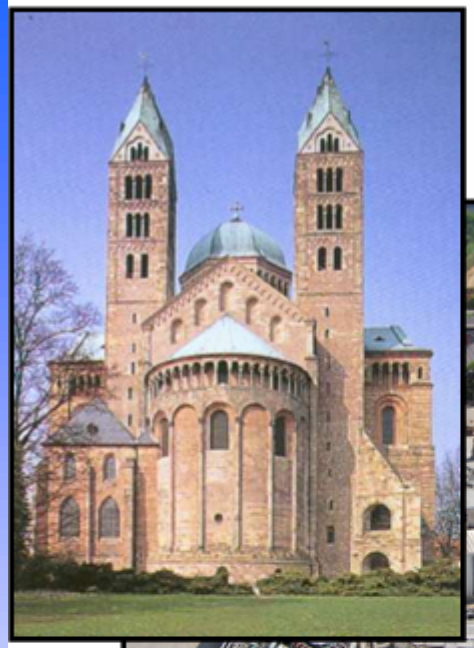
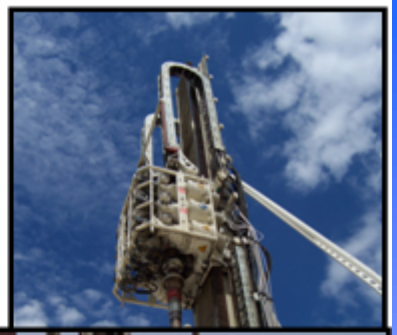
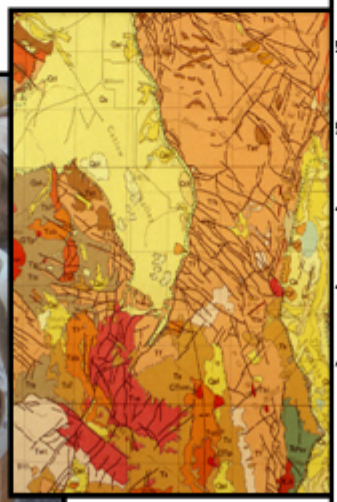
ORC-Units for Industry and Geothermics

