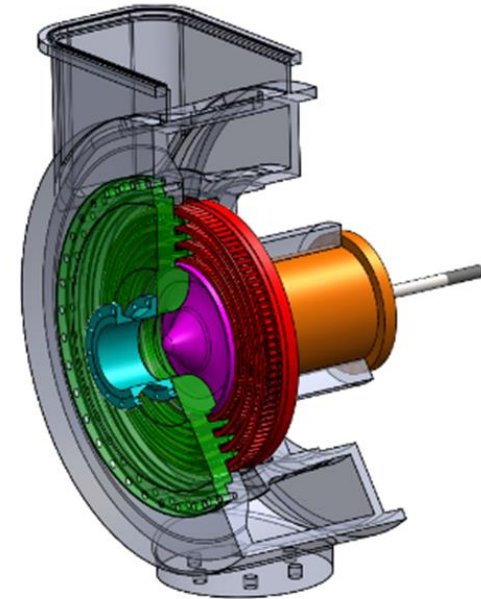


GREEN POWER THROUGH INNOVATION



00/SUMMARY



COMPANIES' PROFILE



TECHNOLOGIES



WHY CHOOSING TICA-EXERGY - SYNERGIES AND ADVANTAGES



MARKET APPLICATIONS



SERVICE



REFERENCES



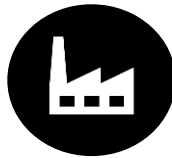
01/COMPANIE S PROFILE





01/TICA GROUP

ESTABLISHED IN 1991, TICA IS A PROFESSIONAL SOLUTION PROVIDER IN HVAC AND THERMAL UTILIZATION.



5 manufacturing bases
and 8 factories



900 million \$ turnover



2300 employees



70+ branch offices



01/TICA GROUP/ TICA THERMAL



UNITED TECHNOLOGIES (UTC), WITH HIGH REPUTATION FOR ITS PRATT & WHITNEY AIRCRAFT ENGINE , CARRIER CHILLER AND OTIS ELEVATOR , TRANSFERRED OR LICENSED WORLD LEADING TECHNOLOGIES SUCH AS ORGANIC RANKINE CYCLE (ORC) , CENTRIFUGE AND SCREW CHILLER TO TICA.





01/TICAGROUP
/
TICA THERMAL

Projects Portfolio Worldwide
100+ ORC Units
45 MWe Total

01/TICA GROUP/EXERGY



ON 25TH SEPTEMBER 2019, TICA ACQUIRED EXERGY FROM THE ITALIAN MACCAFERRI INDUSTRIAL GROUP. IN LESS THAN 10 YEAR HISTORY, THANKS TO ITS PIONEERING TECHNOLOGY EXERGY HAS BECOME THE WORLD 2ND LARGEST ORC PROVIDER IN GEOTHERMAL APPLICATION WITH 441 MWe IN PORTFOLIO

01/ TICA GROUP/EXERGY

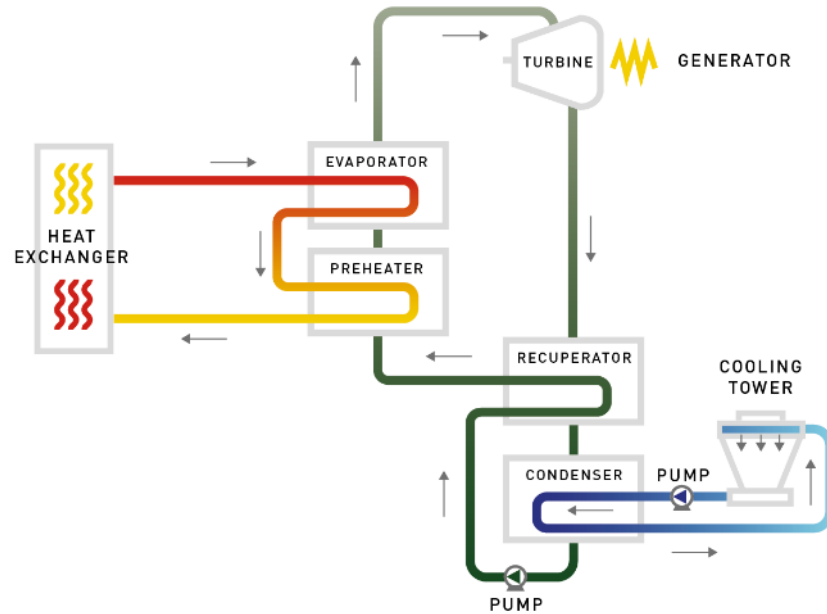
- › PIONEERS AND MOST REFERENCED IN THE DESIGN AND SUPPLY OF NEW GENERATION HIGH EFFICIENCY ORGANIC RANKINE CYCLE (ORC) SYSTEMS
- › THE UNIQUE DEVELOPER OF THE RADIAL OUTFLOW TURBINE TECHNOLOGY
- › THE ORC PROVIDER WITH THE FASTEST GROWTH AND MOST DISRUPTIVE TECHNOLOGY EVOLUTION IN THE MARKET
- › A LEADING ORC SUPPLIER WORLDWIDE WITH 475 MWe IN PORTFOLIO





02/TECHNOLOGIES

02/TECHNOLOGIES/ORC WORKING PRINCIPLE



THE POWER SYSTEM CONVERTS LOW- AND MEDIUM-TEMPERATURE (80-340°C) HOT FLUIDS LIKE WATER INTO ELECTRICITY, BASED ON A THERMODYNAMIC CYCLE KNOWN AS THE ORGANIC RANKINE CYCLE (ORC).

02/TECHNOLOGIES/TICA THERMAL

Power Pure Cycle 280

- 280KW STANDARD MODULAR DESIGN
- STANDARDIZED ASSEMBLY PROCESSES
- DELIVERED FULLY INTEGRATED AND TESTED IN TIGHTLY CONTROLLED FACTORY ENVIRONMENTS
- SHIPPED ON STANDARD TRUCKING
- 14 TO 16 WEEK LEAD TIME ON DELIVERIES



02/TECHNOLOGIES/TICA THERMAL

PURE CYCLE ADVANTAGES

- › GREEN WORKING FLUID R245FA
- › INTEGRATED DESIGN OF TURBINE-GENERATOR, LOW LEAKAGE RISK
- › RADIAL IN-FLOW TURBINE (RIT) WITH HIGH SYSTEM EFFICIENCY
- › MULTIPLE PROTECTION DESIGN WITH HIGH RELIABILITY
- › MODULAR DESIGN WITH HIGH LEVEL INTEGRATION, SKID-MOUNTED STRUCTURE, EASY INSTALLATION
- › AUTOMATIC TRACKING GRID PARAMETERS BY INDUCTION GENERATOR
- › REMOTE CONTROL, ONE-KEY START-STOP



