GREEN INDUSTRIAL REVOLUTION BY YOUNG ENGINEERS FOR THE WORLD

TEN|ENERGY AND ITS PARTNERS AS KNOWLEDGE CENTER FOR THE RENEWABLE AND SUSTAINABLE ENERGY TECHNOLOGY & INNOVATION

29 October 2024

ORGANIZATION DIAGRAM INTERNATIONAL CONSORTIUM GGHE – GLOBAL GREEN HYDROGEN ENERGIES

Partner Pacific Region

TEN|ENERGY INTERNATIONAL
Remond Pahladsingh
President

Business Development
-Olaf Quartel
-Wouter Leefers
-Koos Ham

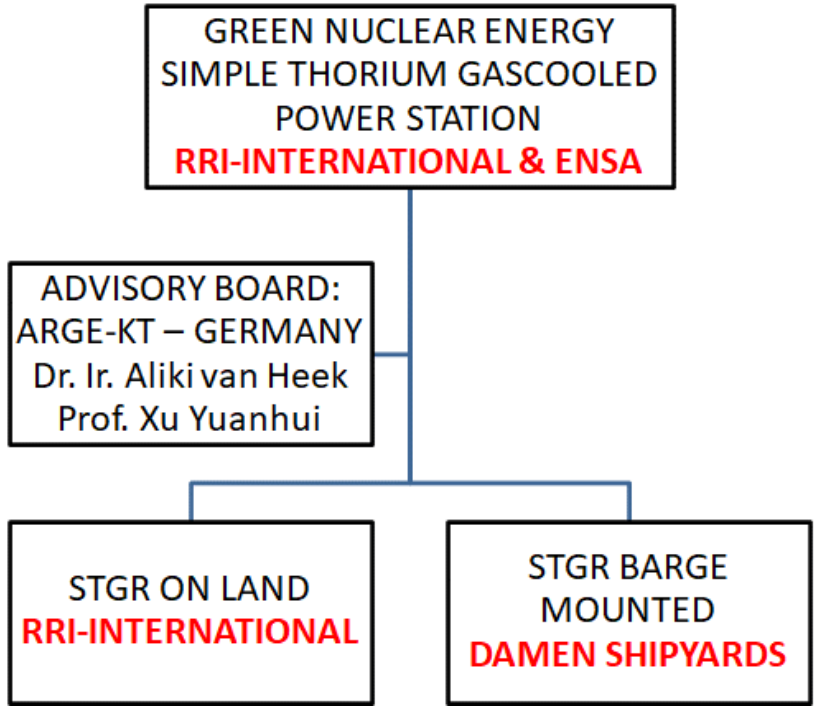
-Legal Affairs
-Information Technology
-Accountancy

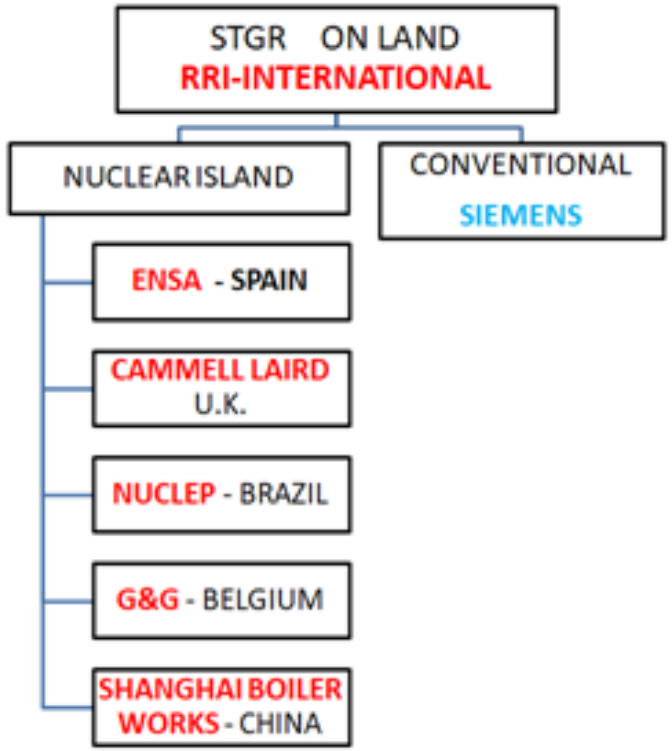
Advisory Board

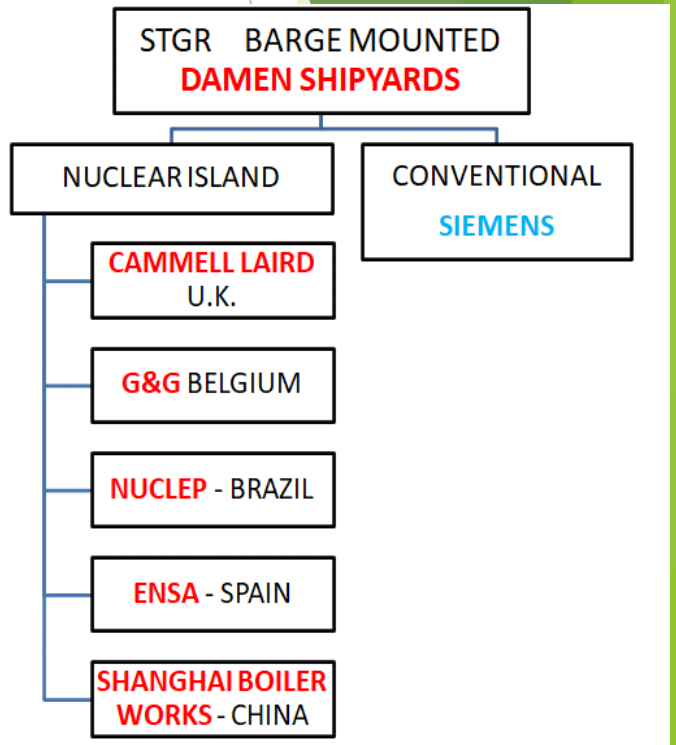
Dr. Aliki van Heek	IAEA
Professor Kurt Kugeler	ARGE-KT
Prof. Xu Yuanhui	INET
Prof. Heiko Barnert	ARGE-KT
Dr. H. Nabielek	ARGE-KT
Dipl. Ing. M. Will	ARGE-KT
Dr. Jim Kuiper	NUCLIC

CHIEF EXECUTIVE OFFICER

DESIGN – ENGINEERING - CONSTRUCTION CONSORTIUM VOOR GLOBAL GREEN ENERGY







TEN\ENERGY – TECHNOLOGY AND ENVIRONMENT PARTNERS

1: TEN\ENERGY STGR – POWER TECHNOLOGIES:

ARGE KT

RRi GmbH
www.rri-gmbh.com

ensa
www.www.ensa.es

DAMEN
www.damen.com

EXO TECH SCHELDE EXOTECH
high quality products in special mater
Schelde Exotech - PTD Companies

CAMMELL LAIRD
Cammell Laird | Home

NUCLEP
NUCLEBRÁS EQUIPAMENTOS PESADOS S.A.
Nuclep - Nuclebrás Equipamentos Pesados S.A

Geldof integrated steel solutions Engicon nv
G&G International integrated steel solutions
Organization – Geldof (Engicon nv)

Optional
बीएचईएल BHEL
Bharat Heavy Electricals Limited (BHEL) | Ministry of Heavy Industries

Optional
L&T India | Larsen & Toubro

2: TEN\ENERGY ENVIRONMENTAL PROTECTION PARTNERS:

groasis®
RESCUE TROPICAL RAINFOREST
www.groasis.nl (Steenbergen-Netherlands)

KKF #75055
ROBED NOORD
GROUP OF COMPANIES N.V.
Goede Verwachting #33 - Paramaribo, Suriname - Tel: (597) 8916298 - E-mail: Fransnoordzee@gmail.com
Prefab Wooden Houses BRUYNZEEL MODEL

PROPOSAL FOR LAUNCHING A GREEN INDUSTRIAL REVOLUTION BY TEN | ENERGY Starting in ROTTERDAM

Front end & back end Green Energy Solutions in the IEA Global Sankey Diagram:

1- Conversion Coal Fired plant to Green Hydrogen plant in Rotterdam

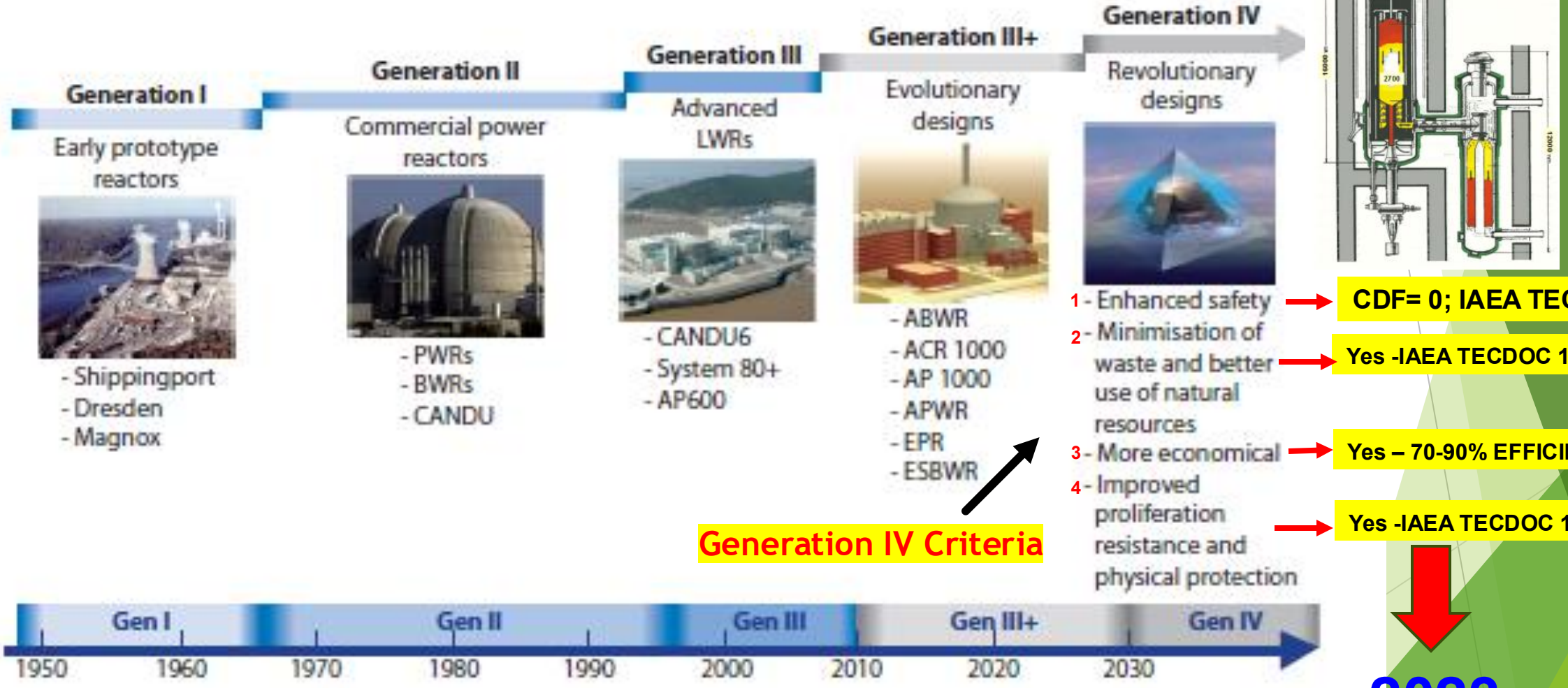
2- SAFE GLOBAL COAL INDUSTRY WITH GREEN GRAPHITE INDUSTRY

