



CLEAG

Zero Emission

CLEAG

CloZEd Loop Energy

Dr. Allan Walker

CLEAG AG, Luzern /Switzerland

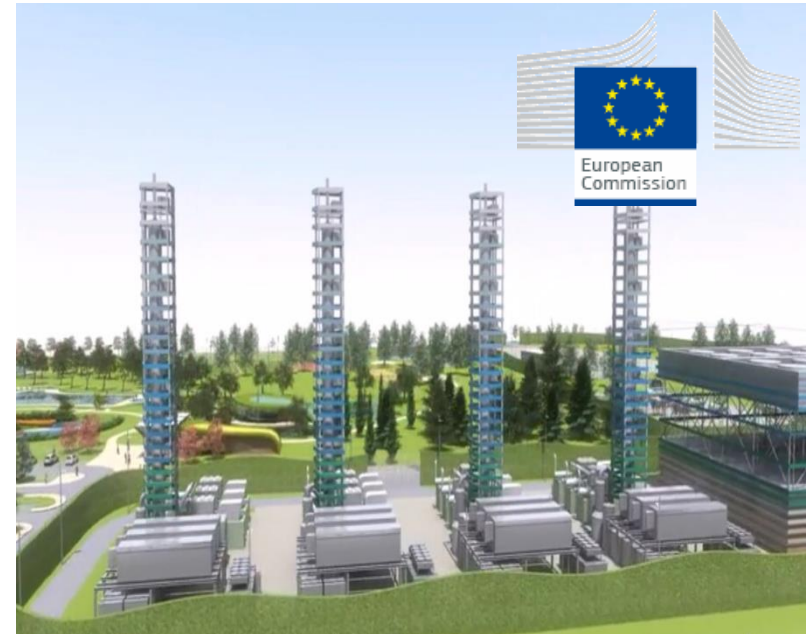
Maturing Geothermal Energy for Kingdom Saudi Arabia

27th – 29th January 2020

- **Crisis** of ever building GHG continues to grow
- **Paris Climate Agreement** was forged in December 2015
- Public attitude versus political action is **out of tune**
- Rising **public pressure** for low carbon future

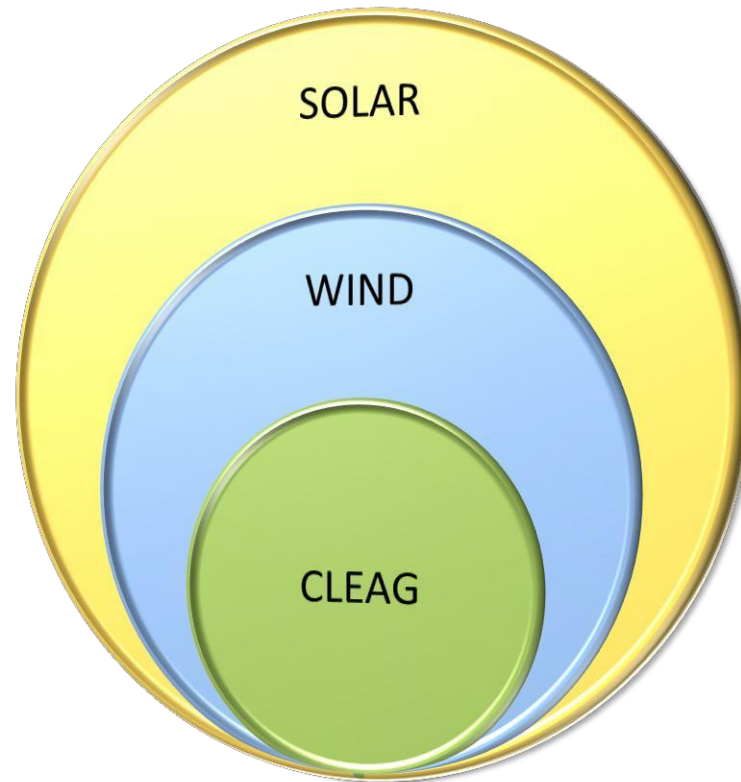
Advanced Geothermal Energy Cleaner and more efficient

- ✓ **Base-load** green energy
- ✓ **Output range:** Heat, electricity, CO₂ and desalinated water
- ✓ **Lower CO₂ footprint** than PV and wind
- ✓ **Decentralized** – Standardized
- ✓ **Closed LOOP** (all gases)
- ✓ **Patented** worldwide



6 x smaller than Solar

3 x smaller than Wind



TECHNOLOGY

- ✓ Geothermal power progressed from high to low enthalpy
- ✓ Closed Loop Energy AG (CLEAG) uses low enthalpy 100 ° C saline from deep aquifers , approx. 2 km, to extract super-saturated methane to power its generators and generate heat
- ✓ Water and gases are treated in the closed loop and then returned to the aquifer.