02/TECHNOLOGIES/ TICA THERMAL IP

50 REGISTERED PATENTS

30 NEW PATENTS IN APPLICATION

20 COPYRIGHTS



02/ TECHNOLOGIES/ EXERGY/ THE ROT

EXERGY RADIAL OUTFLOW TURBINE

- › CONCEPTUALIZED BY EXERGY FOUNDER CLAUDIO SPADACINI THE RADIAL OUTFLOW TURBINE (ROT) IS UNIQUE IN THE ORC MARKETPLACE.
- › THE RADIAL OUTFLOW TURBINE IS THE **HIGHEST EFFICIENCY** TURBINE AVAILABLE ON THE ORC MARKET

02/TECHNOLOGIES/EXERGY/THE ROT

- › RADIAL DEVELOPMENT OF THE STAGES
MATCH BETWEEN VOLUMETRIC FLOW AND CROSS SECTION
- › HIGHER NUMBER OF STAGES (6+)
HIGHER ISENTROPIC EFFICIENCY PER STAGE
BETTER OFF-DESIGN PERFORMANCE
- › LOW SPEED (DIRECT DRIVE)
LOW NOISE AND VIBRATIONS
- › SINGLE-DISK, OVERHUNG CONFIGURATION
ENHANCED COMPONENTS ACCESSIBILITY
POSSIBILITY FOR MULTIPLE ADMISSIONS ON ONE DISK
- › BUILT-IN MECHANICAL GROUP EXTRACTION SLIDE
REDUCED DOWNTIMES

ROT ADVANTAGES

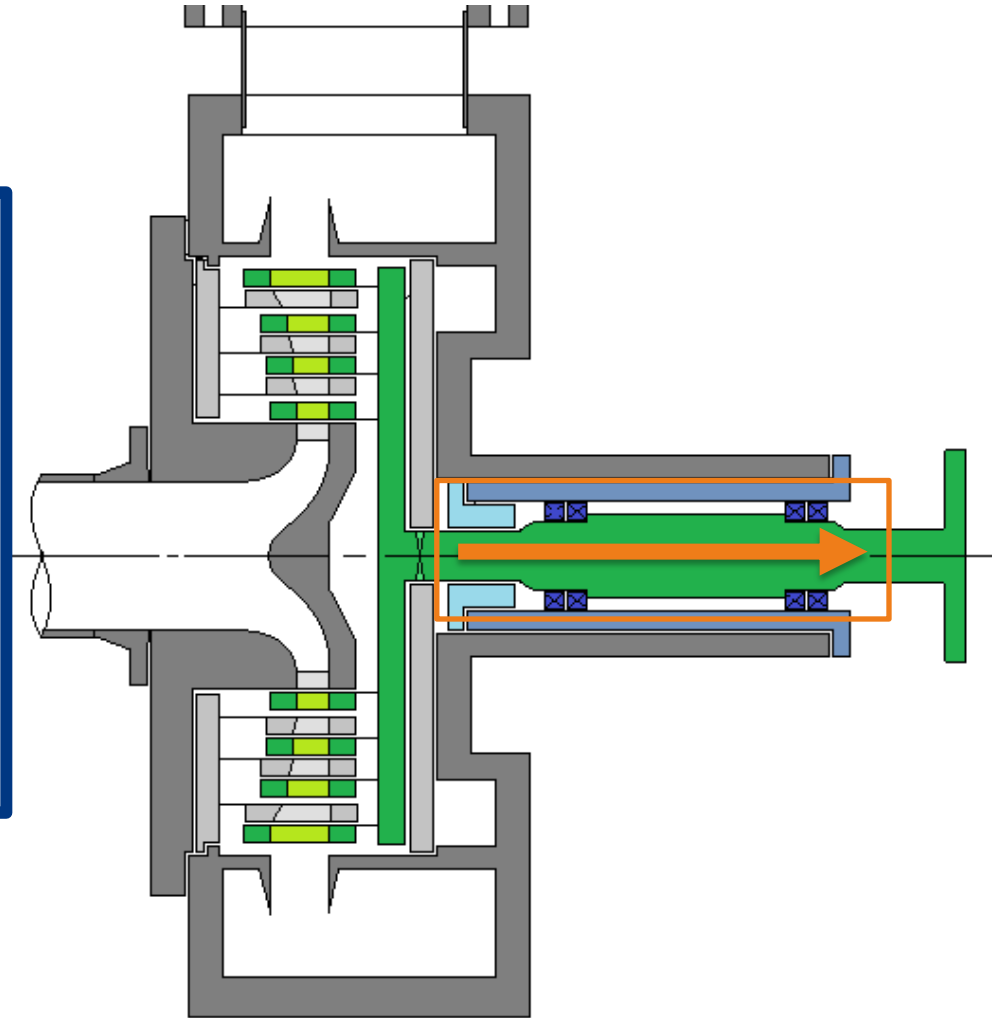


02/TECHNOLOGIES/EXERGY/THE ROT

Feature	Radial Inflow	Axial	Radial Outflow
Number of stages	1	up to 5	up to 9
Off-design performance	IGV		Large number of stages
Rotational speed	High speed Gearbox	Low speed Direct drive	Low speed Direct drive
Design complication	IGV, twisted blades	Twisted blades	Straight blades
Turbine inlet pressure	up to 40 bara	10-15 bara	10-15 bara
Cycle type	Supercritical/Superheated	Saturated	Saturated
Working fluid availability on the market	Typically R134a/R245fa	nPentane	nPentane, iPentane
Turbine cost			Reduced number of parts
Turbine isentropic efficiency	up to 87%	up to 86%	Up to 90%

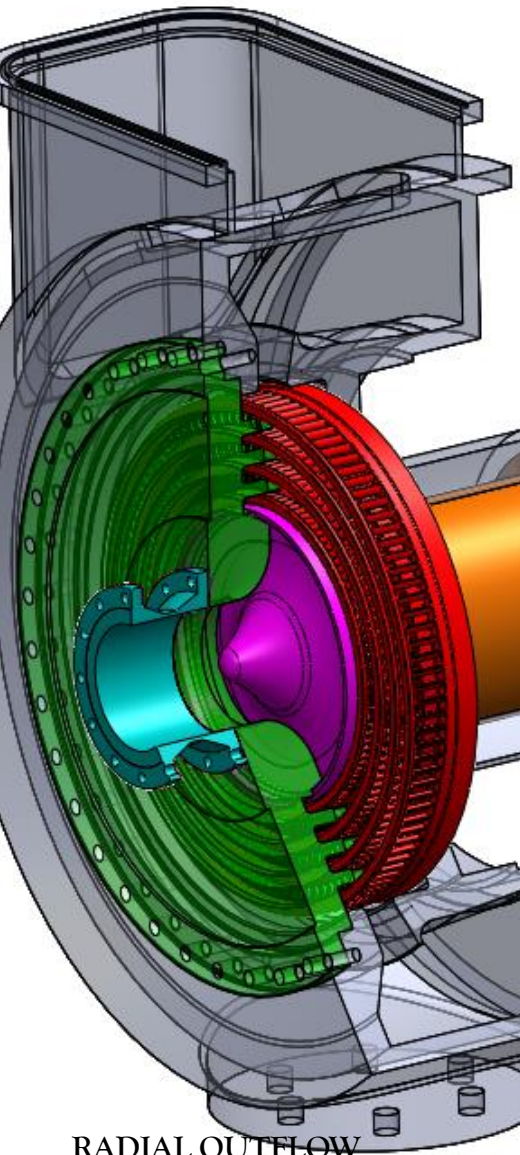
02/ TECHNOLOGIES/EXERGY/MECHANICAL GROUP