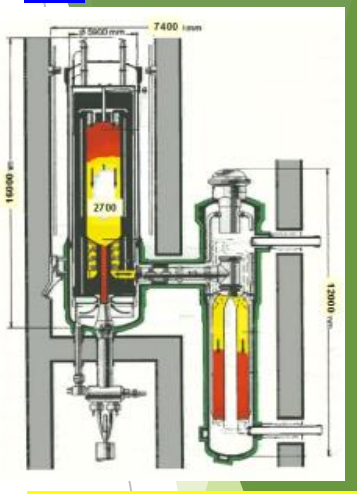
3- Conversion of Oil Refineries to Green Refineries

4- Use Price winner STGR for Green Hydrogen Economy

GENERATION I TO IV REACTORS and the STGR

STGR – GENERATION IV
MADE IN HOLLAND





CDF= 0; IAEA TECDOC 1366

Yes -IAEA TECDOC 1450

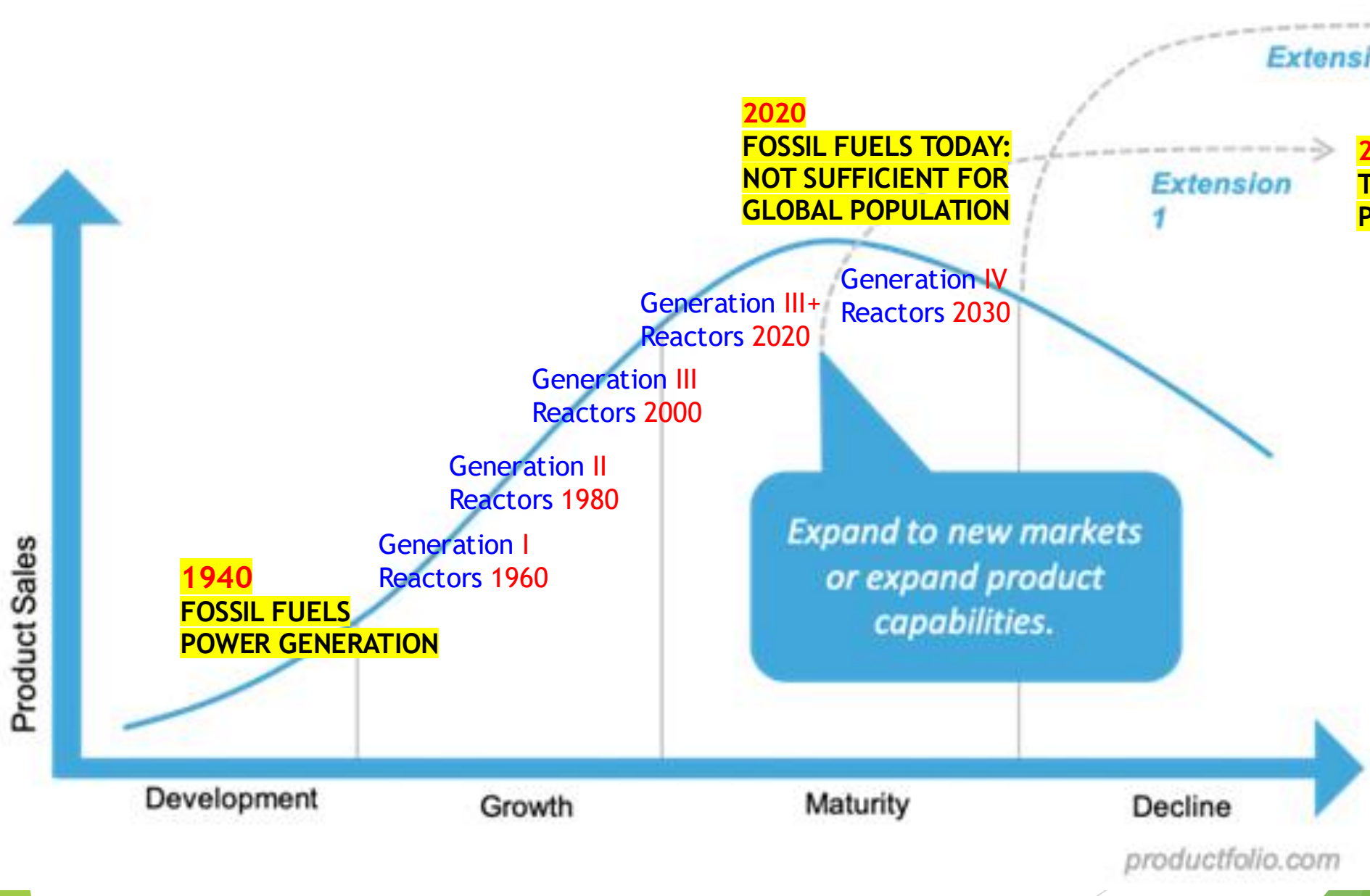
Yes – 70-90% EFFICIENCY

Yes -IAEA TECDOC 1450

2023

ENERGYCRISIS – PEAK COAL – PEAK OIL AND PEAK NATURAL GAS AND GREEN INDUSTRIAL REVOLUTION

Source: Product Lifecycle Management - Productfolio



CONDITIONS NEEDED FOR A GREEN INDUSTRIAL REVOLUTION ON GLOBAL SCALE

- 1: **INSPIRING POLITICAL LEADER**(S) WHO CAN MOTIVATE A/THE NATION(S)
- 2: **A YOUNG NATION** (AGEING EUROPE, USA AND JAPAN NOT THE IDEAL NATIONS)
- 3: **RESOURCES** –
  - MANPOWER - IDEAL IN INDIA
  - INDUSTRIES – AVAILABLE IN THE NETHERLANDS
  - ENERGY SOURCE (**THORIUM**, SOLAR AND WIND) – **THORIUM FOR CENTURIES IN INDIA**
  - ROBUST NUCLEAR INDUSTRY FOR GREEN REVOLUTION
- 4: **ECONOMIC TECHNOLOGIES** (**SUBSIDIES ONLY FOR PROTOTYPE!!!**)
  - STGR- HIGH TEMPERATURE GASCOOLED REACTORS
  - HYDROGEN PRODUCTION TECHNOLOGIES
  - IRON POWER TU-EINDHOVEN AND METALOT

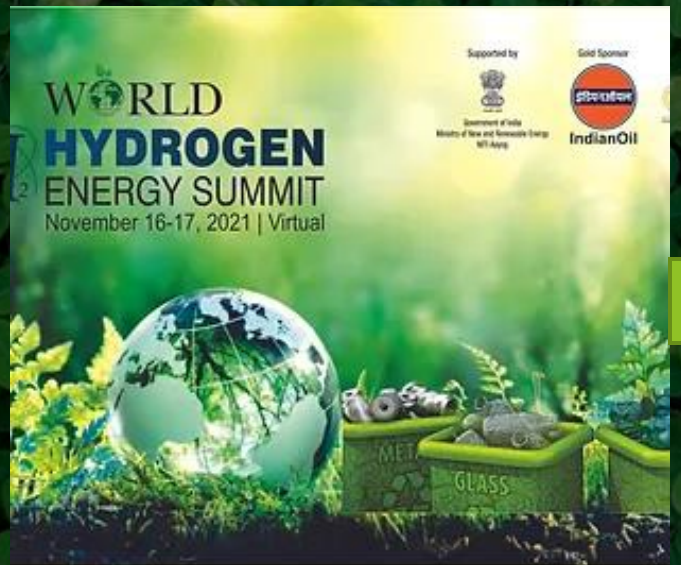
TEN | ENERGY

SUSTAINABLE ENERGY & WATER TECHNOLOGY

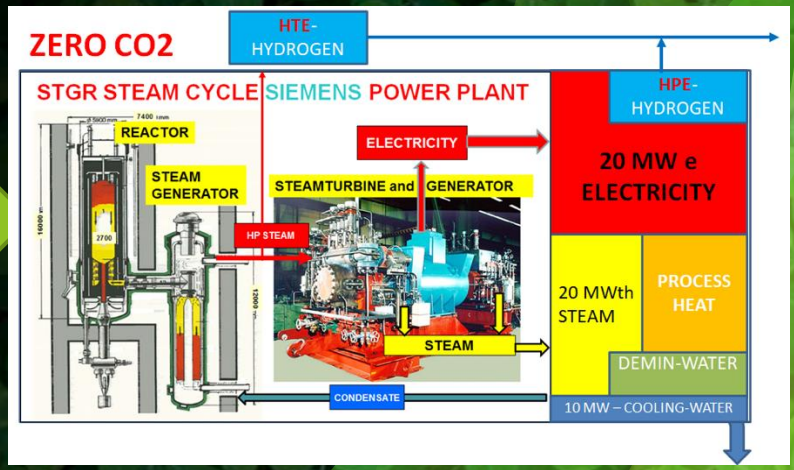
THE GREEN INDUSTRIAL REVOLUTION FOR THE WORLD COULD START WITH: ONYX POWERSTATION ROTTERDAM AS CENTRE FOR GLOBAL MARSHALL PLAN ENERGY

THE PROPOSAL IS TO START THE GLOBAL GREEN REVOLUTION WITH THE ONYX POWER STATION AND SAVE THE UNITED NATIONS (UN) AND THE EUROPEAN UNION ENVIRONMENTAL PLANS AND MAKE THE COP-26, COP-27 AND COP-28 A SUCCESS.

