

Geothermal Energy to Green Hydrogen

Organic Rankine Cycle (ORC) Plants with Radial Inflow Expanders



Dr. Reza Agahi (Presenter)

Vice President, Turbo

Nikkiso Clean Energy & Industrial Gases

Mutlu Akar (Contributor)

Project Engineer

Egesim Group

Today's Topics

- Intro to Nikkiso and Egesim
- ORC Designs with Radial Inflow Expanders
- Extended Geothermal Capabilities
- Integrated Capabilities + Case Studies
- Questions



Geothermal Power Plant- 22 MW- Turkey



Clean Energy &
Industrial Gases

About Us

Driving Innovation through collaboration



Premier global provider of cryogenic solutions

Vision: Leading the change to a healthier world

Founded **1953**

1500+ employees worldwide

Headquarters: Tokyo (corporate); Temecula, California (CE&IG)

Key industries: energy (renewable and conventional), power generation, marine, transportation



Leading system integrator for AC-DC drive systems and automation for Siemens

Vision: Egesim Group specializes in providing environmentally friendly, end-to-end solutions for industrial projects, ensuring sustainable practices from initial design to final implementation with expertise and precision

Founded **1993**

500+ employees worldwide

Headquarters: Izmir, Turkey (corporate); Munich (GmbH)

Key industries: energy, cement, chemical, iron and steel, glass, paper

All around the world... and right by your side



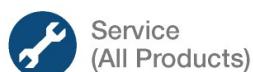
Integrated Solutions Across the Hydrogen Value Chain

- Fabrication & Modularization
- Equipment Manufacturing

MAP KEY:



Turnkey
Solutions



Service
(All Products)