- › **PATENTED TECHNOLOGY** THAT ALLOWS TO REMOVE THE MECHANICAL GROUP WITHOUT ANY FLUID DRAINAGE OR LOSS.
- › THE BUILT-IN MECHANICAL GROUP CAN BE EXTRACTED TO FACILITATE AND MAINTAIN A LONGER LIFE OF THE BEARINGS.
- › THE ENTIRE OPERATION CAN BE COMPLETED IN ABOUT 4 HOURS

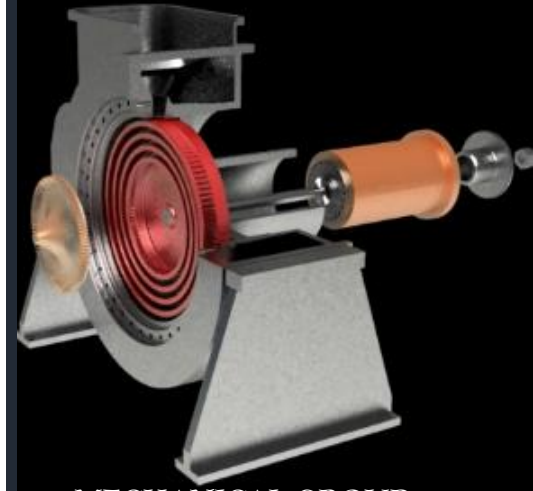


02/ EXERGY/ IP RIGHTS

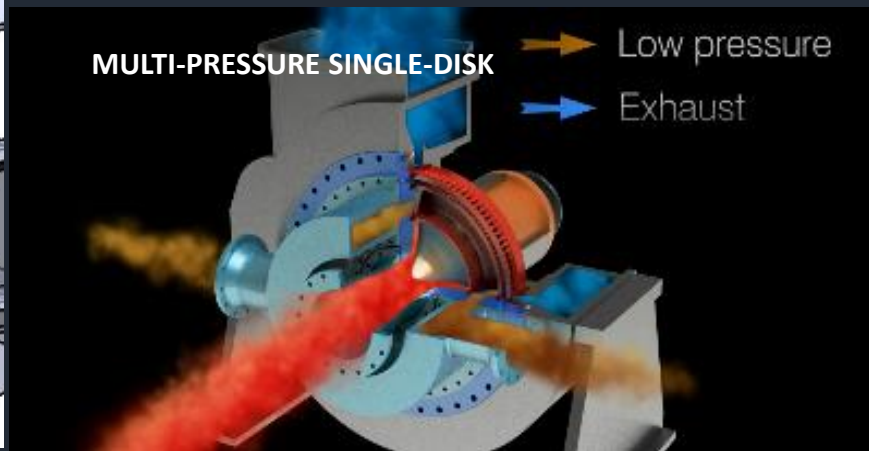
89 GRANTED PATENTS IN
DIFFERENT REGIONS WORLDWIDE



RADIAL OUTFLOW
TURBINE



MECHANICAL GROUP



MULTI-PRESSURE SINGLE-DISK

Low pressure

Exhaust

20 PATENTS UNDER
APPLICATION WORLDWIDE

A grayscale photograph of two hands, one on the left and one on the right, holding two interlocking puzzle pieces. The puzzle pieces are a dark purple color. The hands are positioned as if they are about to fit the pieces together. The background is a plain, light gray.

03/WHY CHOOSING TICA-EXERGY

03/WHY CHOOSING TICA-EXERGY



280 kW units
1-5 MW
units



1 MW up to
tailored units
of 28 MW
each



From 280 kW
up to
tailored
power plants

A BROAD ARRAY OF SOLUTIONS TO SATISFY ANY CUSTOMERS' NEED FOR EITHER SMALL STANDARDIZED UNITS FOR POWER GENERATION FROM LOW TEMPERATURE WASTE HEAT OR BESPOKE POWER PLANTS FOR HIGHER POWER SIZE

03/WHY CHOOSING TICA- EXERGY

MOVED BY SHARED VALUES OF BUSINESS INTEGRITY, CUSTOMER FOCUS, QUALITY FIRST AND TEAMWORKING TO PROVIDE EFFECTIVE SOLUTIONS FOR SUSTAINABLE BUSINESSES

OFFERING A GLOBAL SERVICE THANKS TO OPERATION CENTERS, WORKSHOPS AND PRESENCE IN ALL INTERNATIONAL MARKETS (CHINA AND FAR EAST-EUROPE-AMERICAS)

HAVING IN HOUSE COMPREHENSIVE TECHNICAL SKILLS IN ENGINEERING AND POWER PLANT DESIGN THANKS TO EXERGY'S EXTENSIVE KNOW HOW

HAVING IN HOUSE MANUFACTURING CAPACITY LEVERAGING ON TICA'S STRONG MANUFACTURING SKILLS. GREATER

INTERNAL COLLABORATION AND CONTROLS AT EVERY STEP OF THE PROCESS AND SHORTER DELIVERY TIMES

BEING R&D AND PRODUCT DEVELOPMENT ORIENTED AS IN THE DNA OF BOTH COMPANIES WITH MORE THAN 150 COMBINED REGISTERED PATENTS WORLDWIDE