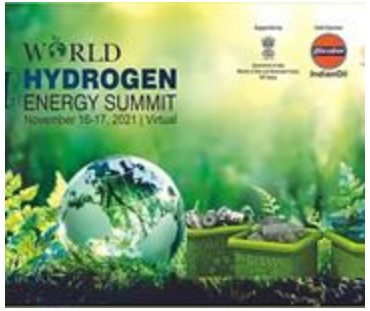
IN THE NEW INTRINSIC SAFE NUCLEAR INDUSTRY. THE TRANSITION PROCESS MUST ENABLE THE CURRENT NUCLEAIR INDUSTRY GROW TO “SAFE” AND “WITHOUT ECONOMIC LOSSES” TO THE NEW NUCLEAIR WORLD WITH URANIUM AND THORIUM.



Award: GREEN HYDROGEN



LARGE SCALE GREEN ENERGY SYSTEMS



WHES WINNER: MODULAR SMALL HTGR ENERGY SYSTEMS

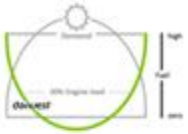
WIND ENERGY

A Danvest® equipped genset + Wind turbines = Hybrid power plant for continuous off-grid power supply. Danvest's unique low-load and fast response capability enables high wind penetration. Direct fuel savings are **50 to 70% per year.**

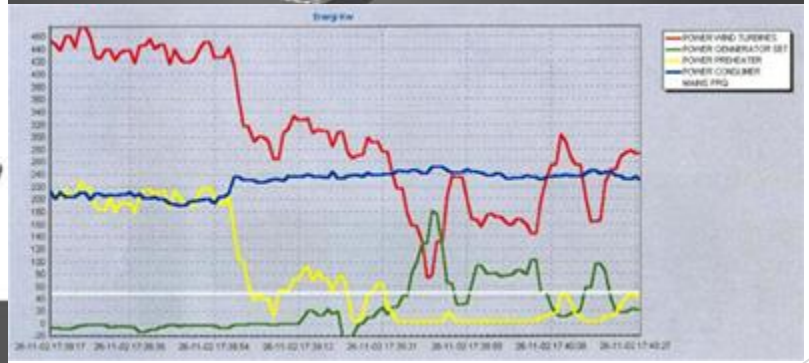
www.danvest.com

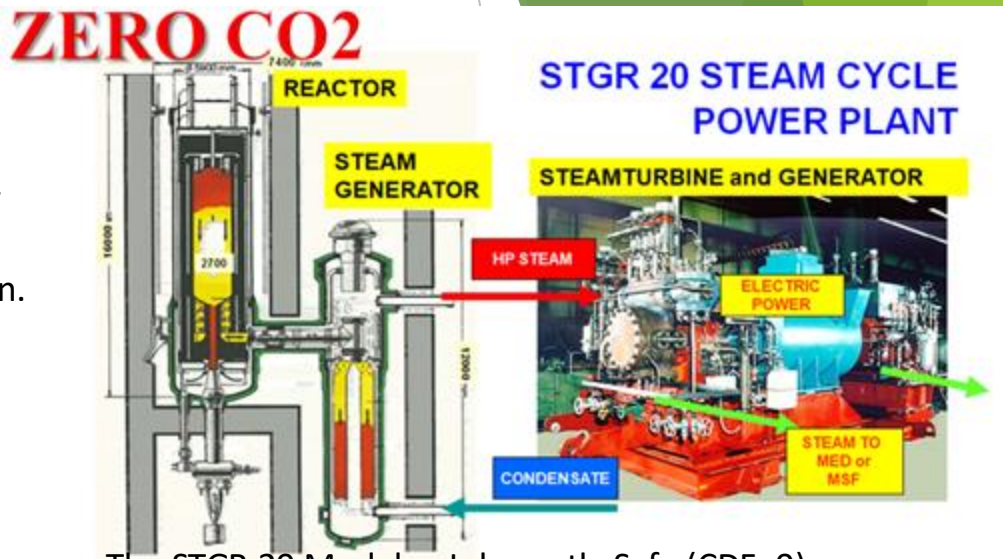
SOLAR ENERGY

A Danvest® equipped genset + Solar PV system = Hybrid power plant for continuous off-grid power supply. Danvest's unique low-load and fast response capability enables high solar penetration. Direct fuel savings are **30 to 40% per year.**



www.danvest.com





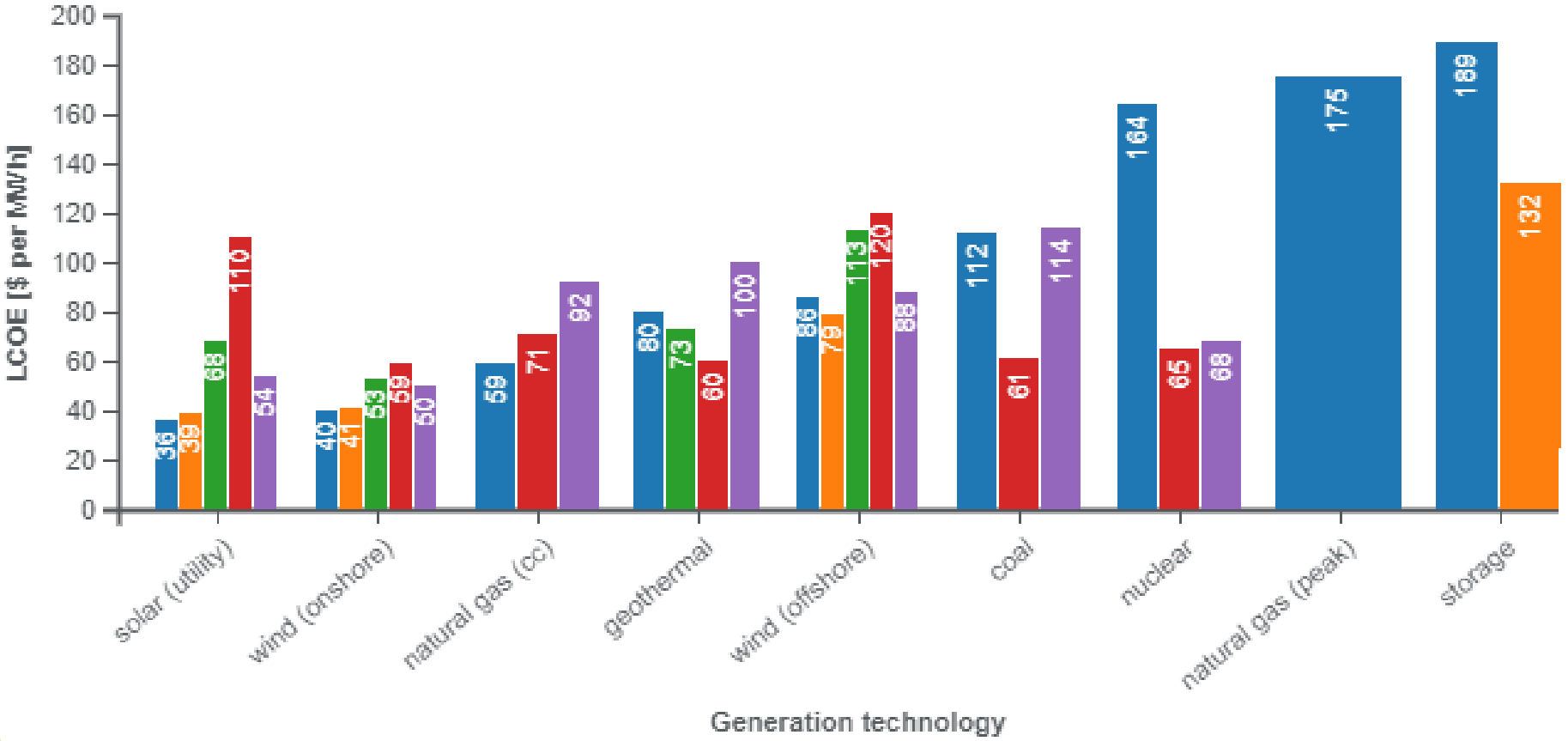
The STGR 20 Modular, Inherently Safe (CDF=0) Pebble Bed Fuel Reactor using Thorium/Uranium as fuel is the Excellent SOLUTION for Power Generation. Also sent to COP-26 Conference.

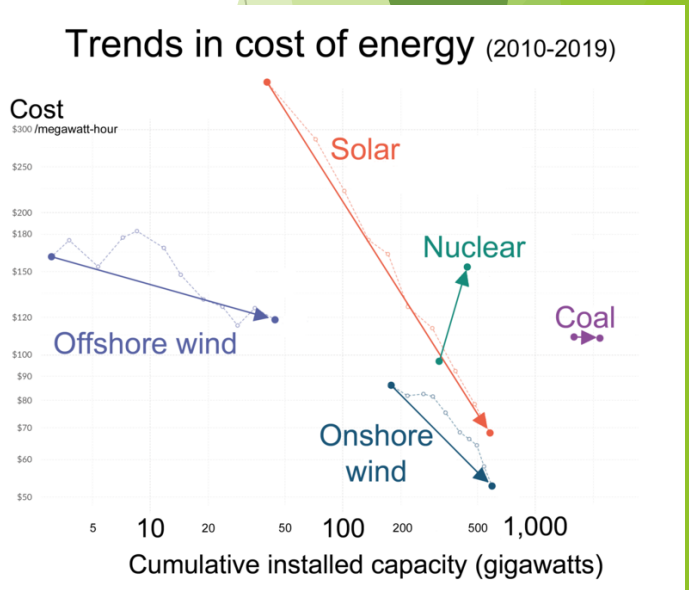
Rotterdam will be leading the World with this Greenest form of Power Generation and Green Hydrogen Technology. Also HTE – High Temperature Electrolysis possible with STGR 20. No large area's for power plant and ideal to support for Solar- and Wind-farms for high reliability and availability. ZERO CO2 solution..

www.tenenergy.com

THE BEST REASON TO GO TO STGR IS: ECONOMICS. ENVIRONMENT IMPROVEMENTS ARE: A BONUS.

Cost of electricity by source - Wikipedia





THE BEST REASON TOGO TO GREEN STGR/ONYX IS: ECONOMICS. ENVIRONMENT IMPROVEMENTS ARE: A BONUS.