PARTNERS

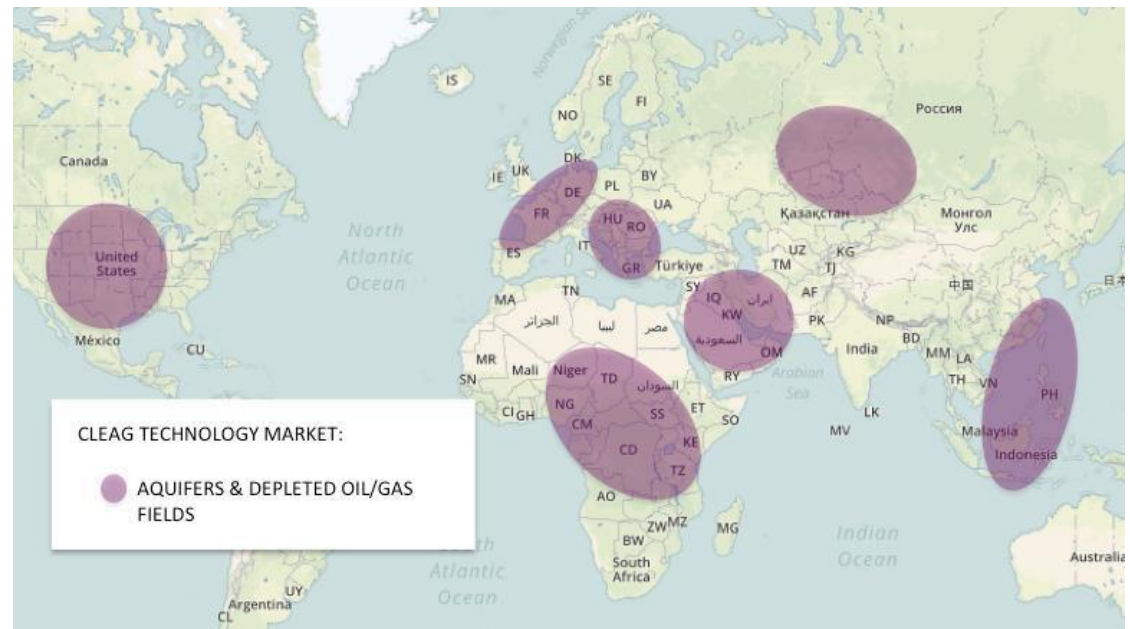
- ✓ Sedimentary basins in EU, USA, ME
- ✓ Proposed test sites: West Coast of Kingdom of Saudi Arabia
- ✓ Additional application: cleaning up oil/gas depleted wells; currently under review potential US partners.

PERFORMANCE

- ✓ Levelized cost of energy of 0.02 EUR at lowest carbon footprint
- ✓ 20MW electricity and 80MW heat, with an estimated 700'000MWh p.a
- ✓ Cascade of heat from 100° C to 40 ° C has a range of uses: cooling, heating, de-salination
- ✓ De-salination machinery and protection of all assets in PP in desert conditions
- ✓ Annual cost-savings: 500'000 metric-tons of CO2.

Growing public pressure is for a low carbon future.
CLEAG facilitates to achieve this. Industrial shareholders are our shareholders!

- ✓ Depleted oil/gas fields = “man-made” aquifers can be used for decades with **CLEAG technology**
- ✓ The worldwide reserves of aquifer gases are estimated at **almost 2x the reserves of conventional gas** (IEA 2009)



Plants

- Pilot plant in Croatia jointly with Croatian government
- Roll out plan:
 - 9 plants in Eastern Europe
 - 10 plants in Western Europe in the next 10 years