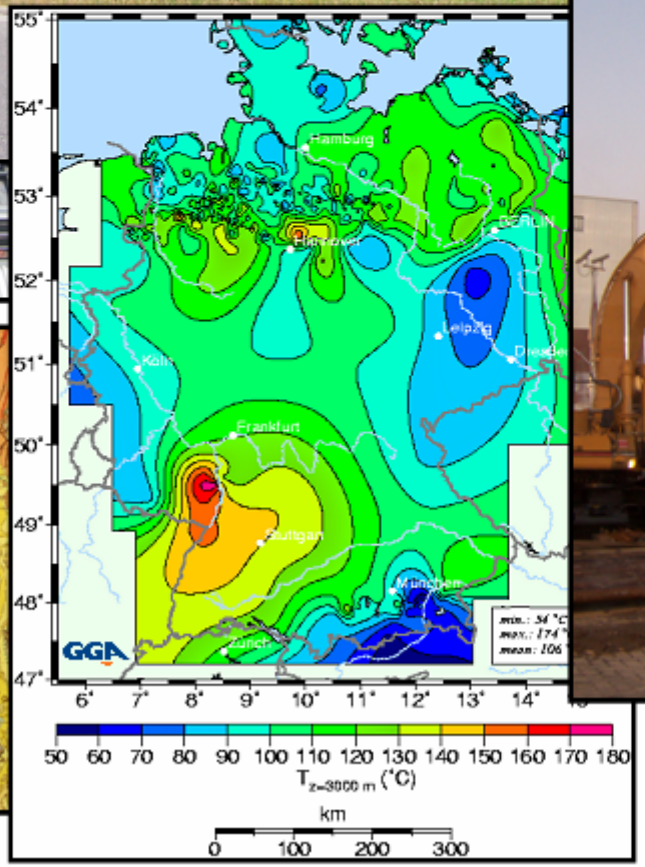
ENGINE Workshop 5 **14.-16. September**

Strasbourg, France



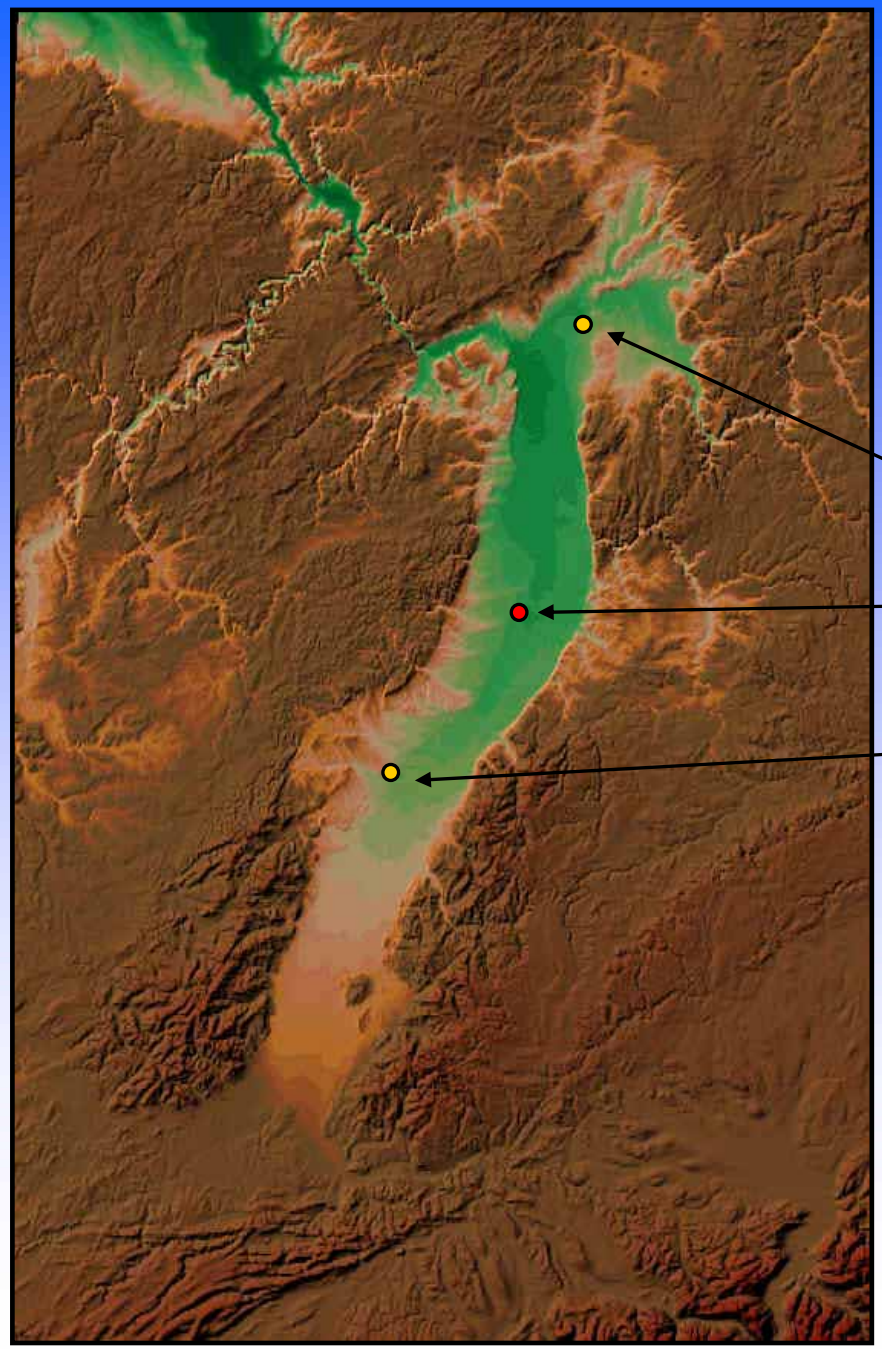






First Geo Therm GmbH

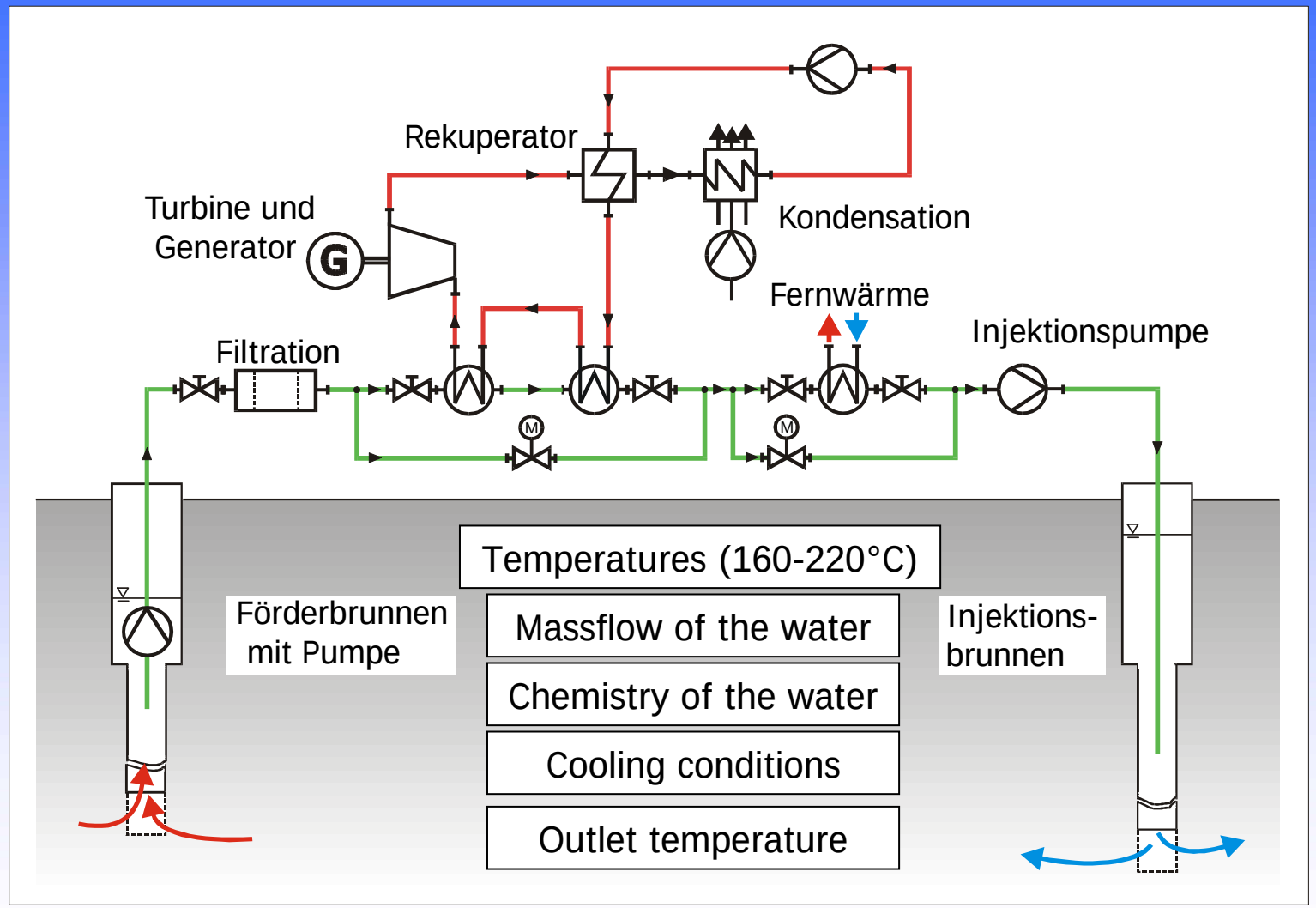
The Upper-Rheinvalley



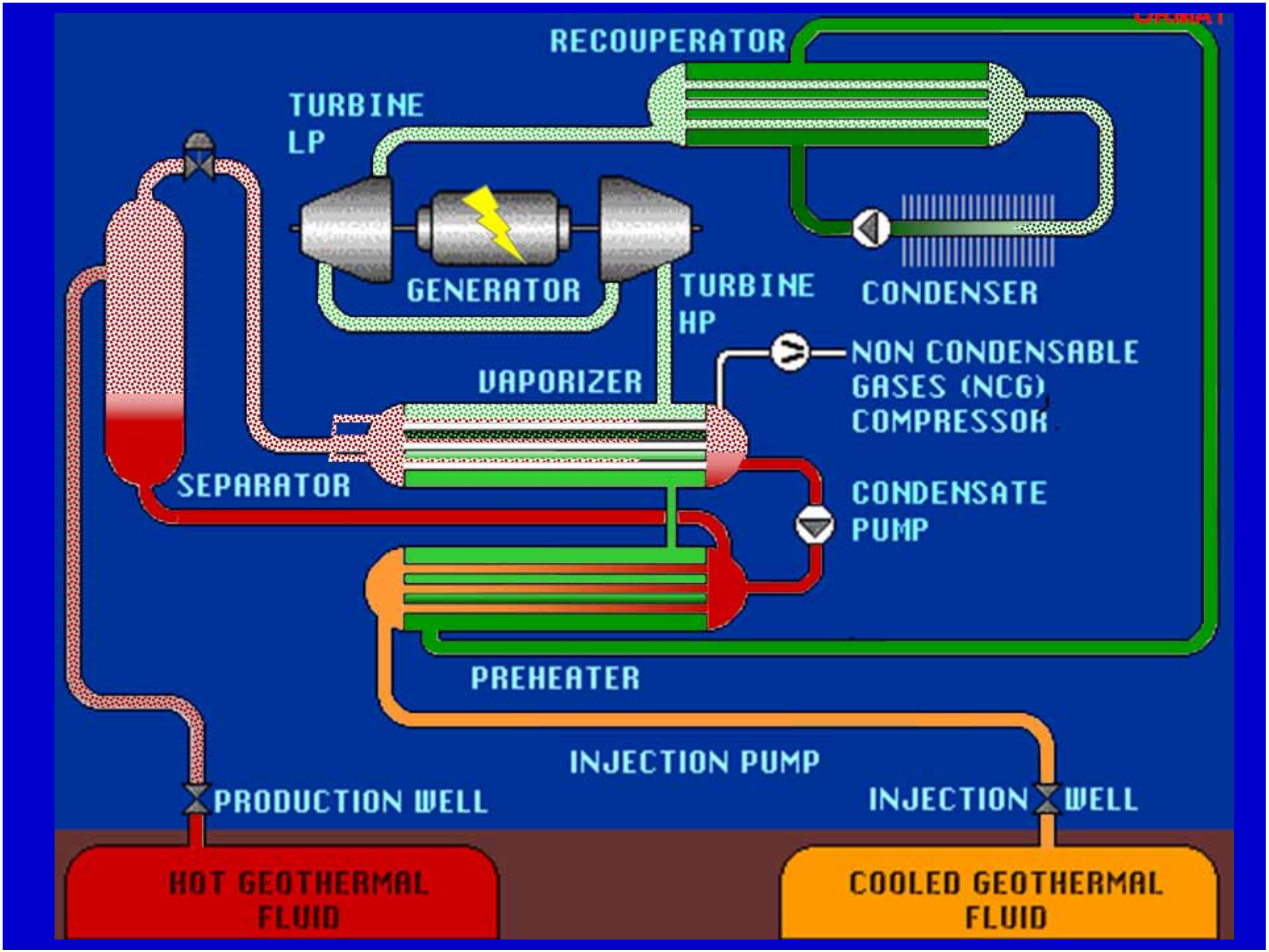
0 50 100 km

First Geo Therm GmbH

Electricity generation from Enhanced Geothermal systems



First Geo Therm GmbH


RECOUPERATOR
TURBINE
LP
GENERATOR
TURBINE
HP
CONDENSER
NON CONDENSABLE
GASES (NCG)
COMPRESSOR
VAPORIZER
SEPARATOR
CONDENSATE
PUMP
PREHEATER
INJECTION PUMP
PRODUCTION WELL
INJECTION WELL
HOT GEOTHERMAL
FLUID
COOLED GEOTHERMAL
FLUID

Geothermal Power Plants

Recovered Energy Generation
Gas Compressors on Pipelines

Recovered Energy Generation
Cement Plants

Recovered Energy Generation
from Industrial Processes

Remote Power Units

REG PROJECTS IN OPPERATION

Transcanadian pipeline, 1999 **7,5 MWel**

ENTERPRISE GAS PROCESING STATION
Luisiana, 2004 4,0 MWel

REG PROJECTS IN OPERATION
5 MWel

Geothermal CHP Project

Hotel & SPA Rogner, Bad-Blumau, AUSTRIA

Geothermal CHP Project; Bad-Blumau, AUSTRIA

Technical Data:

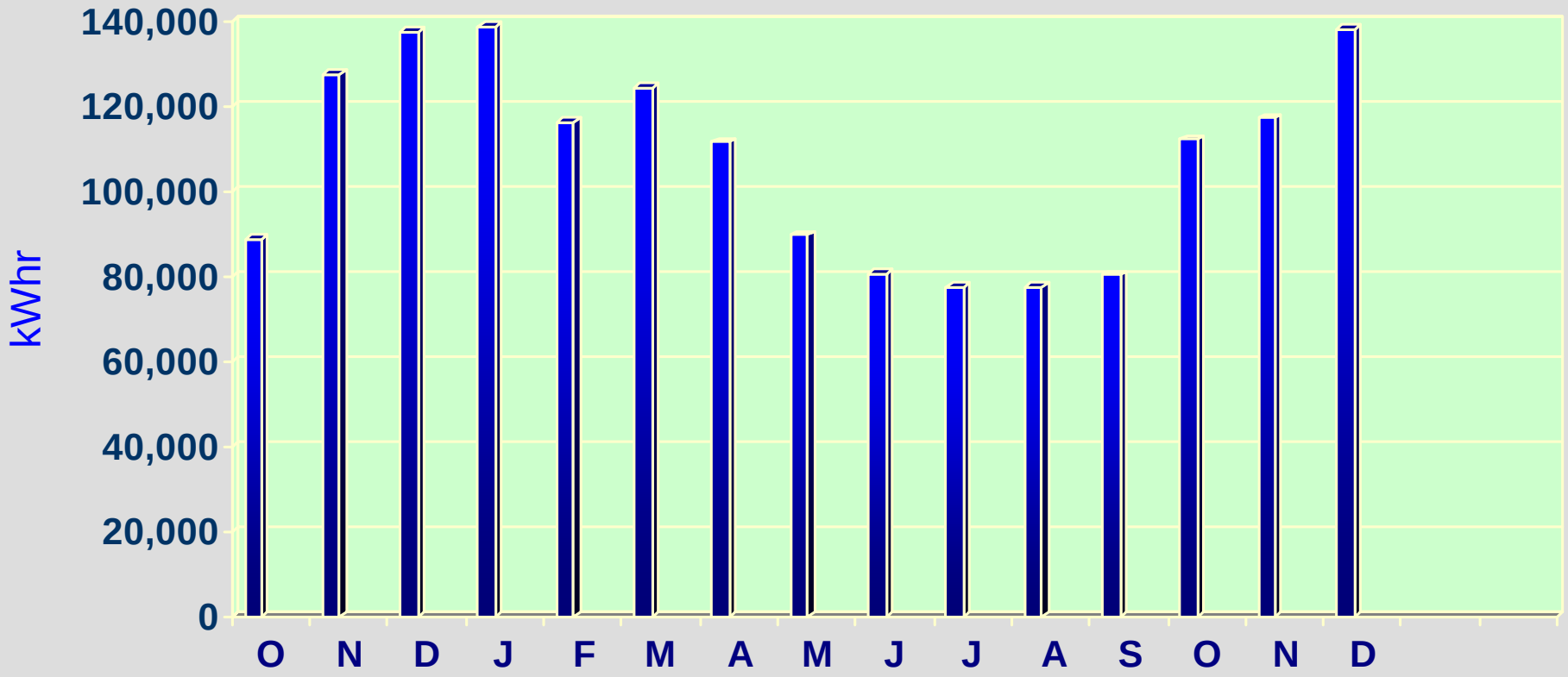
Gross output at Generator Terminals:	250 kWel
Number of OEC´s:	1
Cooling-media:	air
Thermal-fluid:	hot brine from a geothermal well
Geothermal-water flow:	30 l/s
Temperature of thermal-fluid:	108 °C
Start of operation:	Juli 2001
Installation time on site:	5 days
Recorded yearly Maintenance cost:	< 0,001$/kWh

ORMAT

ORMAT ENERGY CONVERTER
250kW AIR COOLED CHP PLANT

Bad Blumau Generated power 200 kW

October 2001- December 2002



Waste-heat power generating plant using the ORC-Process for utilizing residual clinker-cooller exhaust air