Liquefier



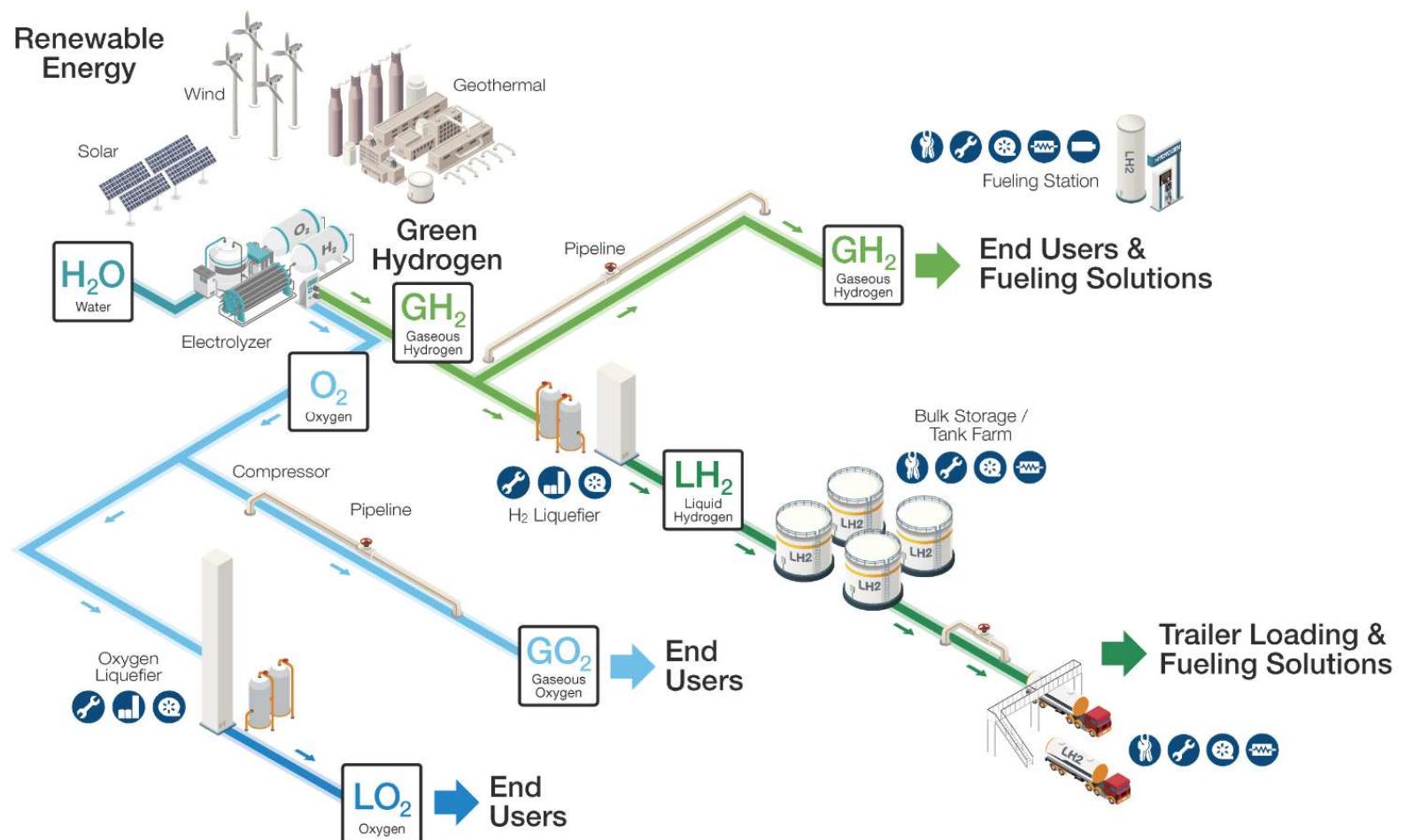
Centrifugal
Pump



Reciprocating
Pump



Vaporizer



ORC Plants with Radial Inflow Expanders Advantages

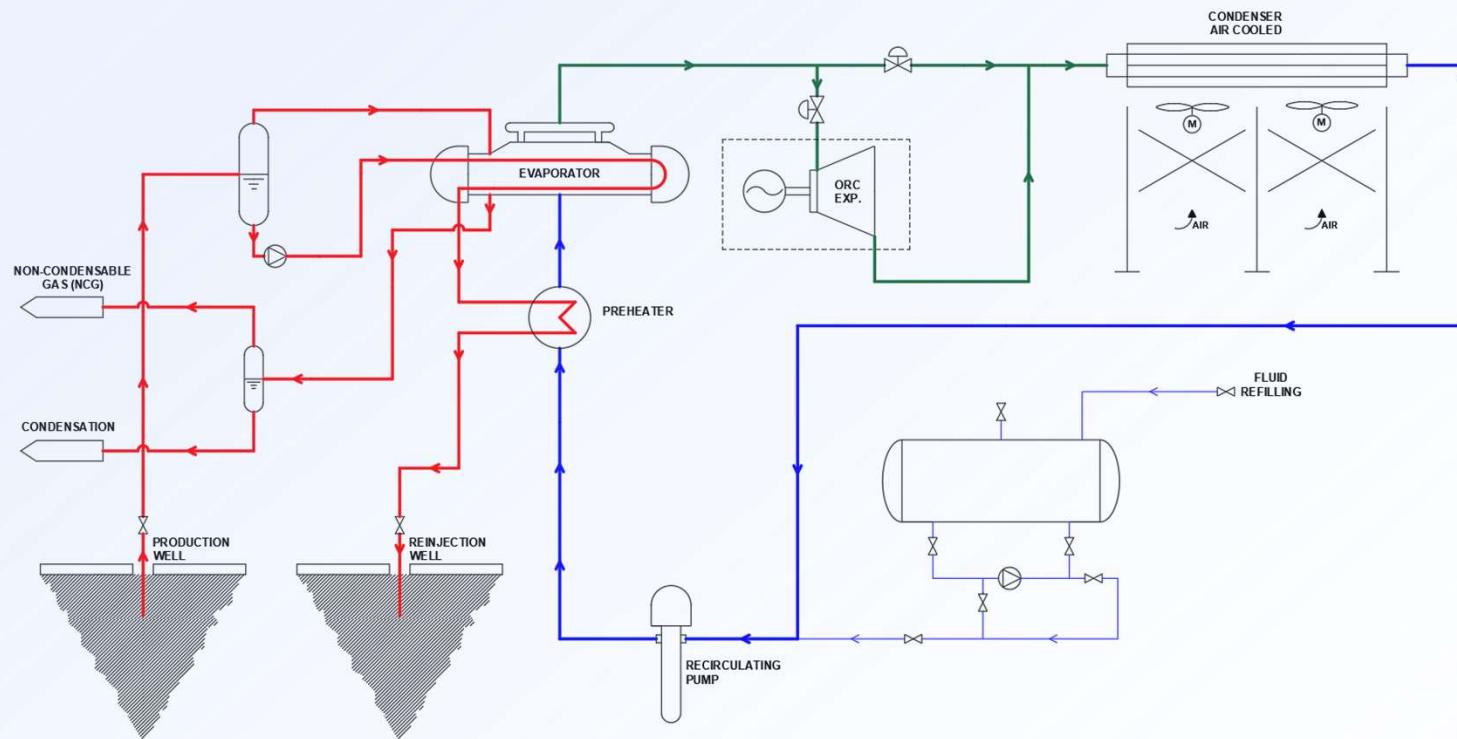
- Efficient over wide range of operations
- Flexibility of working fluids to meet resource temperature needs
- Medium-to-low-temperature (enthalpy) geothermal resources