BEING WELL REFERENCED IN NEW GENERATION HIGH-EFFICIENCY POWER PLANTS SYSTEMS



04/MARKET APPLICATIONS

04/ MARKET APPLICATIONS

RENEWABLES



GEO THERMAL



BIOMASS



CSP

WHR



STEEL



CEMENT



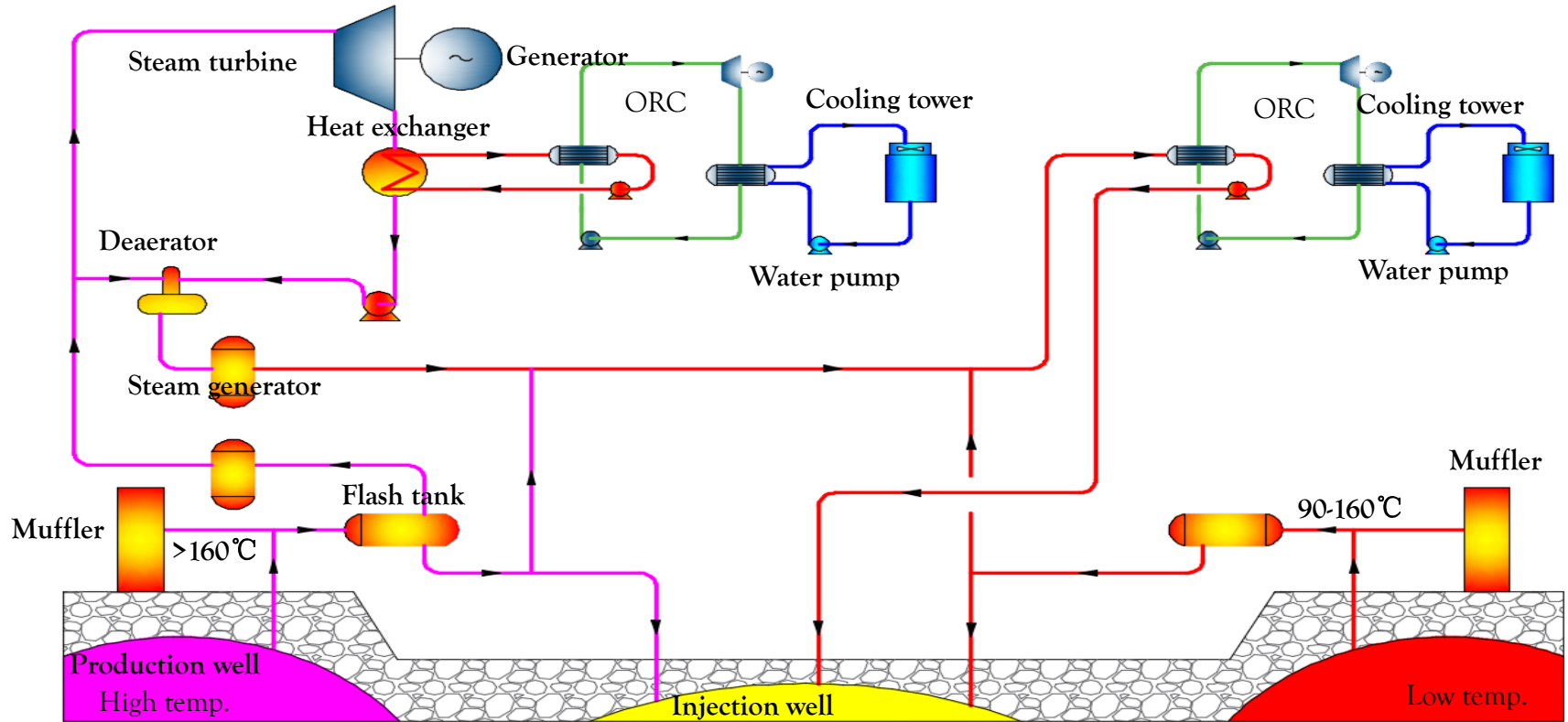
CHEMICAL

04/APPLICATION - GEO



- › KIND OF GEOTHERMAL RESOURCES:
 - STEAM ONLY
 - MIXED STEAM AND LIQUID
 - LIQUID ONLY
- › RANGE OF PLANT CONFIGURATION:
 - ORC ONLY
 - ORC BOTTOMING OF STEAM TURBINE
 - WELL-HEAD GENERATORS

04/ MARKET APPLICATIONS/GEO



04/MARKET APPLICATIONS/GEO

An aerial photograph of a geothermal power plant. The facility features several large, rectangular storage tanks with blue roofs, interconnected by a complex network of green pipes. There are also various smaller buildings and structures scattered throughout the site. The plant is situated in a rural area with agricultural fields and some trees visible in the background.

EXERGY BINARY PLANT ADVANTAGES

- › **COST EFFECTIVE CONFIGURATION**
- › **SUPERIOR EFFICIENCY**
- › **HIGH FLEXIBILITY IN OFF DESIGN CONDITIONS**
- › **MULTIPLE PRESSURE LEVEL PLANT WITH SINGLE TURBINE DISK**
- › **BETTER EXPLOITATION OF HIGH ENTHALPY RESOURCES**
- › **SUITABLE FOR LOW TEMPERATURE SOURCES > 90°C**
- › **GEOHERMAL FLUID DOES NOT TOUCH THE TURBINE**
- › **LOW MAINTENANCE**

04/MARKET APPLICATIONS/GEO

EXERGY

EXERGY's GEO TECHNICAL ACHIEVEMENT

- › **EXTENSIVE KNOW HOW IN GEOTHERMAL POWER PLANT DESIGN WITH THE SECOND LARGEST GEOTHERMAL BINARY FLEET WORLDWIDE**
- › **IN HOUSE TECHNICAL EXPERTISE TO DEVELOP TAILORED SOLUTIONS IN TERMS OF CYCLE AND TURBOMACHINERY DESIGN ACCORDING**
- › **REFERENCES WITH THE BIGGEST ORC TURBINES IN OPERATION IN THE MARKET (20 MWe)**
- › **FIRST REFERENCE IN THE WORLD, MULTI AWARD WINNING POWER PLANT HIGH PERFORMANCE DESIGN WITH TWO PRESSURE LEVEL ON A SINGLE TURBINE DISK (TOSUNLAR 1 client: AKCA ENERJI)**
- › **PROVEN TECHNOLOGY AND PERFORMANCE at 99% AVAILABILITY**

04/MARKET APPLICATIONS/EXERGY PERFORMANCE

OVER 98.5% AVAILABILITY IN ALL THE TRACKED UNITS, AVERAGE 99.2%

SITE	CUSTOMER	OPERATION YEAR	TEMPERATURE	OUTPUT GROSS	AVAILABILITY
Saraykoy 5	Greeneco Enerji	2019	170°C	28 MW	99.6 %
Saraykoy 4	Greeneco Enerji	2018	150°C	12 MW	99.0 %
Kuyucak	Turcas	2017	155°C	18 MW	99.0 %
Kubilay	Bestepeler Enerji	2016	139°C	27 MW	99.3 %
Karkey-Umurlu 2	Karadeniz Holding	2016	145°C	12 MW	99.8 %
Mehmet Han	Kipas Holding	2016	160°C	25 MW	99.9 %
Ken Kipas	Kipas Holding	2016	172°C	25 MW	99.6 %
Karkey-Umurlu I	Karadeniz Holding	2015	145°C	12 MW	99.3 %
Saraykoy 1	Greeneco Enerji	2015	135°C	12 MW	99.3 %
Denizli - Tosunlar	Akca Enerji	2014	105°C	3.5 MW	99.8 %
Bagnore	Enel Green Power	2012	150°C	1 MW	99.3 %