Cost of electricity by source - Wikipedia

Generation Cost for all energy sources

2020: Global levelized cost of generation (US$ per MWh). Source: https://en.wikipedia.org/wiki/Cost_of_electricity_by_source

Source	Solar utility scale	Solar rooftop	Wind on-shore	Wind off-shore	Geothermal	Nuclear new	Nuclear extension	Hydro	Geothermal	Coal	Gas CC	Gas peaker STGR	Storage (1:4) ONYX
NEA 2020[77]	56	126	50	88	100	68	32	72	99	88	71		
IPCC 2014[78]	110	150	59	120	60	65	-	22	60	61	71		
BNEF 2021[79]	39	-	41	79	-	-	-	-	-	-	-		
Lazard 2020[80]	36	125	40	86	80	164	29	-	80	112	59		
IRENA 2020[81]	68	164	53	113	73	-	-	47	73	-	-		
TENENERGY												6.8	3.2
REDUCTION GENERATION COST STGR AND ONYX 40 YEARS:						Million $	(NEA COAL 88 - TEN | STGR 6.8)*20*24*365*40YRS					569	
						Million $	(NEA COAL 88 - TEN | ONYX 3.2)*700*24*365*40YRS						20799

NEA 2020[77] (at 7% discount rate)

IPCC 2014[78] (at 5% discount rate)

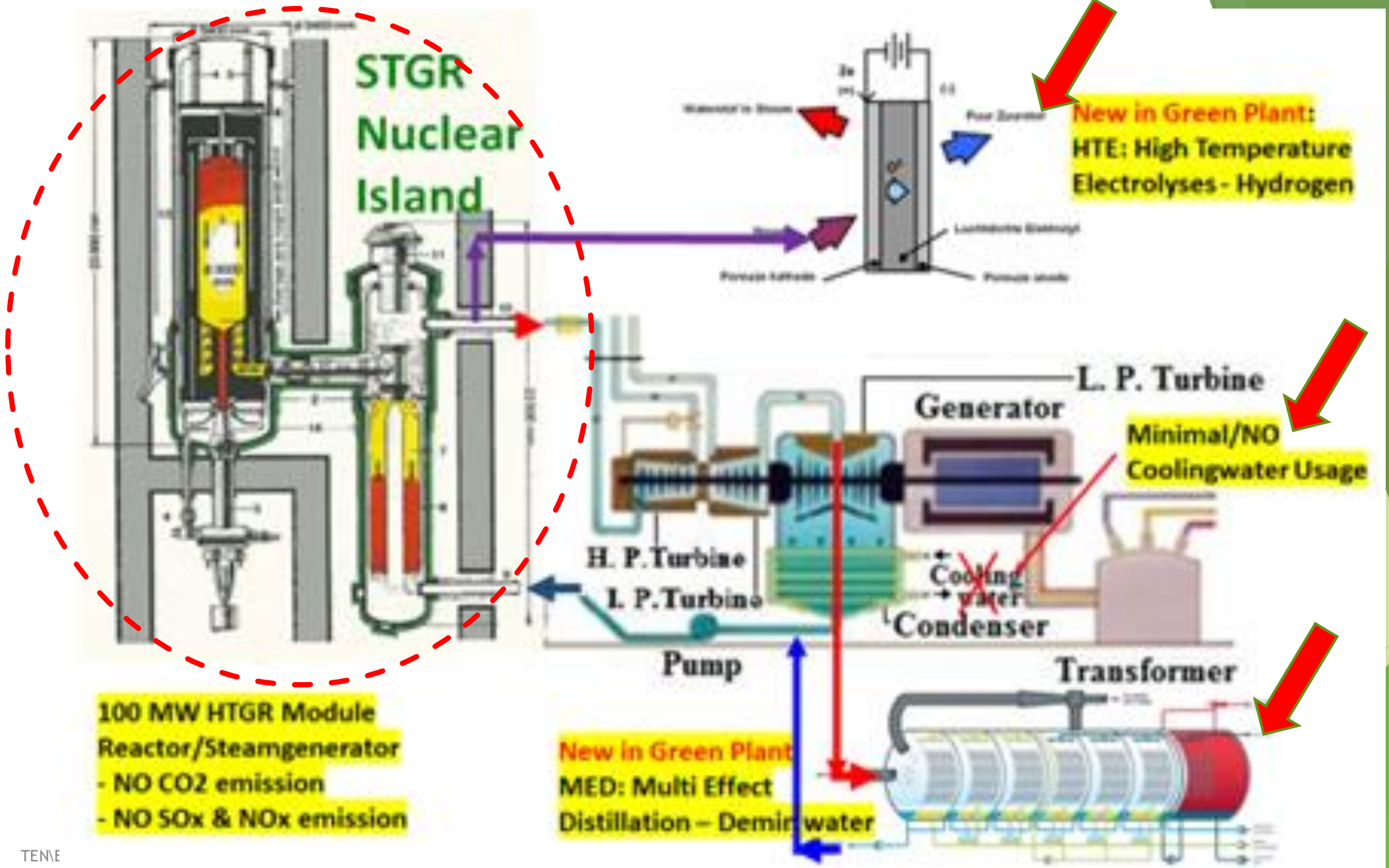
Gaspeaker replaced by STGR powerplant

Storage (1:4) replaced by ONYX powerplant

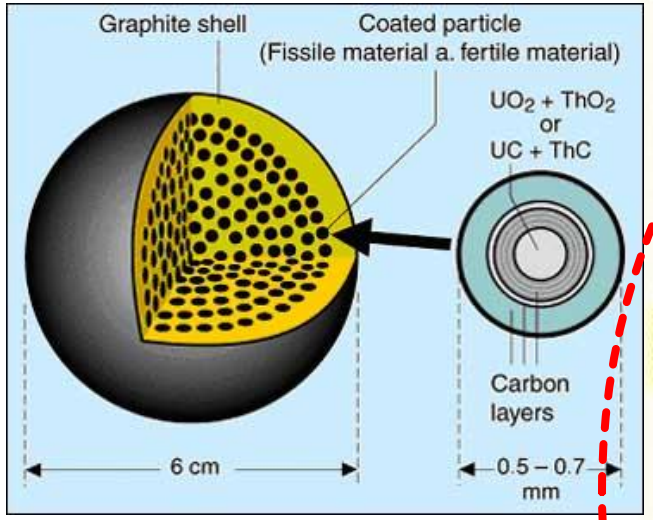
GREEN REVOLUTION ROTTERDAM BEGINS WITH: CONVERSION ONYX COALFIRED PLANT TO GREEN HYDROGEN POWERPLANT

PAYBACK PERIOD: 5 YEAR

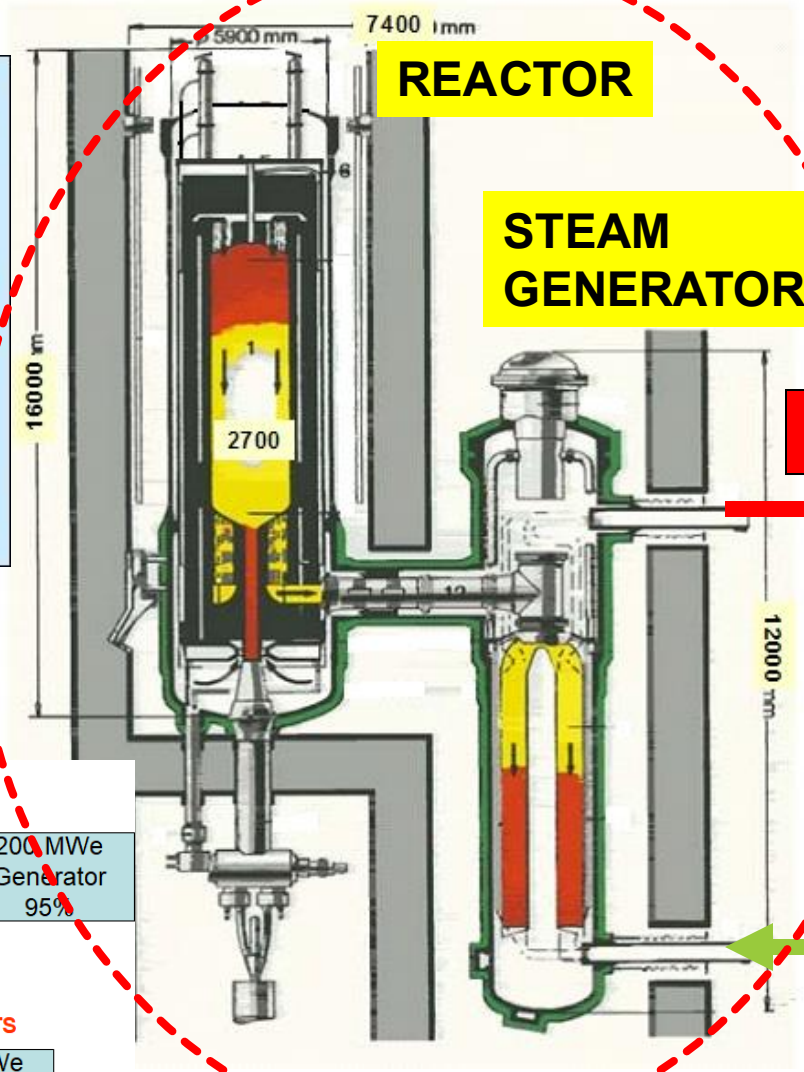
ZERO-CO2 EMISSION
ZERO-AIRPOLLUTION


STGR
Nuclear
Island
New in Green Plant:
HTE: High Temperature
Electrolyses - Hydrogen
L. P. Turbine
Generator
Minimal/NO
Coolingwater Usage
H. P.Turbine
I. P.Turbine
Cooling water
Condenser
Pump
Transformer
100 MW HTGR Module
Reactor/Steamgenerator
- NO CO2 emission
- NO SOx & NOx emission
New in Green Plant
MED: Multi Effect
Distillation – Demin water