Geothermal Power Plant - 16 MW- Turkey

GEOHERMAL ENERGY TO GREEN HYDROGEN

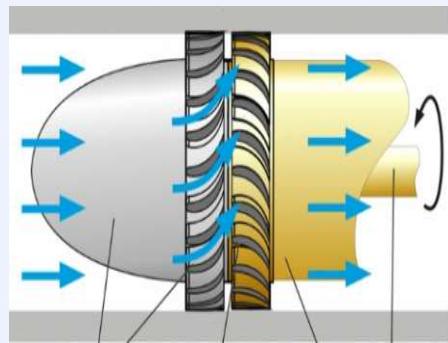
Geothermal ORC PFD



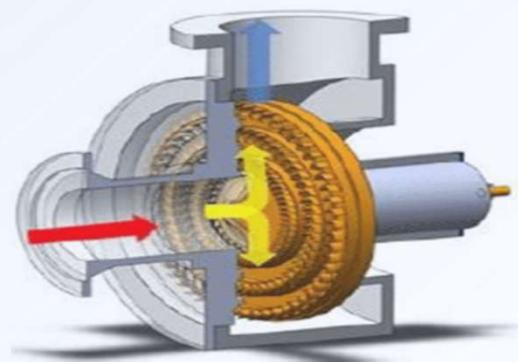
EGESIM

NIKKISO
Clean Energy &
Industrial Gases

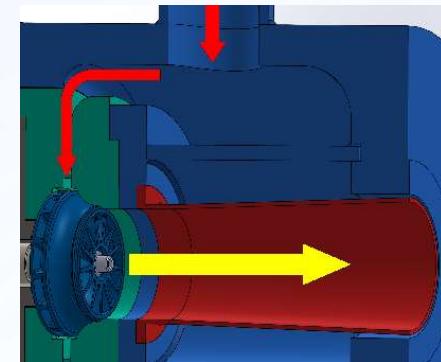
Turbine Technologies



Axial Turbine

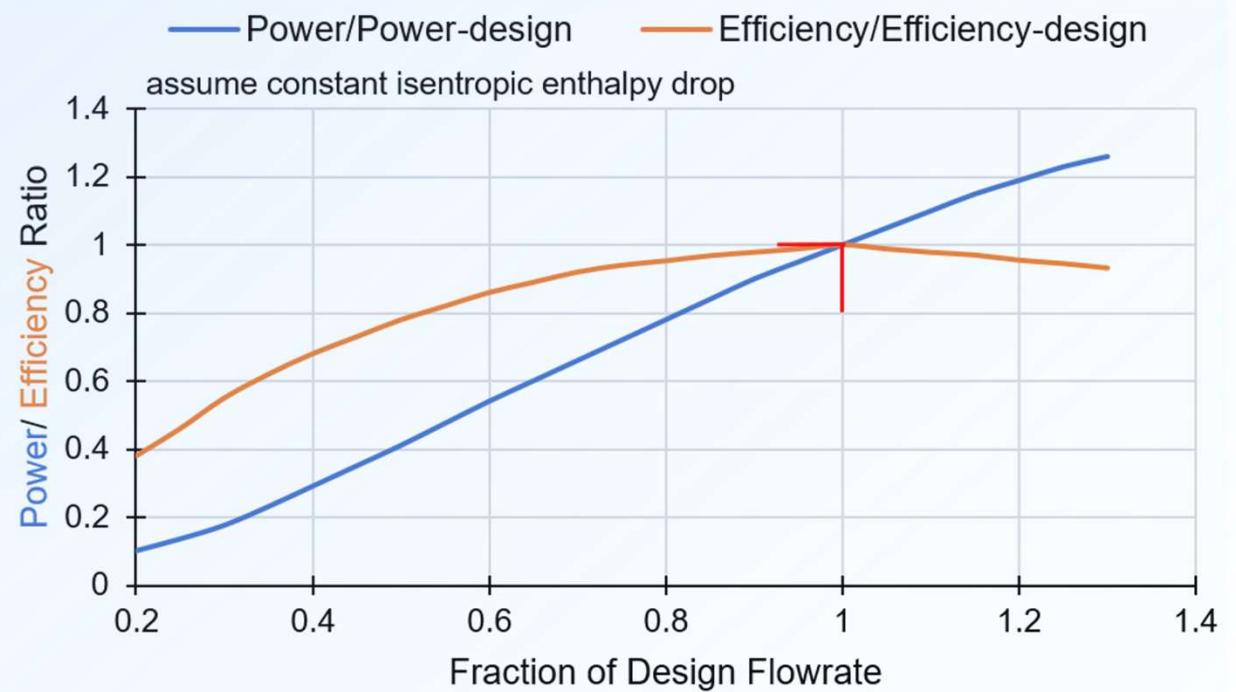


Radial Outflow Turbine



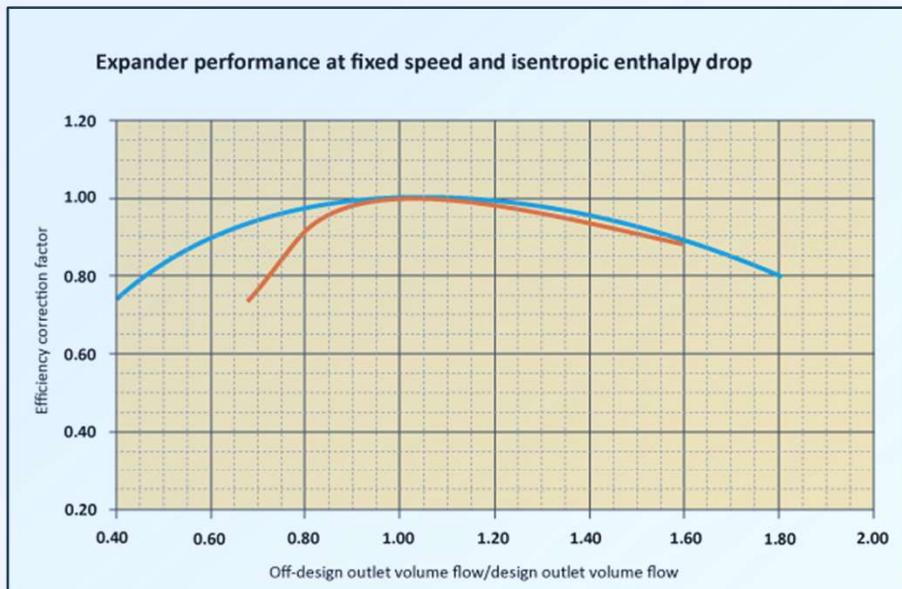
Radial Inflow Turbine

Turboexpander with Variable Inlet Guide Vanes

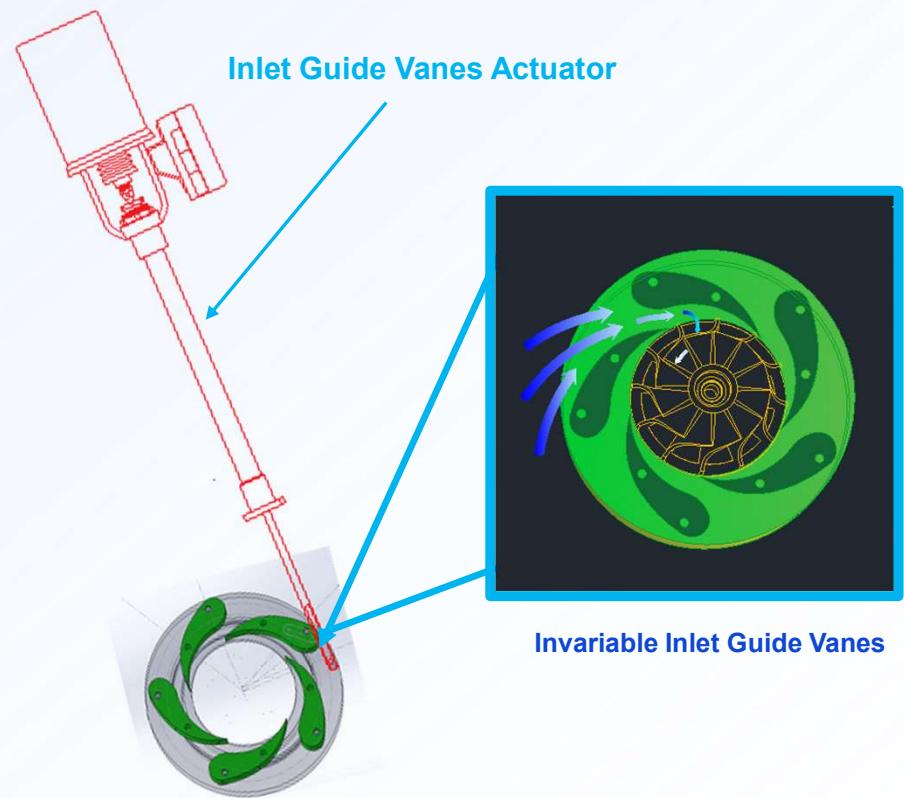


Variable Inlet Guide Vanes

Externally actuated
Non-galling
Provide swirl to drive expander wheel



Efficiency of RIT vs AT



Extended Capabilities

- CO₂ purification for agricultural and food industries
- CO₂ purification and liquefaction
- O₂ liquefaction



Ozman Geothermal Power Plant

Cooperative Agreement: ORC Geothermal Power Plants

Integrated capabilities

- **Nikkiso:** Radial inflow turbine technology + variable inlet guide valves
- **Egesim:** ORC design and optimization + electrification and automation + geothermal expertise

Renewable energy track record

- **Australia:** Raygen Solar Hybrid PP
- **Germany:** Strabag Silenos Energy GEPP
- **Turkey (Aydin):** Limak Limgaz Unit 1 GEPP
- **Turkey (Aydin):** Pamukören 1,2,3,4,5 GEPP
- **Turkey (Aydin):** Sultanhisar 1 GEPP
- **Turkey (Çanakkale):** Tuzla GEPP
- **Turkey (Manisa):** Özmen 1 GEPP
- **Turkey (Manisa):** Özmen 3 GEPP



ORC Geothermal Power Plant

Questions

 **EGESIM**

 **NIKKISO**