Investment

Potential investment of 2 billion EUR

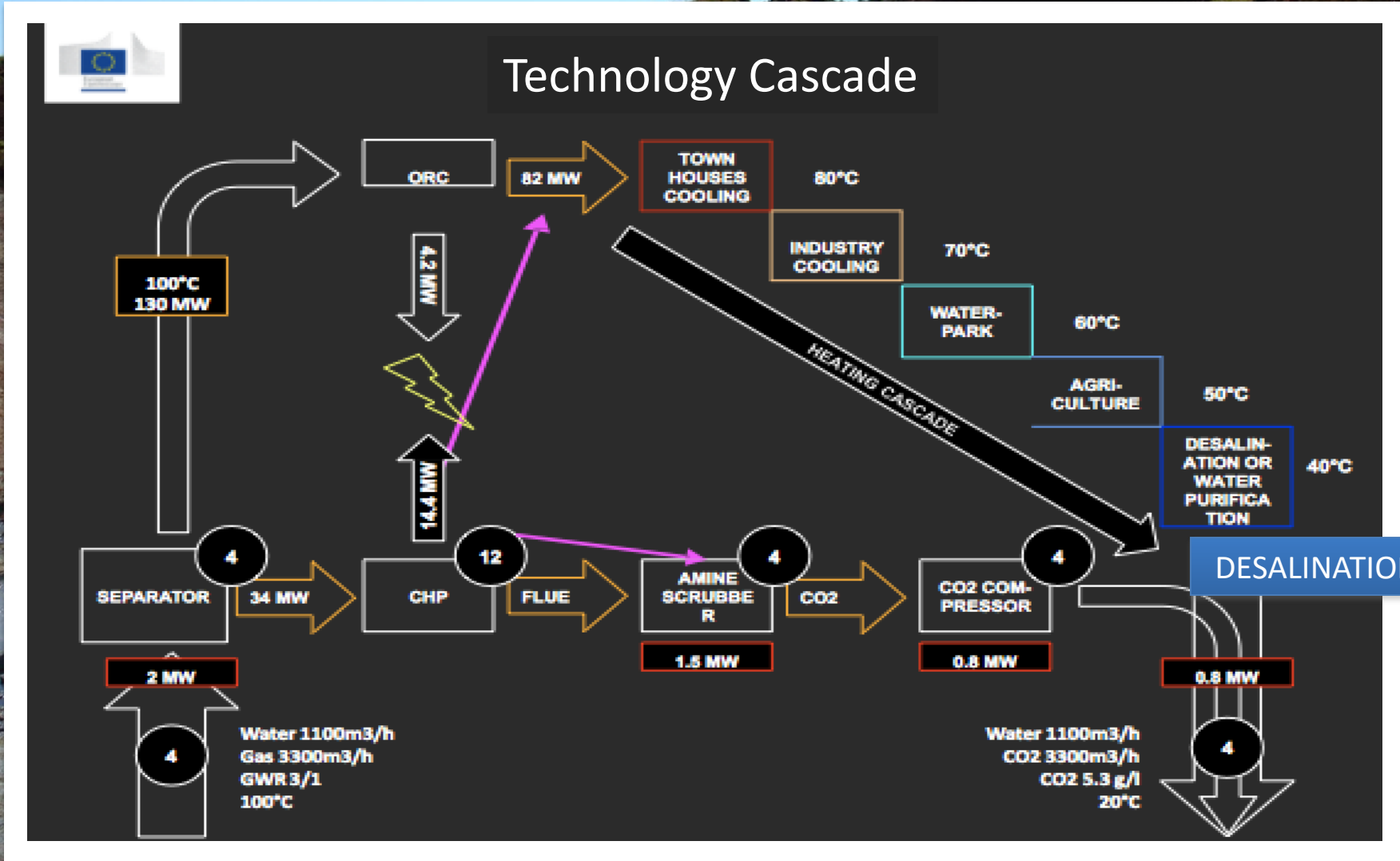
Cooperation Partners

- Set up the first company in the Netherlands
- Contact to Umweltbundesamt, Germany; contact to geologists in Belgium, Italy, France
- In discussion with Total Oil (US) to use CLEAG technology in depleted hydrocarbon reservoirs