ZERO-CO2 STGR GREEN POWER STATION



Pebble fuel



REACTOR

STEAM GENERATOR

STGR 20 WITH SIEMENS STEAM CYCLE POWER PLANT

STEAMTURBINE and GENERATOR

HP STEAM

ELECTRIC POWER

CONDENSATE from Low Temperature Applications

STEAM for Low Temperarture Applications

250 MW th
LARGE-HTR: 95%

250 MWth
LARGE-HTR: 95%

LARGE UNIT

500 MWth
Steam Turbine
90%

200 MWe
Generator
95%

SKID MOUNTED UNITS

50 MWth
STGR = 95%

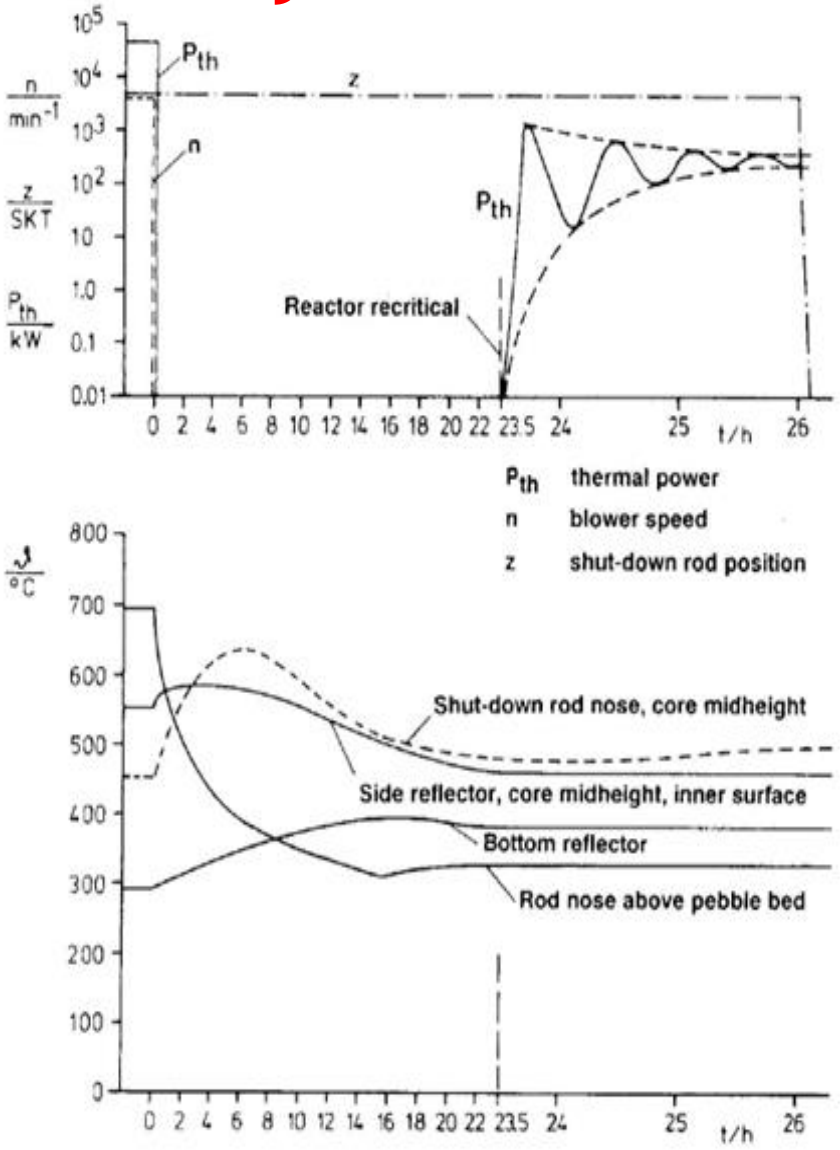
25 MWth
90%

10 MWe
95%

25 MWth
90%

10 MWe
95%

Inherently Safe tests on GENERATION IV AVR and HTR-10



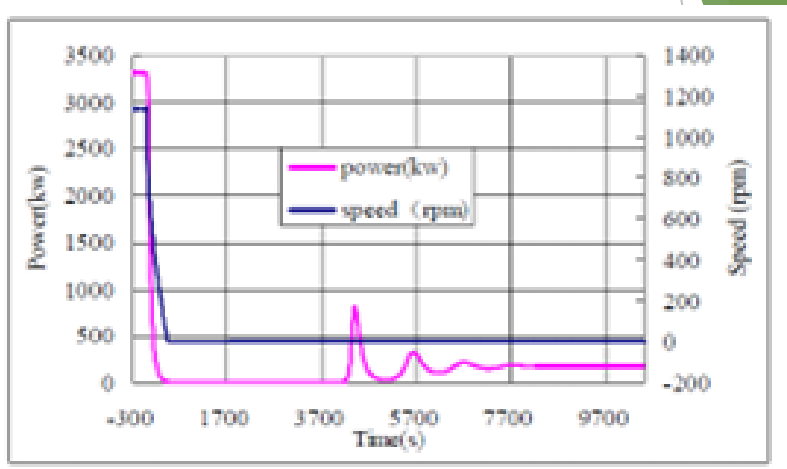


Fig.6 transient of power after helium circulator trip (test)

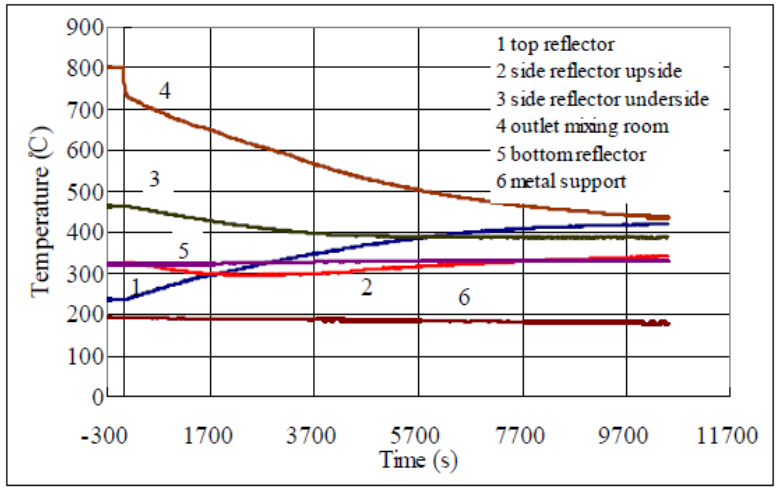
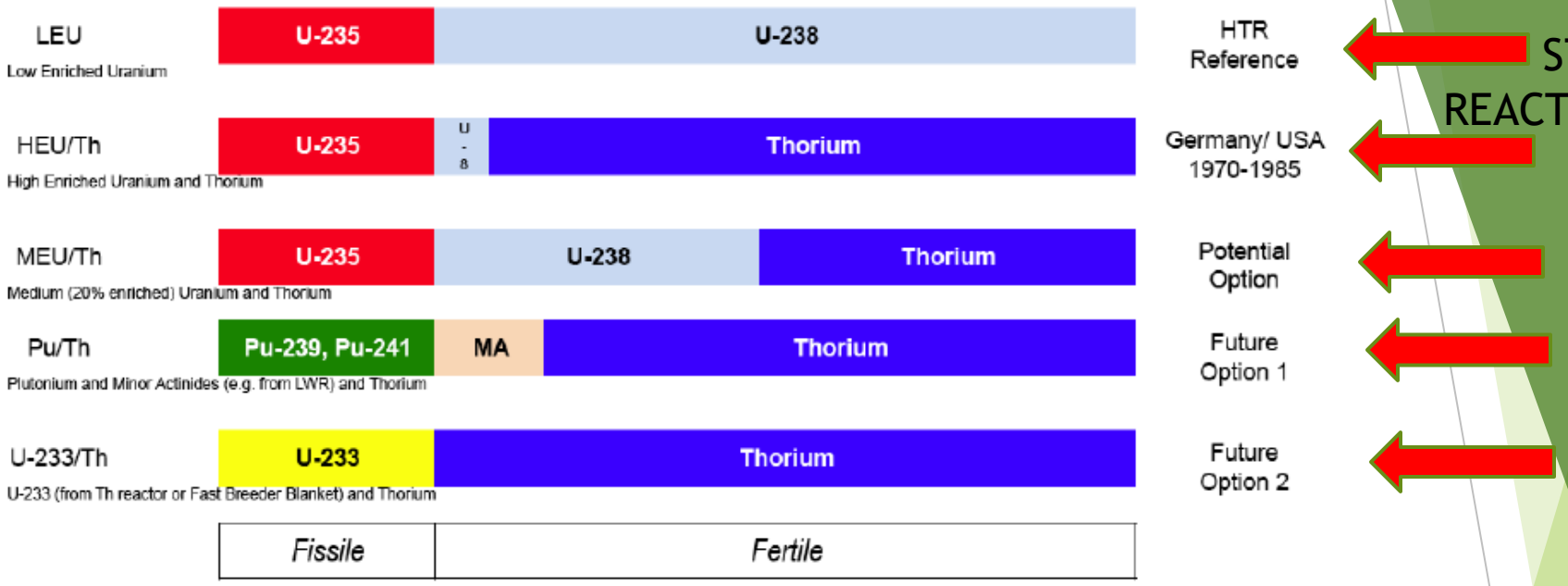


Fig.8 transient of core temperature after helium circulator trip (test)

Test on AVR -Juelich Germany 1970

Test on HTR - Beijing -China 2004

CURRENT URANIUM REACTORS



STGR REACTORS

ARGE KT

Nabielek Manufacture

NUCLEAIR FUEL TYPES FOR NUCLEAR REACTORS

THE GREAT ADVANTAGE OF THE ONYX HTGR POWERSTATION IS THAT IT CAN USE MOST OF THE FUELS AVAILABLE.

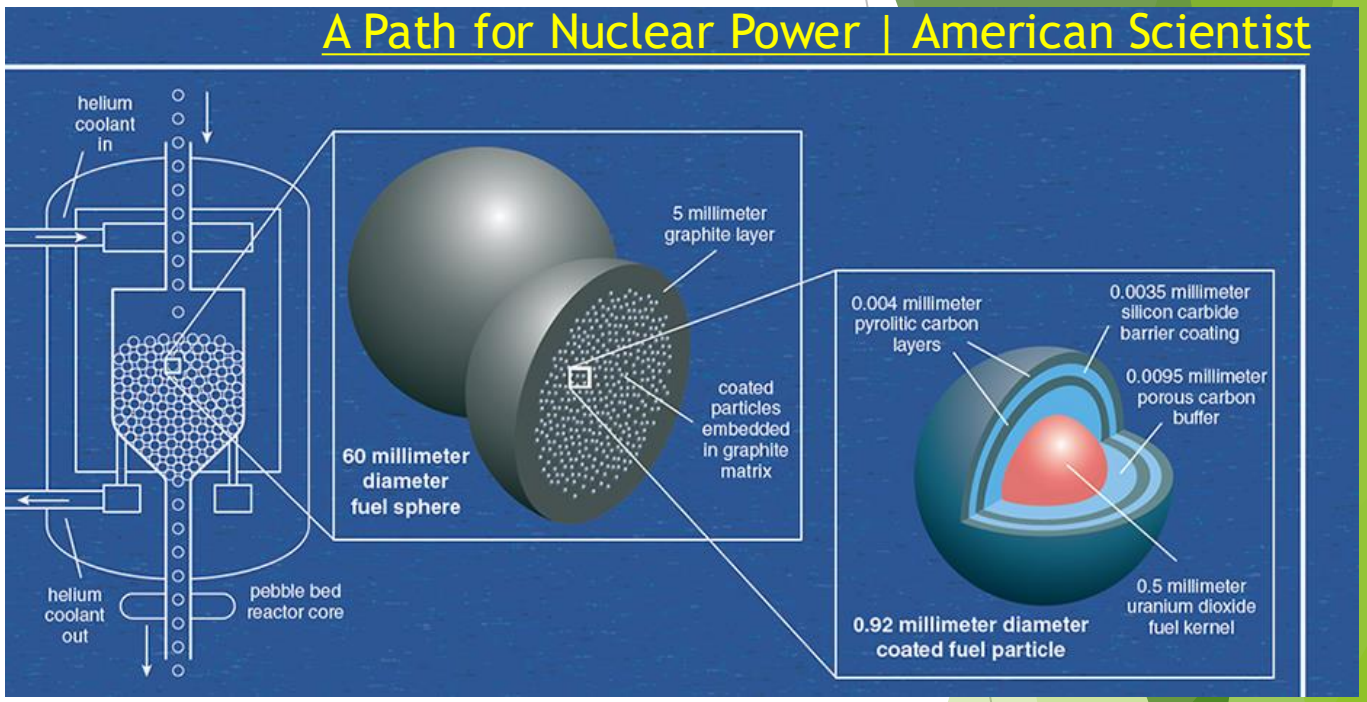
IT CAN USE THORIUM FOR MINIMAL RADIOACTIVE WASTE.

