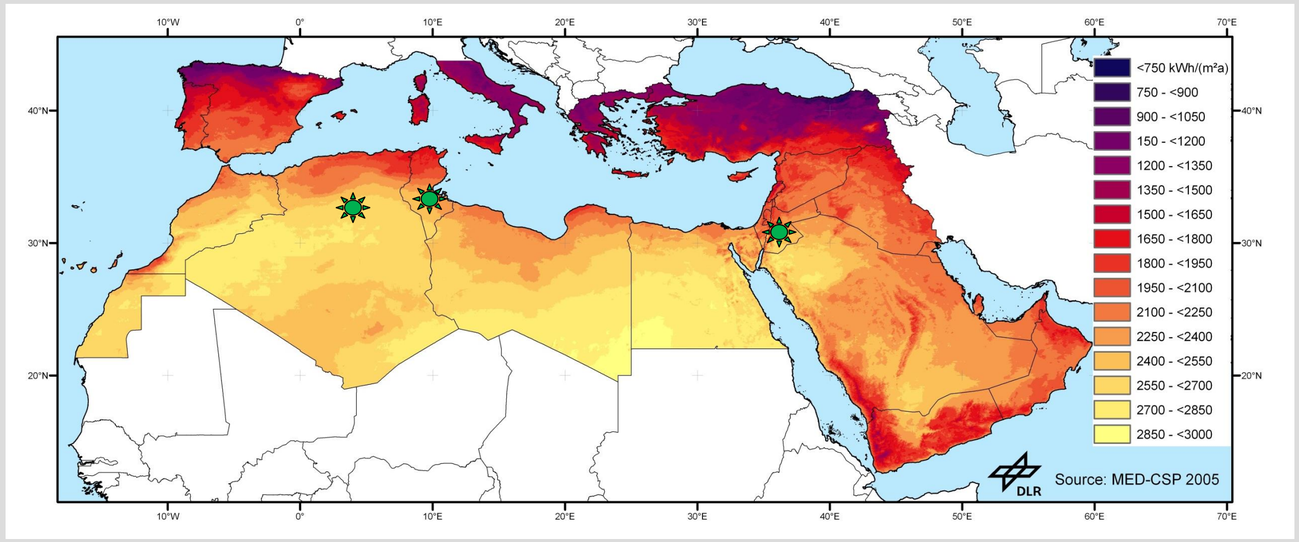

Fig 1:

Meteorological stations used for ground measured data (source: DLR)

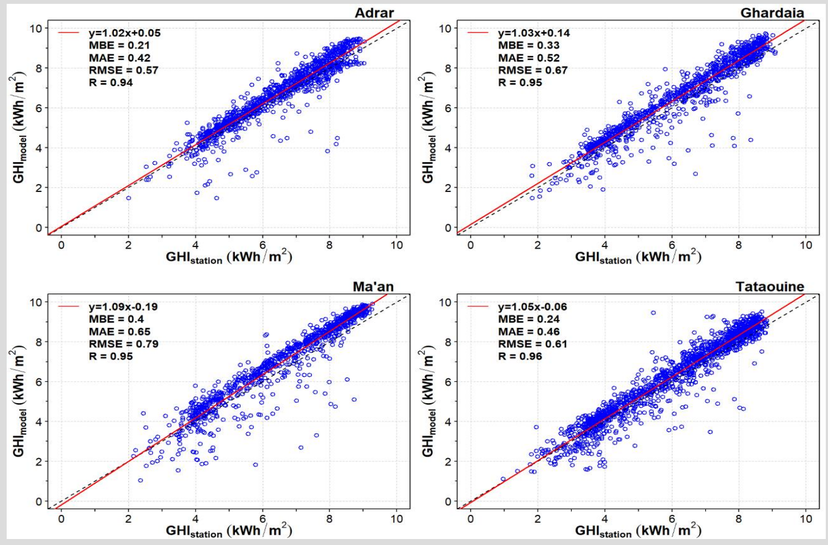

Fig 2:

Validation of modelled GHI data (Source: University of Patras, Greece)

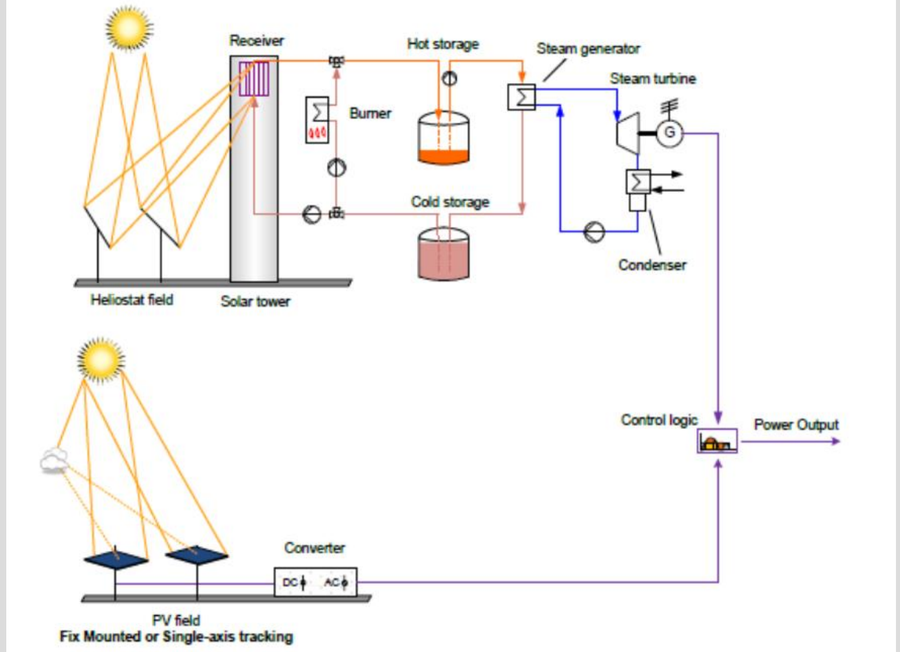

Fig 4:

Exemplary CSP + Natural Gas Burner + PV plant (source: DLR)

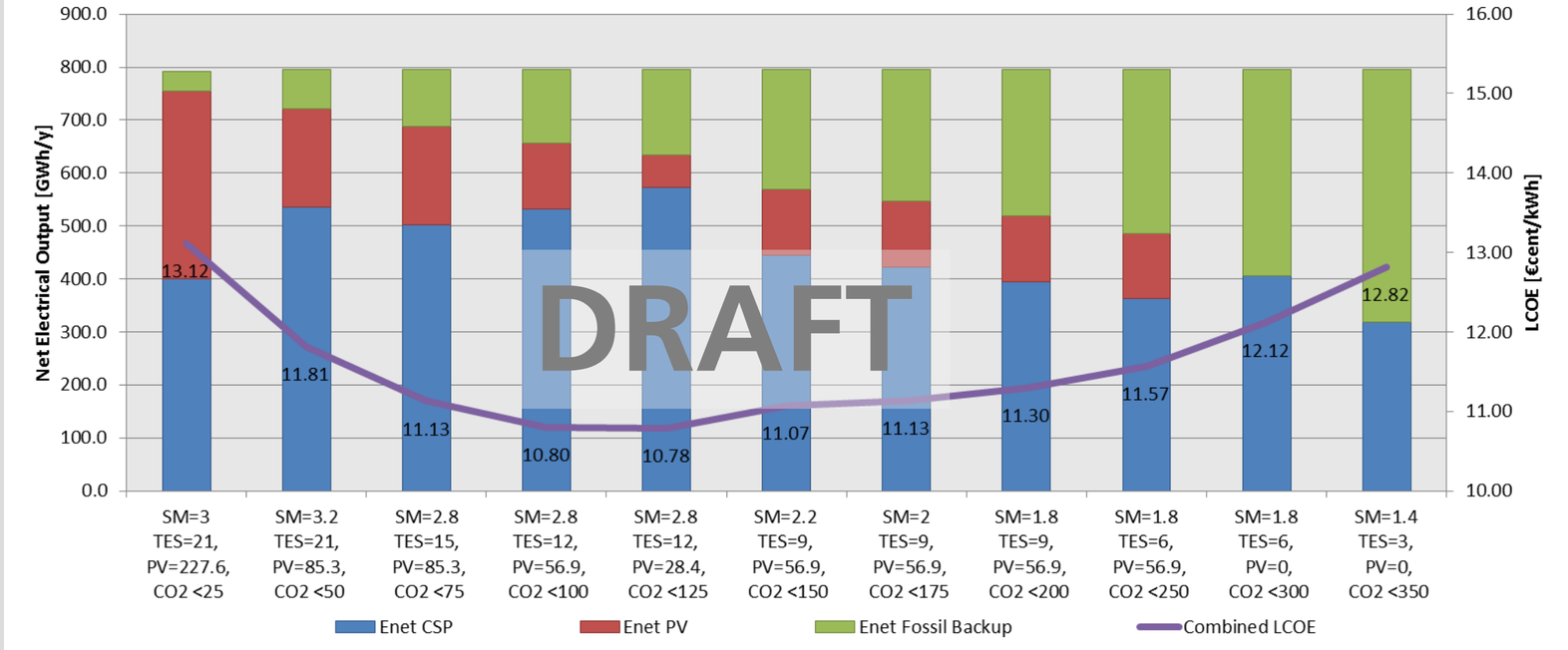

Fig 5:

Exemplary configurations depending on CO2 emission limits (Source: DLR)
SM: CSP solar multiple [-], TES: Th. storage capacity [h], PV: PV design capacity [MWe], CO2: specific CO2 emissions [g/kWhe], LCOE: Levelized cost of electricity [€cent/kWh]

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Hybrid CSP-PV power plants for MENA

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Within the project HYMENSO combinations of PV and CSP systems are investigated, in order to harvest the advantages of both systems: easy installation and low levelized cost of electricity (LCOE) of PV, versatility and dispatchability of CSP.
Furthermore, due to the relevance of fossil fuels, e.g. in Algeria, back-up systems with Natural Gas are considered.

The project has the main goal to investigate the optimal configurations depending on specific boundary conditions such as solar resource, local costs, water availability and grid demand for locations in Algeria, Tunisia and Jordan. Additionally, sub-systems will be tested at partner's research platforms.

The current main results are the following:

- Local data collection such as ground meteorological data, electrical demand curves, water and fuel costs.
- University of Patras proposed a methodology for the generation of global and direct normal solar irradiances (GHI and DNI) based on satellite-derived atmospheric products from MODIS instrument and radiative transfer model outcomes. The algorithm calculated GHI and DNI for clear skies and cloudy conditions.
- Relevant plant configurations were selected:
    - Parabolic trough plants with thermal-oil HTF + PV polycrystalline single axis tracked
    - Parabolic trough plants with molten salt HTF + PV polycrystalline single axis tracked
    - Solar tower plants with molten salt HTF + PV polycrystalline single axis tracked

  → All CSP plants include molten salt thermal energy storage and natural gas heater
- Automatic performance simulation of hybrid plants and search for optima as function of CO2 emissions *(in progress)*

The main tasks to be covered during the rest of the project - until end of 2018 - are:

- Validation of the performance and cost models with pilot plants
- Knowledge transfer and dissemination activities

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