04/ MARKET APPLICATIONS/ HEAT RECOVERY

INDUSTRIAL

- › CEMENT FACTORIES
- › STEEL MILLS
- › GLASS MILLS
- › FURNACES

OIL & GAS

- › INTERNAL COMBUSTION ENGINES
- › GAS TURBINES
- › COMPRESSOR STATIONS



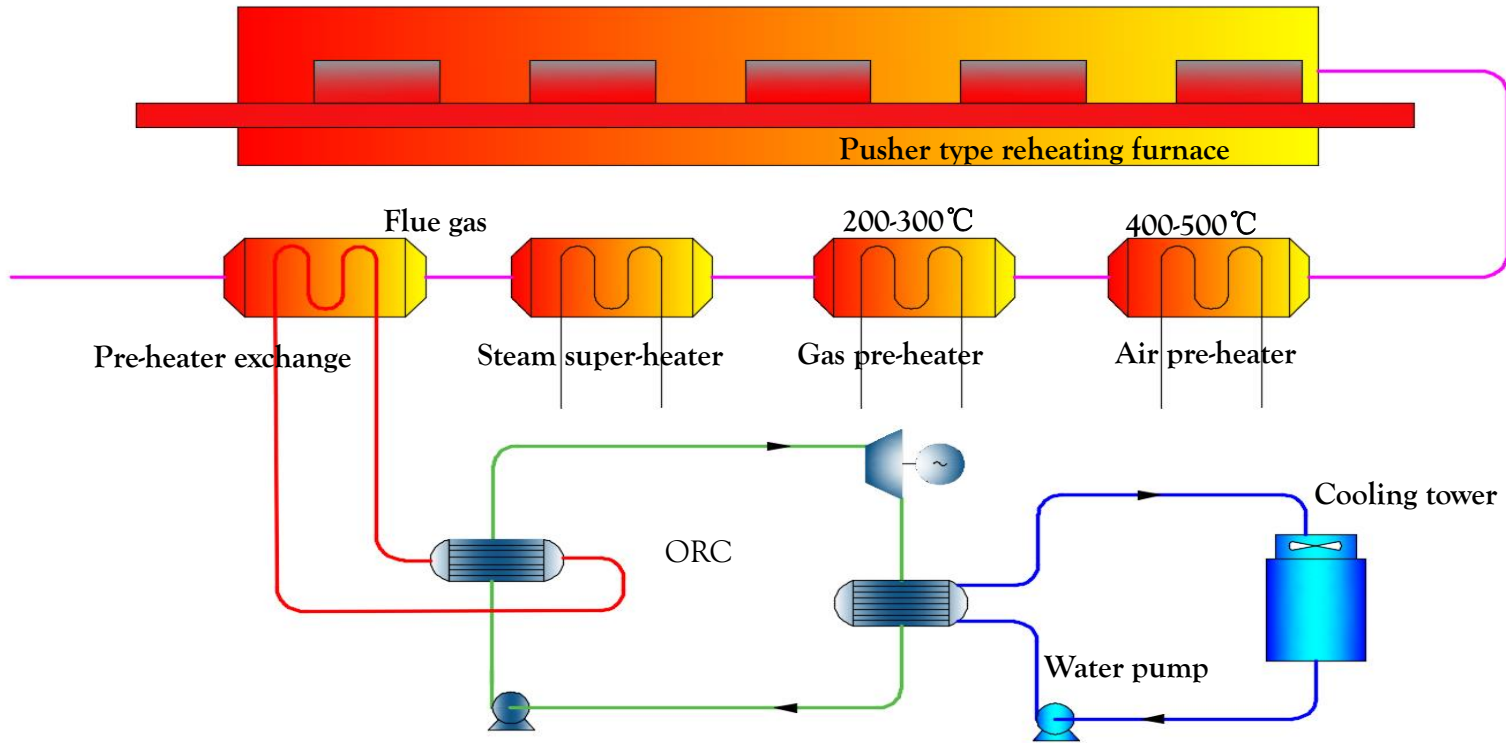
04/ MARKET APPLICATIONS/ HEAT RECOVERY

- › **COMPETITIVE CAPITAL COSTS**
- › **HIGH EFFICIENCY AT A VARIETY OF OPERATING TEMPERATURES AND LOADS**
- › **FAST START UP AND SHUT DOWN**
- › **AUTOMATED OPERATION**
- › **NO WATER TREATMENT OR MAKE UP**
- › **FLEXIBLE PLACEMENT**
- › **REDUCTION OF THE PLANT ENERGY CONSUMPTION AND CARBON FOOTPRINT, IN THE CASE OF INDUSTRIAL PROCESSES**