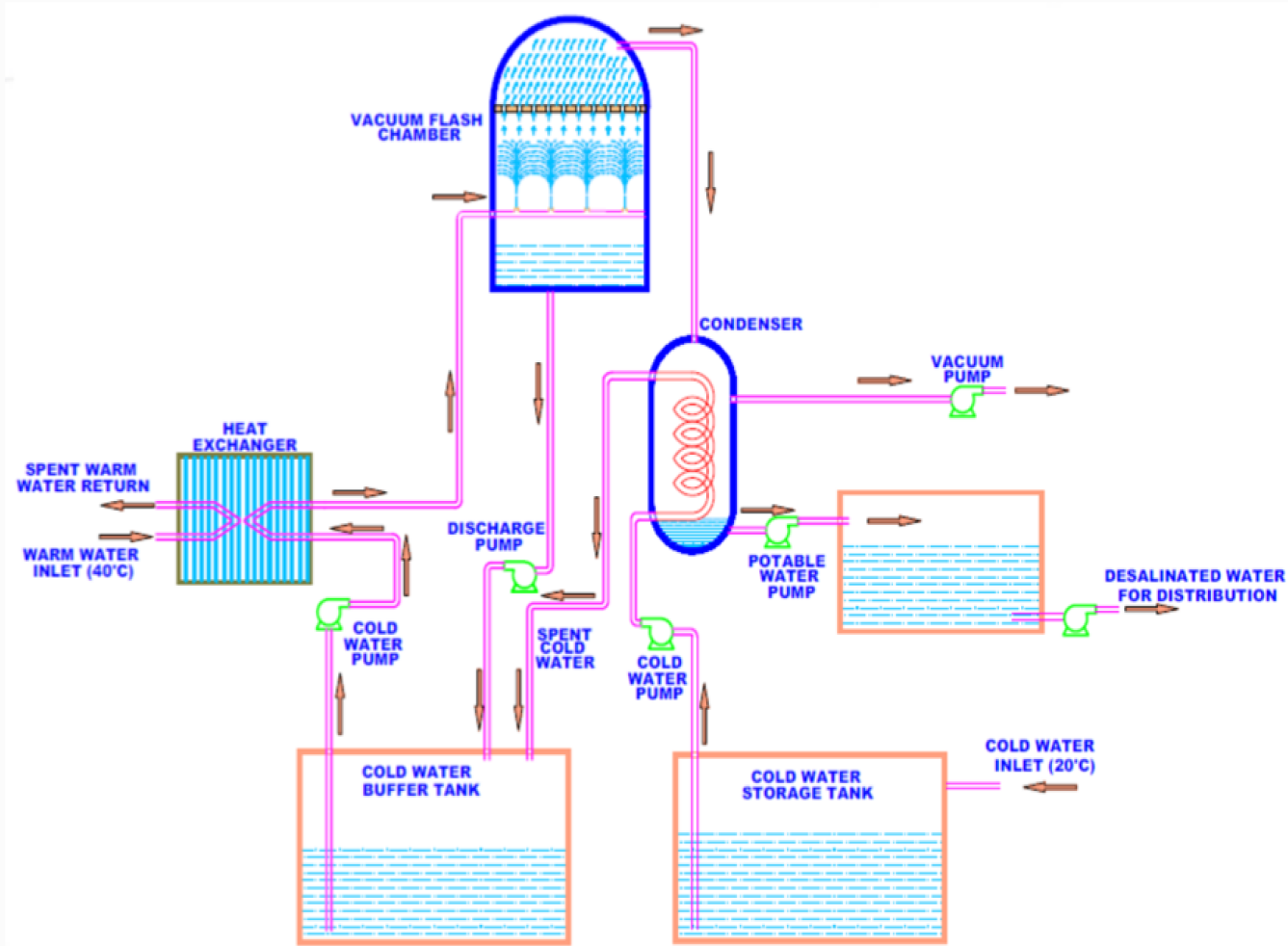
Awarded and financially supported by the European Commission via NER300 and European Investment Bank

The Swiss registered company Clozed Loop Energy (CLEAG) offers an innovative geothermal system:

- **Optimal variant of geothermal energy**, efficiently using both methane gas and heat; methane is separated from deep aquifer saline on a basis which is sustainable for decades. In addition, all heat is harnessed.
- The generated power has a **increased yield, lower emissions, low carbon footprint** and novel permanent CCU (Carbon Capture Utilization). Aquifer water and CO₂ is returned to the aquifer.
- CLEAG systems delivers a compact, decentralized and independent energy supply. CLEAG power plants **generate >92% at base load levels** (incl. service time).
- **Additional benefits**. Desalination and cooling of domestic houses or institutions. These benefits are capable of spawning industries and jobs.



Low Temperature Thermal Desalination (LTTD)



Our proposed solution:

Low Enthalpy

Advanced Geothermal Closed Loop Classification: **CLEAG Technology**

Incorporating local employment, its expertise and training

What is the **CLEAG Business case proposition:**

- ✓ Baseload supply
- ✓ 700'000 MWh p.a. (100'000MWe)
- ✓ CO2 savings annually (based on EU average) = 500'000Mt.
- ✓ IRR greater > 15%
- ✓ Diverse uses of heat and electricity and free CO2
- ✓ Modularity of building
- ✓ Efficiency & Profitability

THANK YOU!