IT CAN ALSO BURN THE PLUTONIUM (WPu) FROM THE COLD WAR TOWARDS SAFE MATERIAL.

NUCLEAIRE ENERGY SOURCES: COMPARISON FUEL ELEMENTS

In the current nuclear reactors the fast neutrons must pass the Zircalloy tubewall first to be slowed down by the water to thermal neutrons.

In cases where water is not available the Zircalloy can start releasing hydrogen that can lead hydrogen explosions and coremelt as in Fukushima.



Pyrolytic graphite is the main structural material in these pebbles. It sublimates at 4000 °C, more than twice the design temperature of most reactors. It slows neutrons very effectively, is strong, inexpensive, and has a long history of use in reactors and other very high temperature applications. For example, pyrolytic graphite is also used, unreinforced, to construct missile reentry nose-cones and large solid rocket nozzles.[9] Its strength and hardness come from anisotropic crystals of carbon

SAVE COAL INDUSTRY: From "BURNING" COAL towards "CLEAN" COAL:

FROM: 250 $/ton Air-polluting Coal

TO: 250.000 $/ton "ZERO CO2 emission" STGR Pebbles

250 $/ton

250.000 $/ton

Electricity → HYDROGEN (HPE)

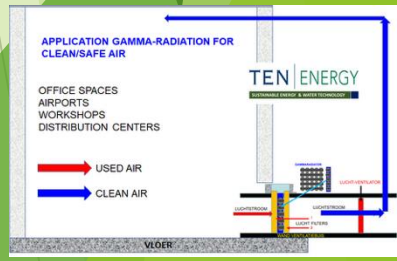
Hydrogen (HTE)

Shippropulsion

STEAM

HEAT → Stirling-Motoren, Demi-water, District Heating

GAMMA RAYS → Safe/Clean Air, Safe Food & Water, Combat diseases, Sterilization instruments



SAVE 2.500 GW GLOBAL COAL INDUSTRY: From "BURNING" COAL towards "CLEAN" COAL:

FROM: 250 $/ton Air-polluting Coal

TO: 250.000 $/ton "ZERO CO2 emission" STGR Pebbles

TEN | ENERGY
SUSTAINABLE ENERGY & WATER TECHNOLOGY

250 $/ton

250.000 $/ton

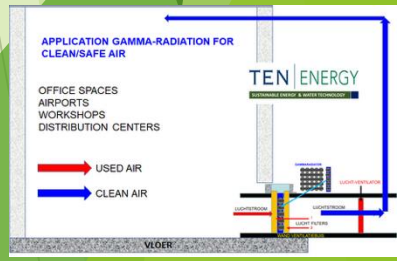
1,5 Million $/MW

Electricity → HYDROGEN (HPE)
Hydrogen (HTE)
Shippropulsion

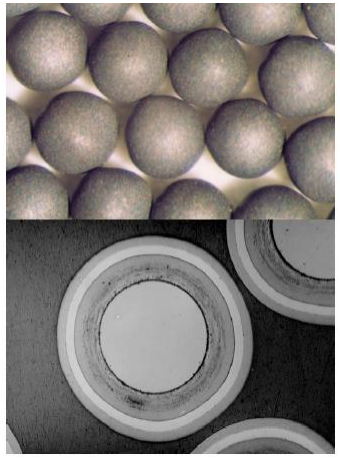
STEAM

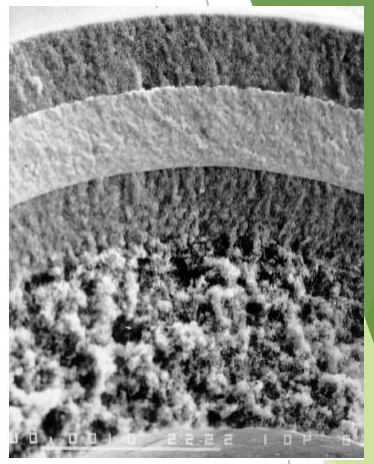
HEAT → Stirling-Motoren
Demi-water
District Heating

GAMMA RAYS → Safe/Clean Air
Safe Food & Water
Combat diseases
Sterilization instruments

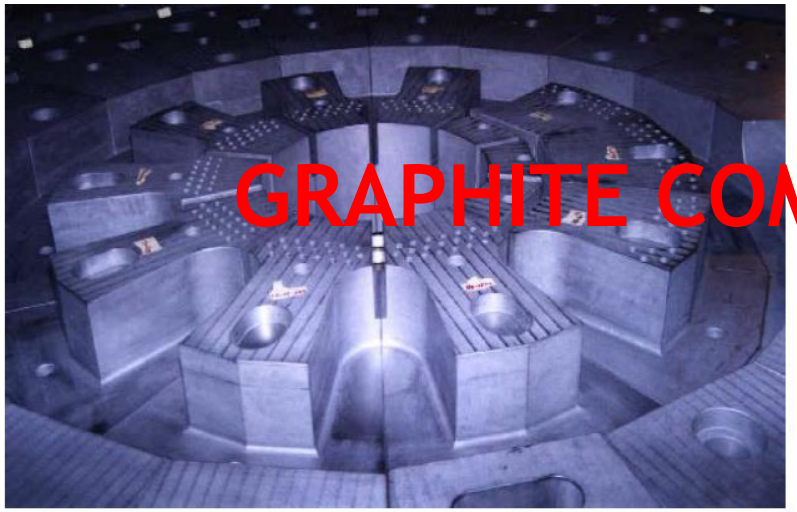


SAVE COAL INDUSTRY: The New Green Mega Graphite (Coal) Industry for ROTTERDAM (from 250 $/Ton to 250.000 $/Ton)

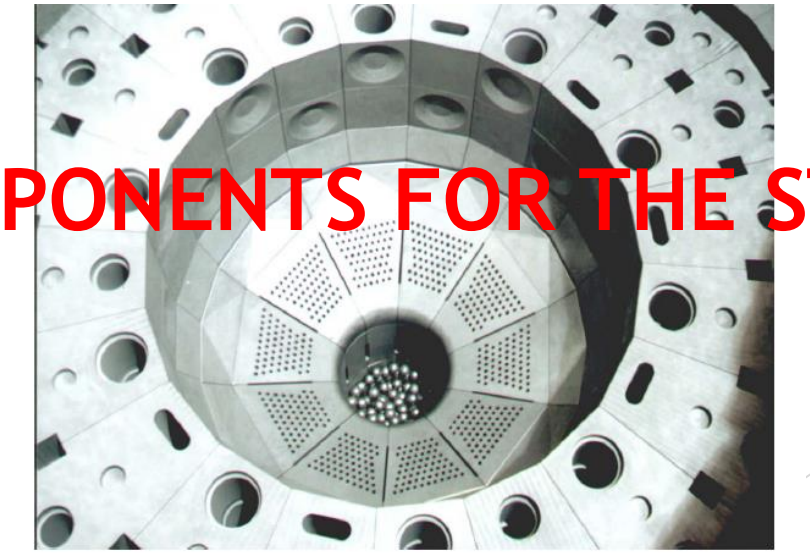




GRAPHITE COMPONENTS FOR THE STGR REACTOR



Lower half structure of the hot gas chamber



Core cross section

Top reflectors

GLOBAL GREEN INDUSTRIAL REVOLUTION

WITH LOW COST HYDROGEN A COMPLETE GREEN REVOLUTION CAN START ON GLOBAL SCALE OUT OF ROTTERDAM

HTGR (STGR) HISTORY:

Past:

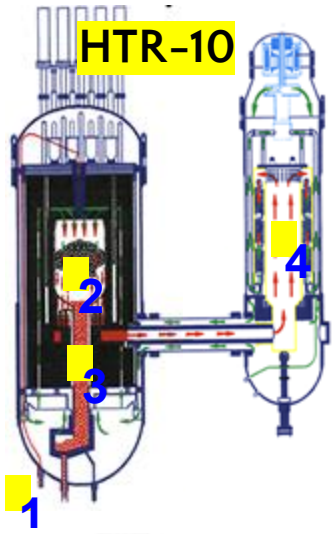
1- AVR - Jeulich Germany 1966-1988
2- THTR - Hamm Euntrop 1986-1988 (Germany stopped R&D after Chernobyl)
3: PBMR - South Africa - Project stopped on high development cost (gasturbine)
4: HTR-10 - Start-up 2000 Beijng China Test and demonstration reactor
5: STGR 20 - design started in 1990 - Also visit to BARC. Scaled down German Reactor.
6: HTR-PM200 - Start-up in China January 2022 - Copy of German HTR Moduul Reaktor

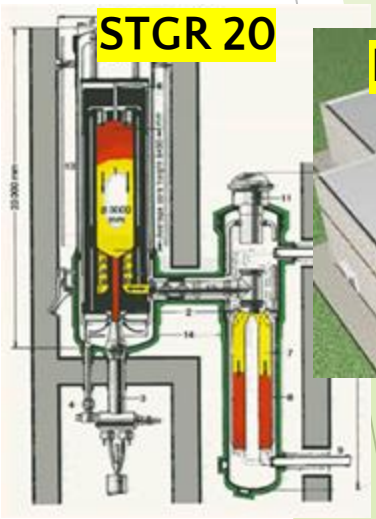
Present:

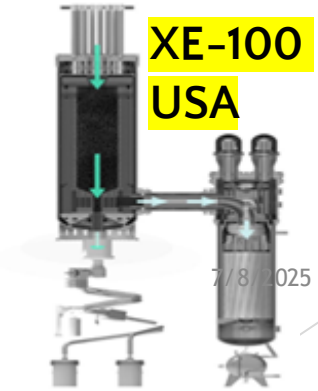
7: XE-100 - Xenergy USA started the design some year ago. NRC approval. Copy Germany.
8: XE-100 - Cavendish UK joins X energy to develop the XE-100. Copy Germany
9: HTR-PM600 - Same German concept (3 x HTR-PM200)

10: Proposal STGR 20 MADE IN IHOLLAND !!!!