ADVANTAGES



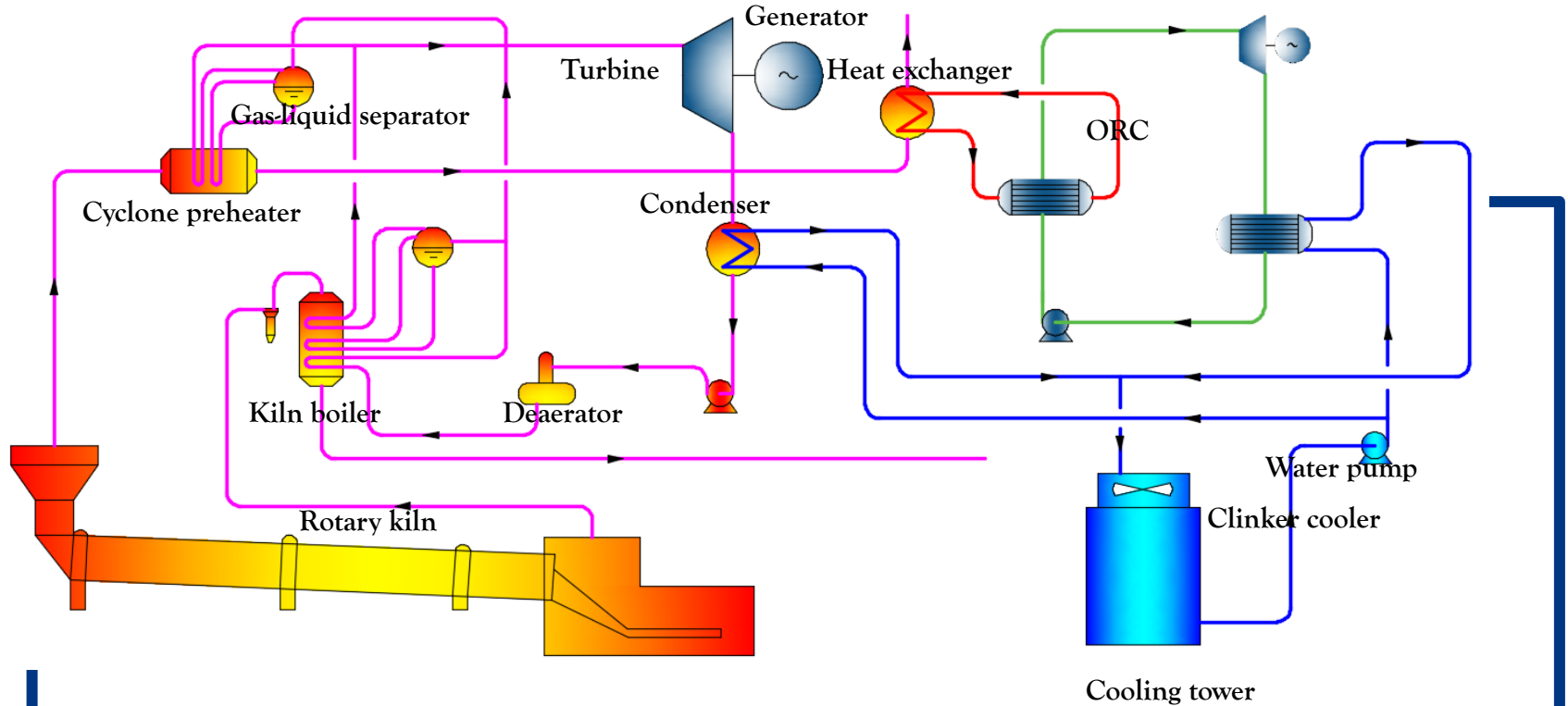
04/ MARKET APPLICATIONS/ HR STEEL



HEAT SOURCES

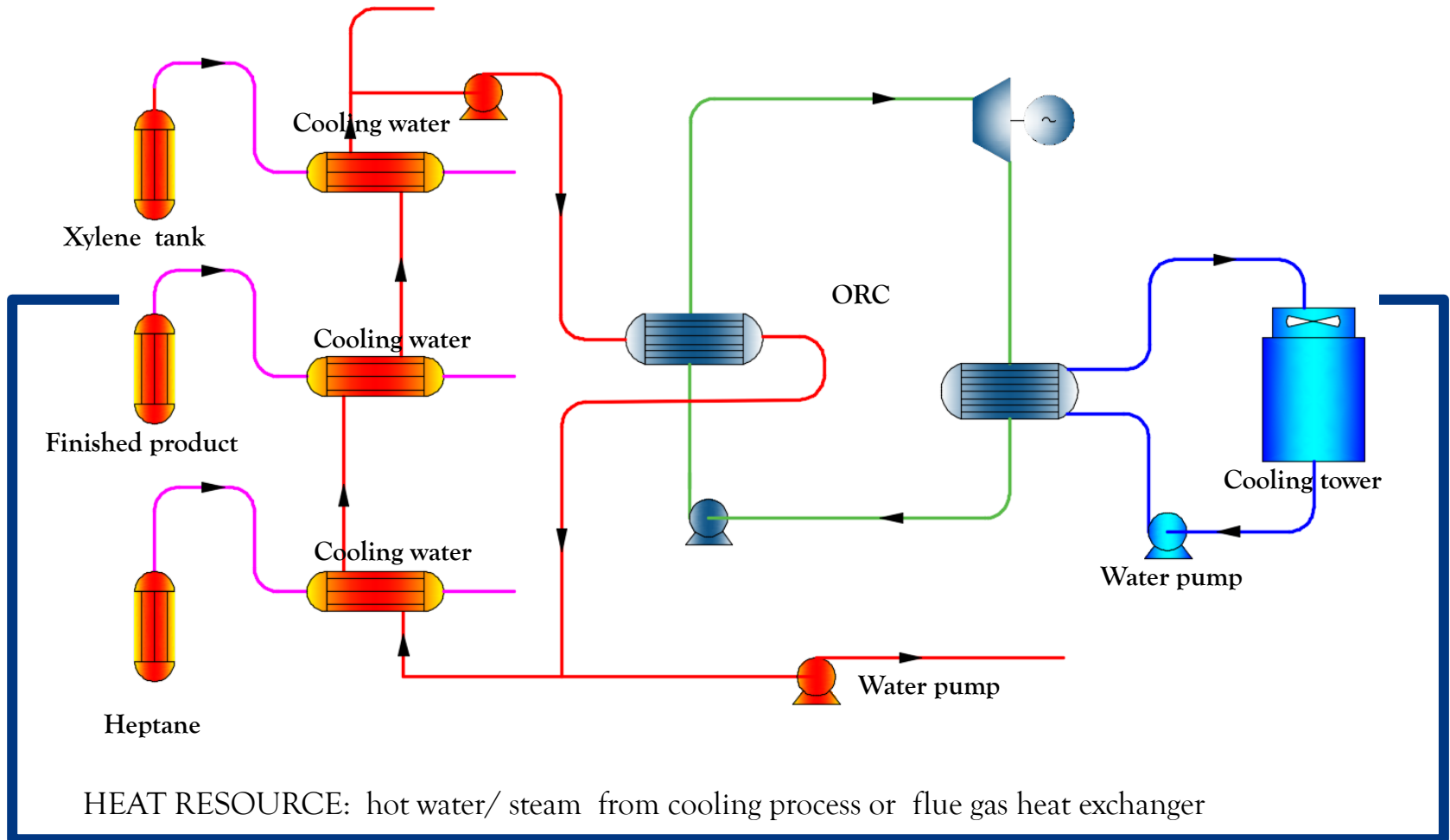
1. blast furnace waste heat exchanging to hot water/ steam
2. rolling mill waste heat exchanging to hot water/ steam

