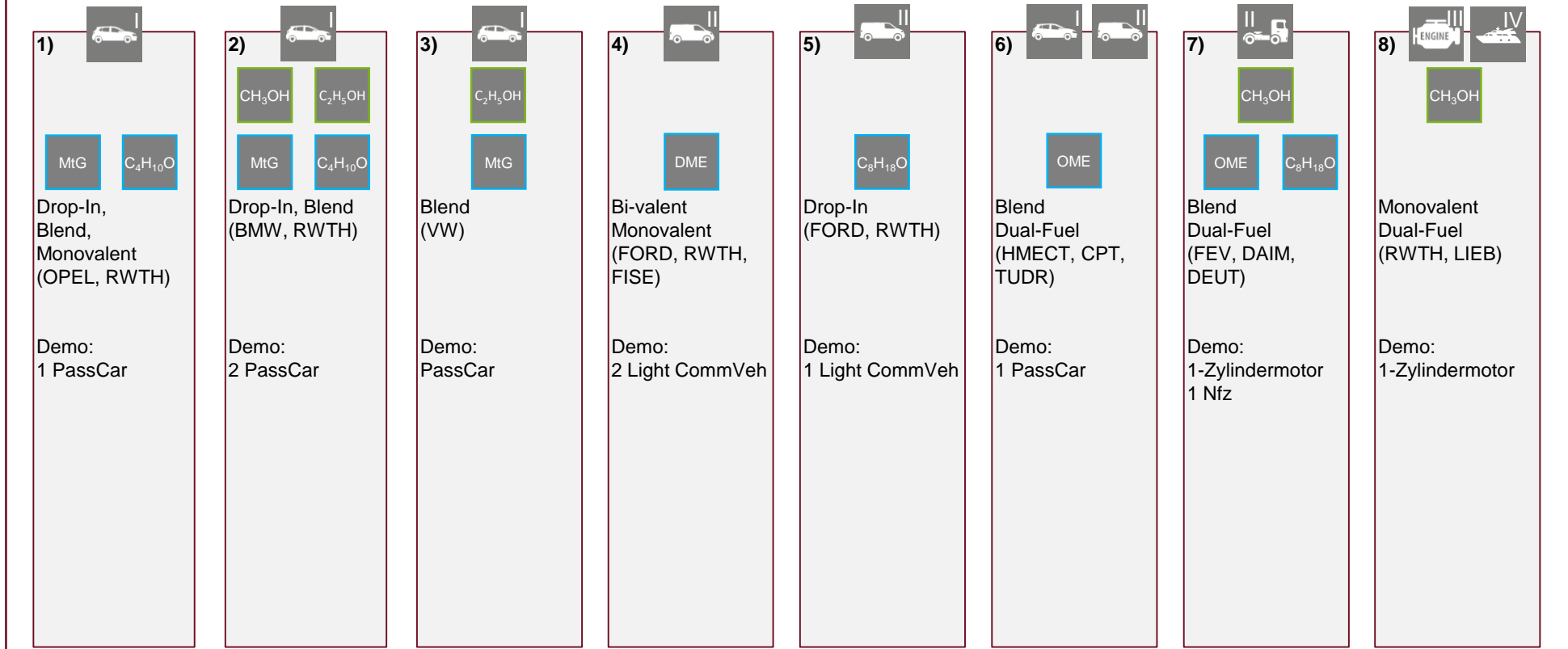
### C) Optimal Usage of Climate-neutral Fuels in Industry and Transport Modul II-IV

Research, Development of Combustion Processes and Demonstration



Cylinder Displacement:  
≤ 0.5 l

≥ 2.0 l



# Project Structure

## Usage of Climate-neutral Fuels



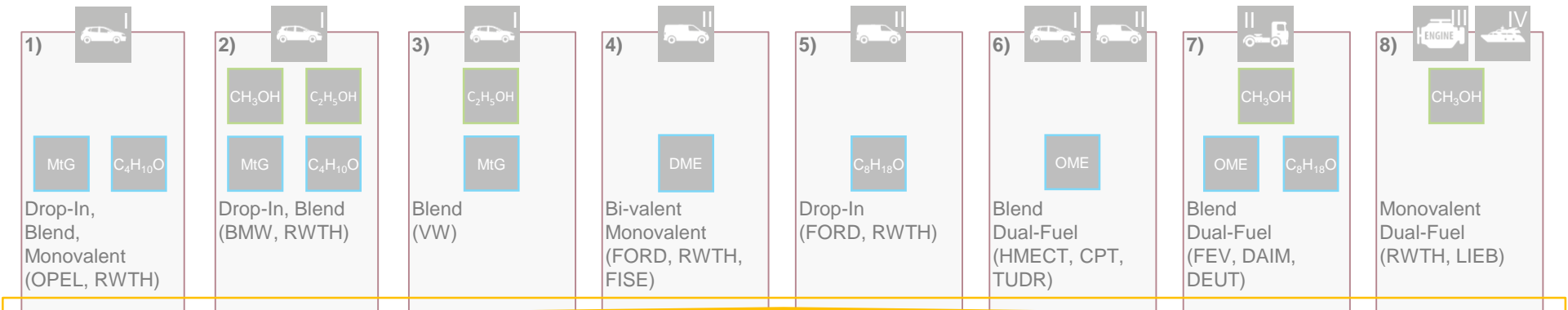
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1) Fuels/Material Compatibility (T4F/Shell) & Fuel Deterioration/Oil Interaction (OWI)

2) Method Development 3D-CFDR for Fuel Blends (AVL, RWTH)

3) Thermal Management Optimization (QP)

4a) Exhaust Gas Aftertreatment (Components) (TUD, UMI, AVL)

4b) ANB (Strategy) (FEV, FISE)

5) Injection Systems:

5c) PassCar DME (DENSO)

5a) PassCar OME (CPT)

5b) CommVeh + Large Engine (LIEB)

6) Fuel Sensors (CPT)

7) Model-based Torque Path and Ignition (FEV, WEG, FHAC)

D) Cross-sectoral Issues module-spanning  
Components and Method Development



# Project Structure and Division of Labour

## System Evaluation and Scenarios / Project Management

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### **E) System Evaluation and Market Launch Scenarios**

#### Modul I

- collection and analysis of project results
- Estimation of efficiency degree of the entire energy chain
- (possibly derivation of recommendations)

(FZJ, INO, SH, FEV, DAIM, FORD, BMW, OPEL, RWTH)

### **F) Project Management and Public Relations**

- Coordination of project activities
- Alignment and organization of public relations work

(FEV, FZJ)

## Project Partners



ALWAYS AN IDEA AHEAD



DAIMLER



\*until 31st of March 2020



## Associated Partners



**Thank you for your attention!**

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Gefördert durch:



Bundesministerium  
für Wirtschaft  
und Energie



aufgrund eines Beschlusses  
des Deutschen Bundestages



**TÜVRheinland<sup>®</sup>**  
Genau. Richtig.

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