TEN|Energy: HTGR(STGR) TECHNOLOGY SOFAR THE BEST INITIATIVE OF ALL NEW WORLDWIDE INITIATIVES ON SMR – SMALL MODULAR REACTORS.







THE GREEN REVOLUTION CAN START WITH THE CONVERSION OF THE ONYX COALFIRED PLANT AS MODEL FOR THE ENERGY-TRANSITION FOR ENERGY INTENSIVE INDUSTRIES IN THE WORLD:

GOING GREEN GLOBAL MARSHALL PLAN

NOT WAIT FOR COP-26, IPCC etc…

1: CONVERSION COALFIRED PLANTS TO GREEN "ZERO-CO2 Emission" power stations (GRAPHITE and GRAPHENE MEGA-INDUSTRIES at ESD-SIC bv FARSUM GRONINGEN)

2: SYNERGY WIND-PARKS (Technical University -Delft - Prof. A. Verkooijen en Dr. B. Boer)

3: SYNERGY SOLAR-PARKS

4: GREEN CEMENT INDUSTRY (ENCI-MAASTRICHT)

5: GREEN STEEL INDUSTRY (TATA STEEL - HOOGOVENS IJMUIDEN)

6: GREEN AMMONIA INDUSTRY (YARA – TERNEUZEN)

7: GREEN ALUMINIUM INDUSTIE (ALDEL - DELFZIJL GRONINGEN)

TEN|ENERGY AND THE DUTCH ZERO-CO2 INDUSTRY

COAL : 250 $ PER TON

HIGH TEMPERATURE ELECTROLYSIS HYDROGEN

TEN|Energy Products

ENVIRONMENTAL IMPACT:

Nill - Low - High

CO2	NOx	SOx
Nill	Nill	Nill
Nill	Nill	Nill
Nill	Nill	Nill
Nill	Nill	Nill

STEEL INDUSTRY Hoogovens

PRESSURE VESSELS
SHIPS/PONTOONS
RAIL/TRAINS
CAR INDUSTRY

STGR - LAND
STGR on PONTOONS
WATERPLANTS
HYDROGEN TECH.

ELECTRICITY

ALUMINA INDUSTRY Aldel

ALUMINIUM INDUSTRY Aldel

AIRPLANES
MAG-LEV
TRAINS
STEEL CONSTR.
MACHINES

USED PEBBLES

STGR GRAPHITE FUEL PEBBLES : 250.000 $ PER TON
ESD-SIC BV Delfzijl

AMMONIA INDUSTRY YARA

CEMENT INDUSTRY ENCI

GAMMA RADIATION INDUSTRIE NRG-PETTEN

Gamma Radiators:
Food-Industry
Healthcare
TRANSPORT

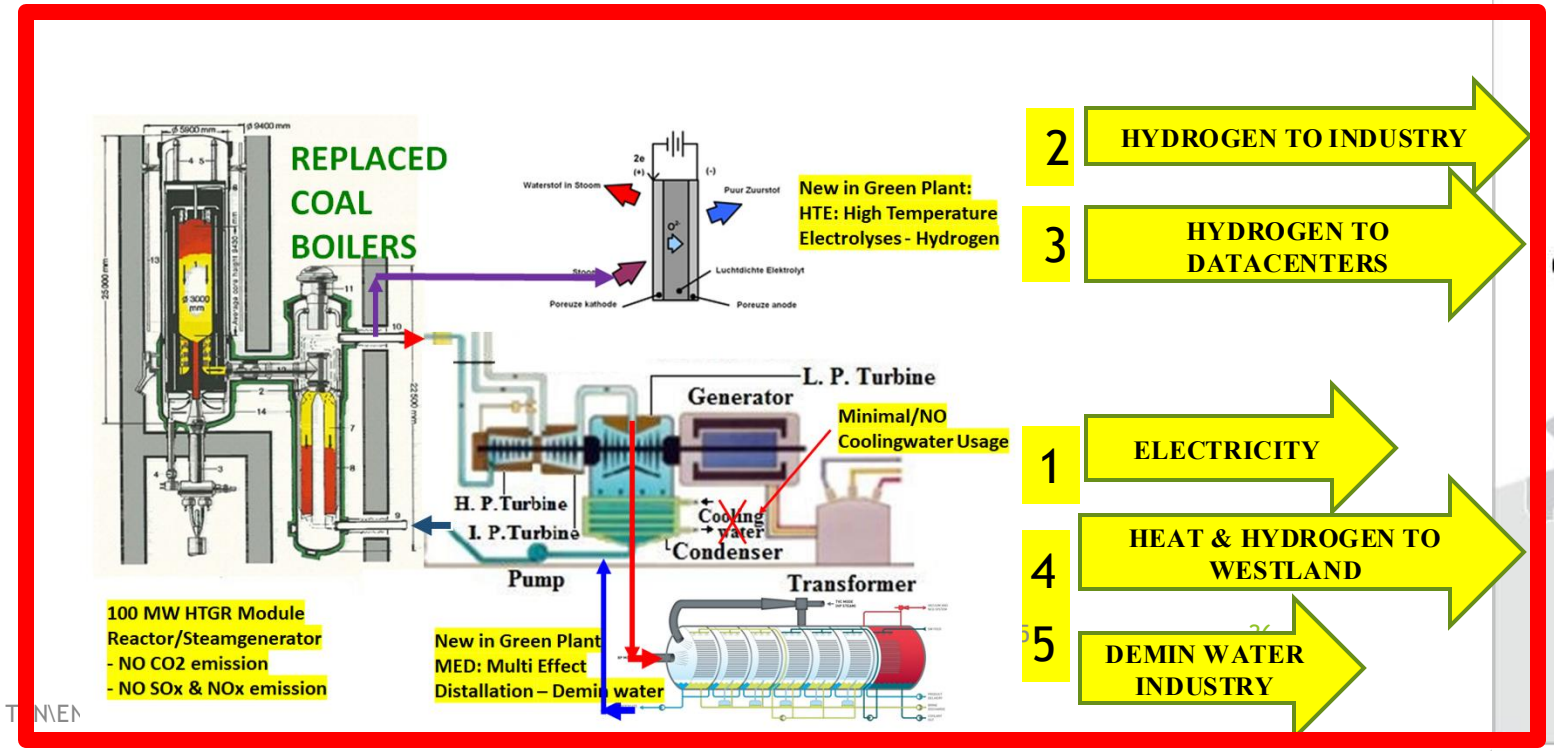
Nill	Nill	Nill
????	????	????
????	????	????

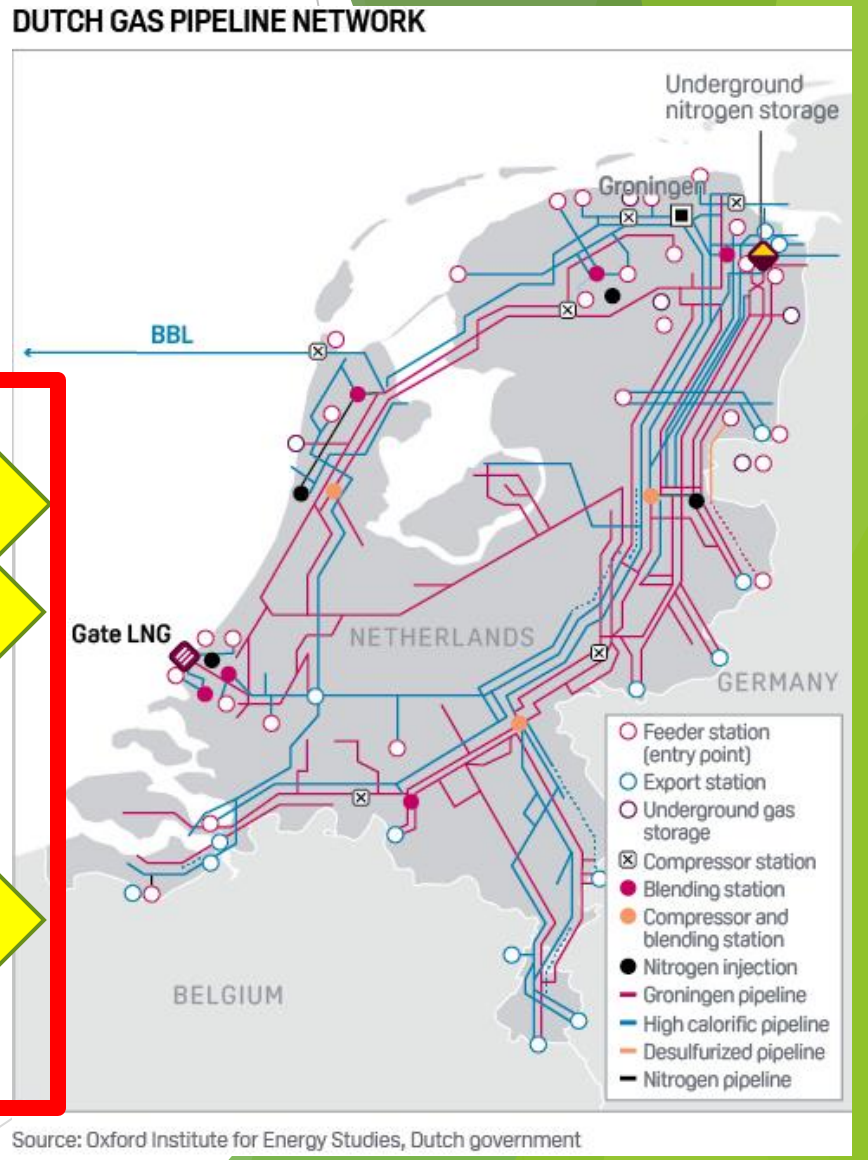
HEALTH & ENVIRONMENT Ministery VWS

MEDICINES
Healthcareproducts
STERILIZZATION INST.