04/ MARKET APPLICATIONS/ HR CEMENT



HEAT SOURCE: hot water/ steam from flue gas heat exchanger or kiln boiler Heat

04/ MARKET APPLICATIONS/ HR CHEMICAL



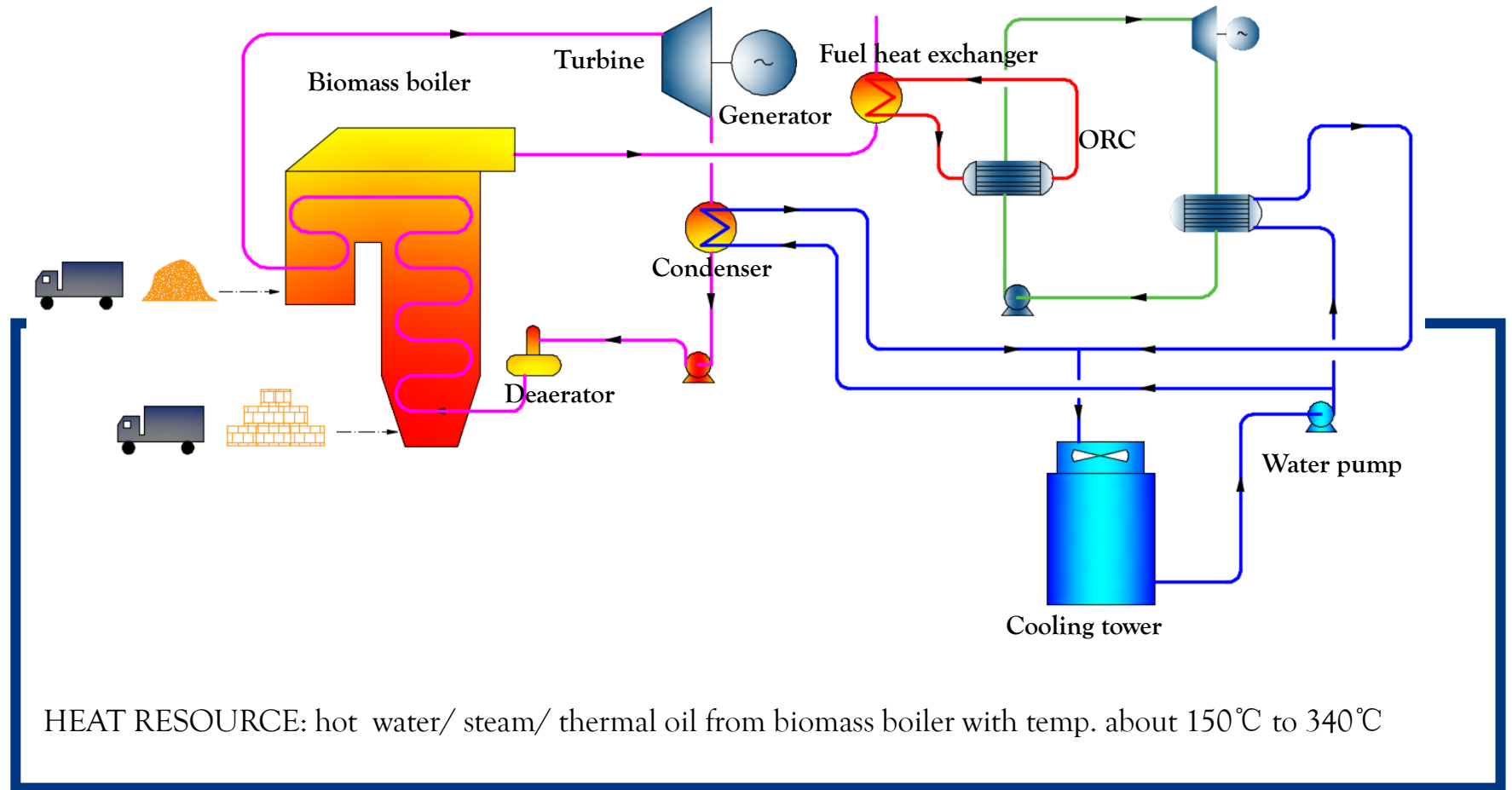
04/ MARKET APPLICATIONS/ BIOMASS

- › **GOOD COMPROMISE BETWEEN INVESTMENT COST AND EFFICIENCY**
- › **HIGH RELIABILITY THANKS TO PROVEN TECHNOLOGY**
- › **HIGH FLEXIBILITY IN BIOMASS FEED QUALITY**
- › **HIGH MODULARITY AND SIMPLE INSTALLATION**
- › **FEW CIVIL WORKS REQUIRED**

ADVANTAGES



04/ MARKET APPLICATIONS/ BIOMASS



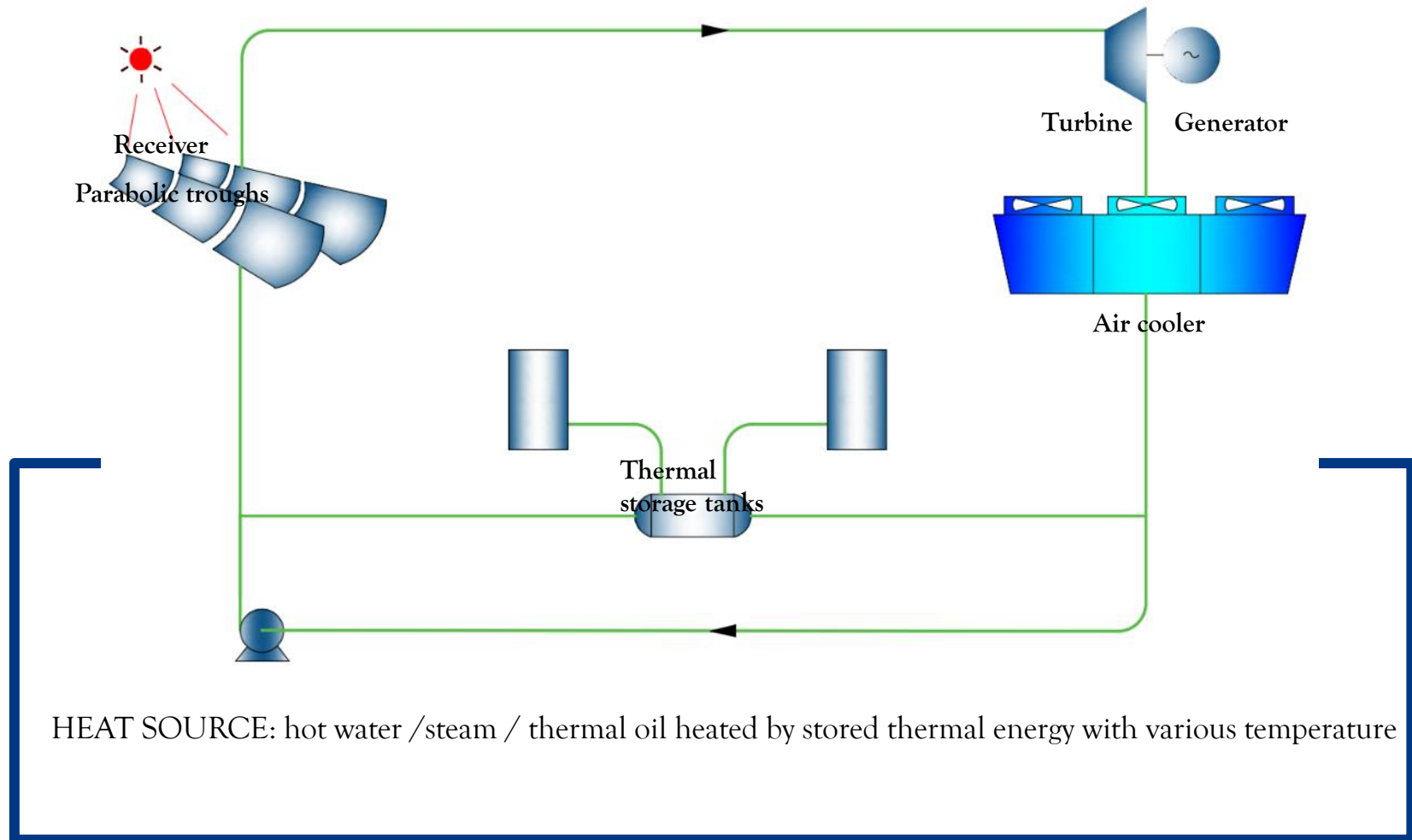
04/ MARKET APPLICATIONS/ CSP

- › **HIGH LEVEL OF EFFICIENCY FOR CONVERTING THE THERMAL ENERGY COLLECTED BY SOLAR PANELS INTO ELECTRICITY**
- › **COST EFFICIENT SOLUTION**
- › **LOWER OVERALL SYSTEM COST THANKS TO THE REDUCTION OF THE REFLECTORS USED**