Powergeneration from Waste-heat

Lengfurt, Germany

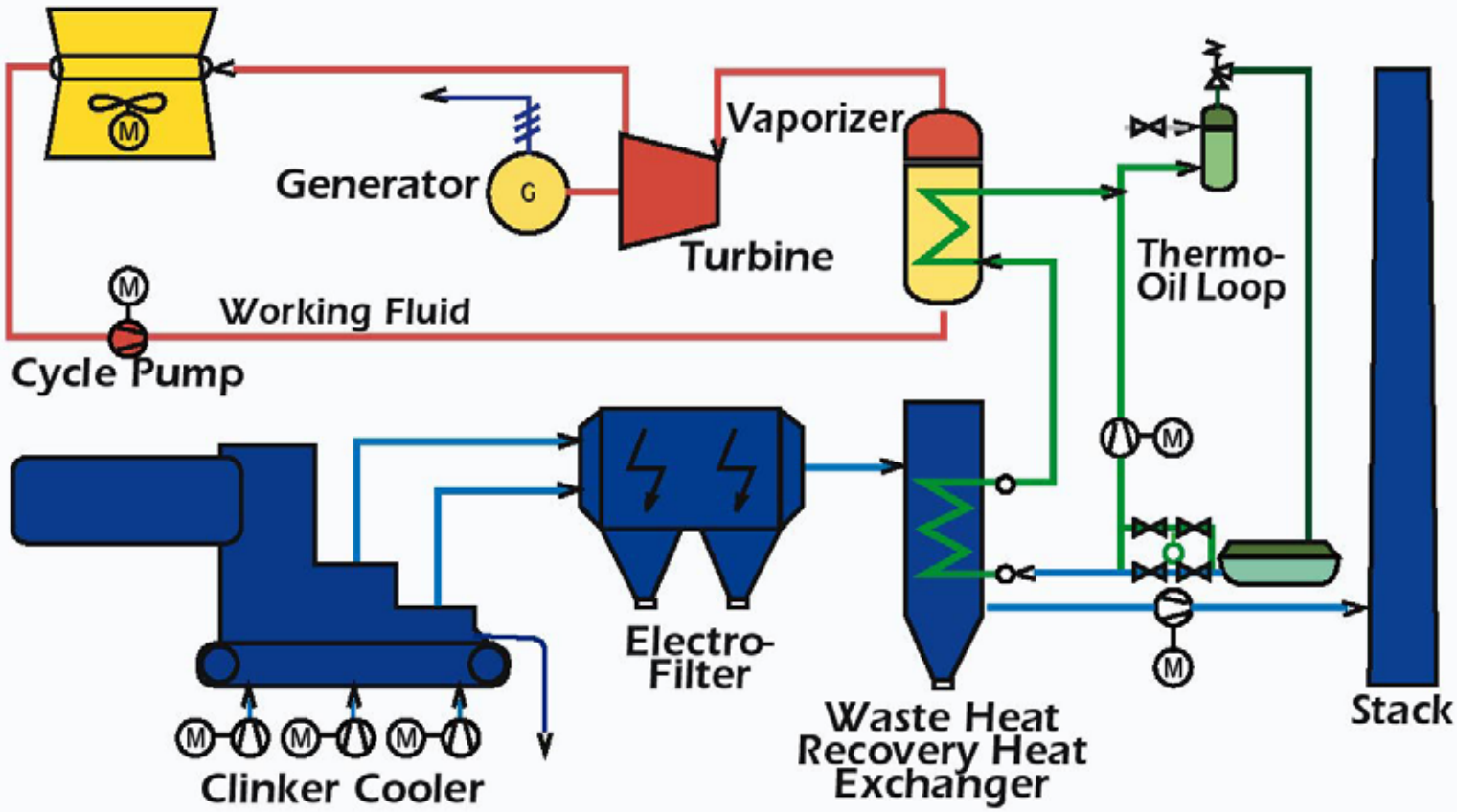
Technical Data:

Gross output at Generator Terminals:	1.320 kWel
Net. Output Generator:	1,13–1,22 MWel
Number of OEC´s:	1
Cooling-media:	air
Thermal-fluid:	thermal oil
Waste-heat-flow (Oil):	7 – 9 MWth
Temperature of thermal-fluid:	230 °C
Start of operation:	June 1999
Installation time on site:	3 Weeks
Recorded yearly Maintenance cost:	< 0,003$/kWh