ADVANTAGES



04/ MARKET APPLICATIONS/ CSP

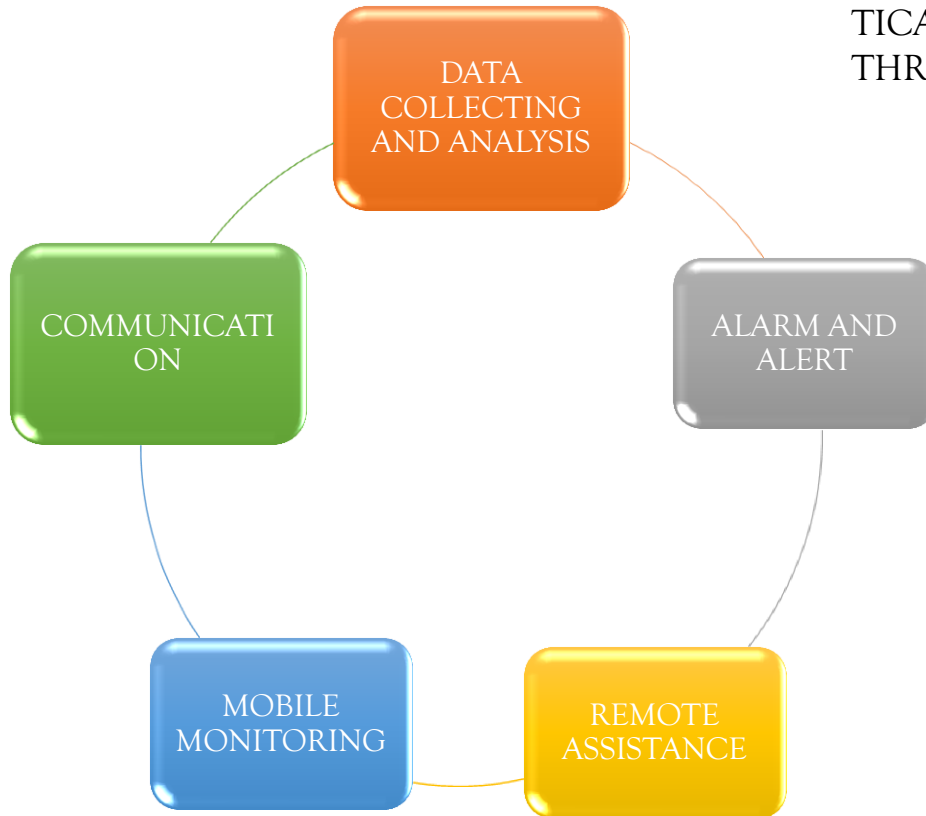


05/SERVICE

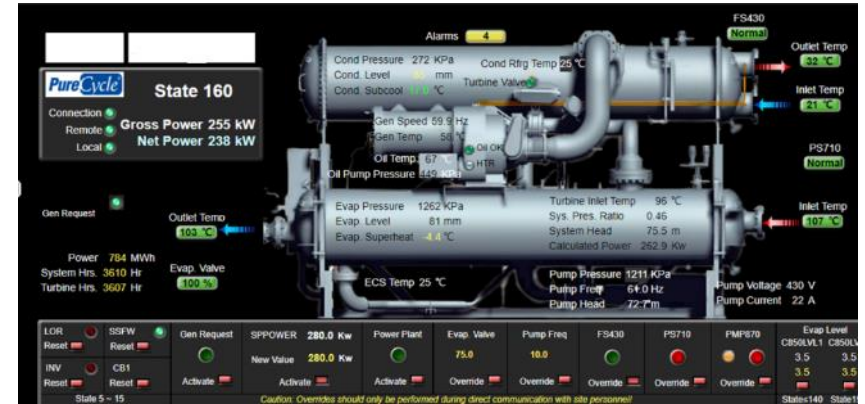
EXERGY

TICA®

05/SERVICE



TICA AND EXERGY SERVICE OFFER 24/7 SUPPORT THROUGH REMOTE MONITORING SYSTEMS





06/REFERENCES



BEŞTEPELER
ENERJİ,
 KUBILAY 1,
TURKEY

YEAR: 2015
APPLICATION: GEO
POWER: 24 MW



TBK TURCAS
KUYUCAK
YEAR: 2016
APPLICATION: GEO
POWER: 18 MW





PTT LNG,
RAYONG,
THAILAND



YEAR: 2017
APPLICATION: HR
POWER: 5MW



SISECAM
TARGOVISHTE,
BULGARIA



YEAR: 2014
APPLICATION: HR
POWER: 4MW



GREENECO
SARAYKOY,
TURKEY

APPLICATION: GEO
POWER: 104MW



BIO
2.9 MW
5 Plants

RENEWABLES



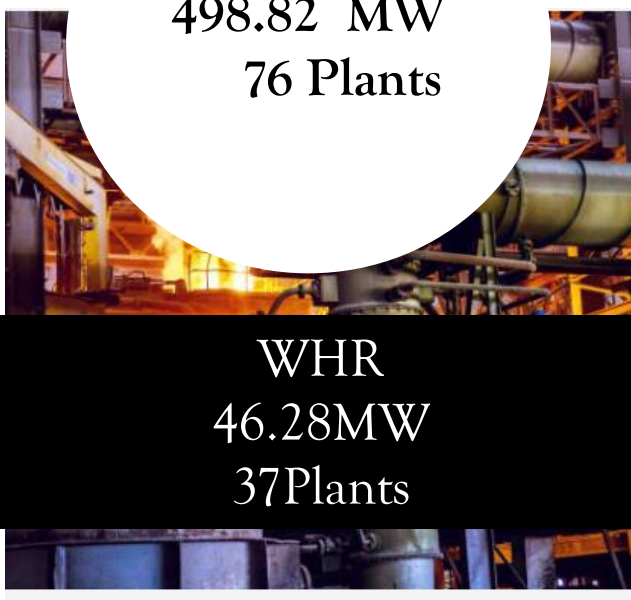
GEO
448.64 MW
33 Plants



CSP
1 MW
1 Plant



WHR



498.82 MW
76 Plants



WHR
46.28MW
37Plants



06/REFERENCES



«TICA PRO» LLC

official representative of Nanjing TICA Thermal Technology Co., Ltd.
in Russian Federation, Republic of Belarus and Republic of Kazakhstan

Tel.: +7 495 127 79 00,
+7 915 650 85 85
e-mail: info@tica.pro
www.tica.pro