ORMAT

ORMAT® ENERGY CONVERTER

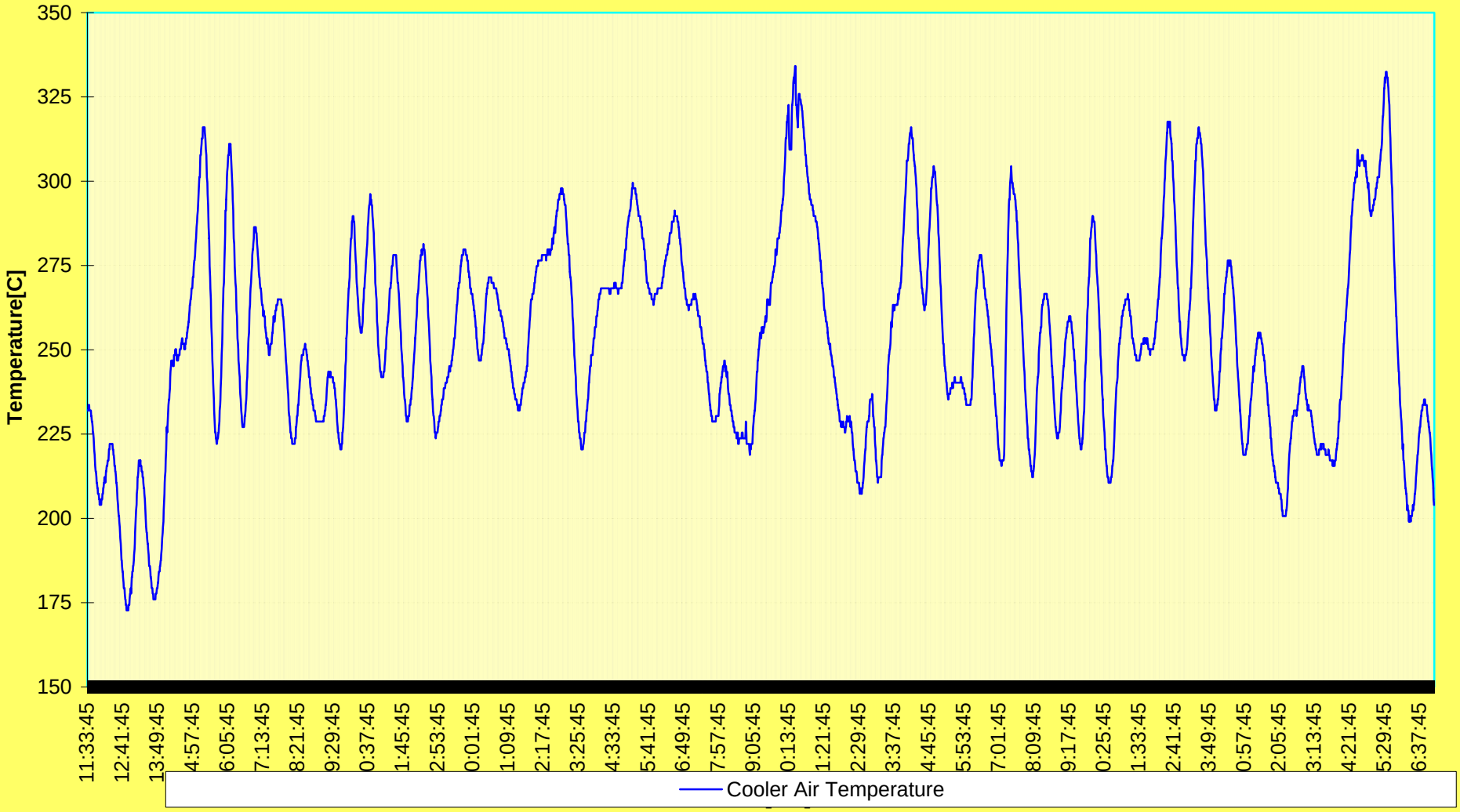
Clinker Cooler Recovery System




1.5 MW Heat Recovery from Clinker Cooler
Heidelberger Zement AG, Lengfurt Plant Germany

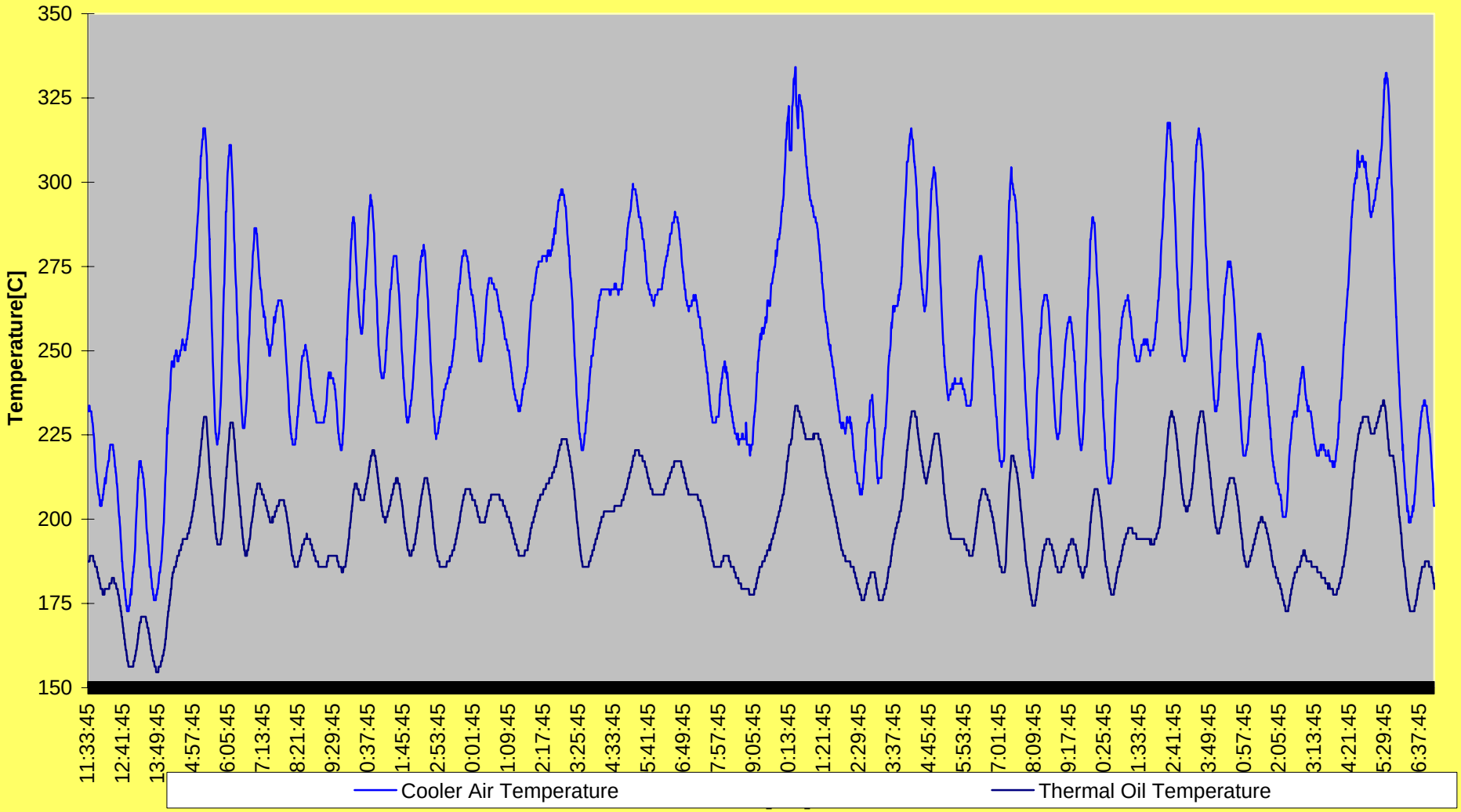
ORMAT

CLINKER COOLER AIR TEMPERATURE FLUCTUATION



ORMAT

CLINKER COOLER AIR AND THERMAL OIL TEMPERATURE FLUCTUATION



ORMAT

AVAILABILITY OF INDIVIDUAL

Ormat Energy Converters

Power Plant	Commissioning Year	Number of OEC's	Availability
Steamboat	1986	9	96.7 %
Ormesa II	1987	20	99.1 %
TOI	1989	2	98.5 %
Puna	1993	10	96.7 %
Heber	1993	12	98.1 %
Rotokawa I	1997	3	98.6 %
Ngawha	1998	2	98. 8 %
HZ -Lengfurt	1999	1	98.7 %
Mokai I	2000	6	98.2 %
Rogner	2000	1	99.1 %

The economy of the combustible is only one of the conditions to be fulfilled in heat engines. In many cases it is only secondary. It should often give precedence to safety, to strength, to the durability of the engine, to the small space which it must occupy, to small cost of installation, etc. To know how to appreciate in each case, at their true value, the consideration of convenience and economy which may present themselves; to know how to discern the more important of those which are only accessories, to balance them properly against each other, in order to attain the best results by the simplest means: such should be the leading characteristics of the man called to direct, to co-operate towards one useful end, of whatsoever sort it may be.

RÉFLEXIONS

SUR LA

PUISSANCE MOTRICE

DU FEU

**

SUR LES MACHINES

PROPRES A DÉVELOPPER CETTE PUISSSANCE

CARNOT .S ARP

ANCIEN ÉLÈVE DE L'ÉCOLE POLYTECHNIQUE

,A PARIS

,LIBRAIRIE ,CHEZ BACHELIER

55 .No ,QUAI DES AUGUSTINS

**

1824

"On ne doit pas se flatter de mettre à profit, dans la pratique, toute la puissance motrice des combustibles. Les tentatives que l'on ferait pour approcher de ce résultat seraient même plus nuisibles qu'utiles, si elles faisaient négliger d'autres considerations importantes. L'économie du combustible n'est qu'une des conditions à remplir par les machines à feu, dans beaucoup de circonstances, elle n'est que secondaire, elle doit souvent céder le pas à la sûreté, à la durée de la machine, au peu de place qu'il faut lui faire occuper, au peu de frais de son établissement, etc. Savoir apprécier, dans chaque cas, à leur juste valeur, les considerations de convenance et d'économie qui peuvent se presenter, savoir discerner les plus importantes de celles qui sont seulement accessoires, les balancer toutes convenablement entre elles, afin de parvenir par les moyens les plus faciles au meilleur résultat, tel doit être le principal talent de l'homme appelé à diriger, à coordonner entre eux les travaux de ses semblables, à les faire concourir vers un but utile de quelque genre qu'il soit."