TEN | ENERGY
SUSTAINABLE ENERGY & WATER TECHNOLOGY

GREEN ELECTRICITY & GREEN HYDROGEN & POWER QUALITY IN ROTTERDAM FOR GREEN INDUSTRIAL REVOLUTION



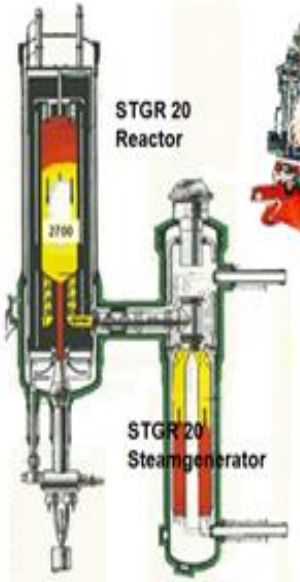


Source: Oxford Institute for Energy Studies, Dutch government

STGR 20 SYNERGY WITH WINDPARKS AND HYDROGEN. ZERO - CO2 ENERGY SYSTEM.

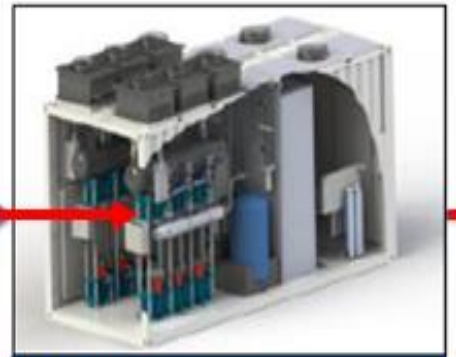
Study: Technical University-Delft - Largescale Energysupply

CUSTOMERS



20.000 kW
Electricity

5.000.000 liter
Dinking water/day

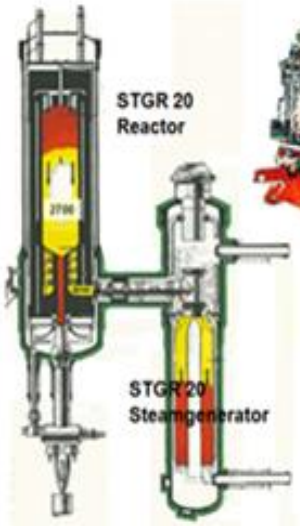


MAKE HYDROGEN AT THE PUMPSTATION

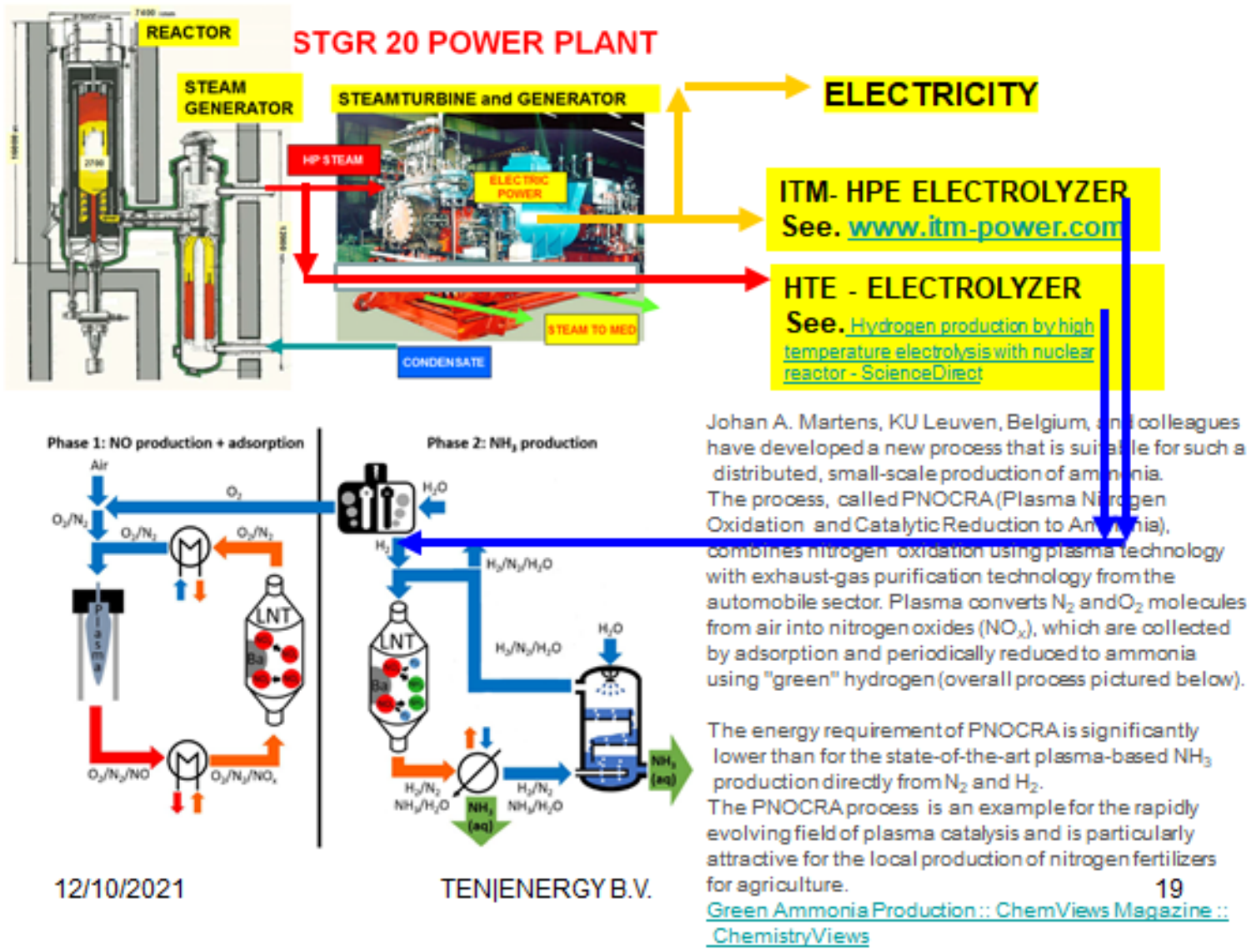
STGR 20 SYNERGY WITH SOLAR ENERGY AND HYDROGEN. ZERO - CO2 ENERGY SYSTEM

CUSTOMERS

MAKE HYDROGEN AT PUMP STATION

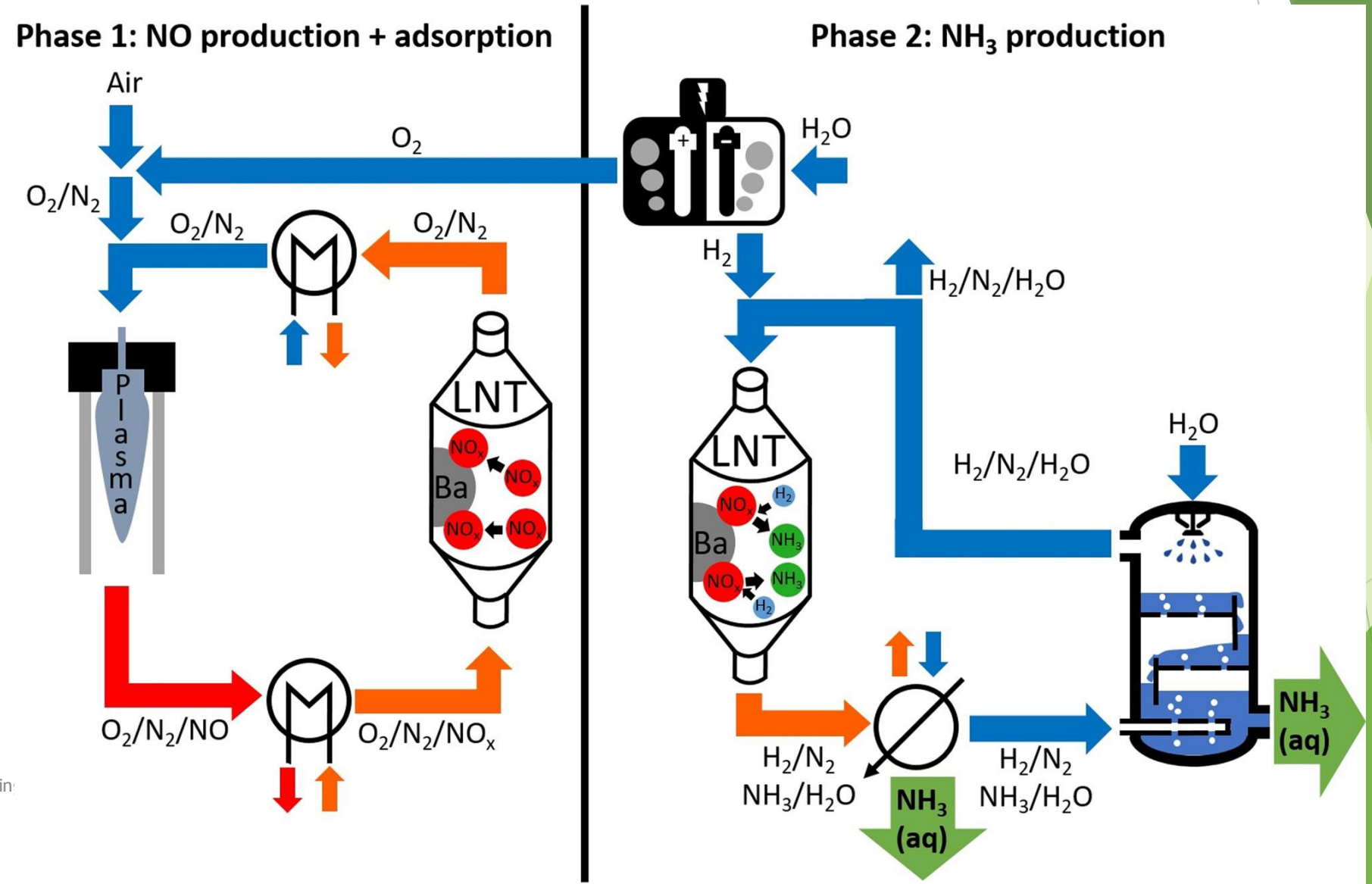


GREEN AMMONIA INDUSTRY



BESTE OPLOSSING VOOR YARA

Figure 1. PNOCRA process, with its two phases: Phase 1: Plasma-assisted N2-oxidation, followed by NOx adsorption on a lean NOx trap (LNT); Phase 2: Catalytic operation of the LNT to reduce the adsorbed NOx with H2 to NH3 and followed by NH3 extraction with water. Temperatures: Red=1100 Degrees C, orange=175 Degrees C and blue=40 Degrees C



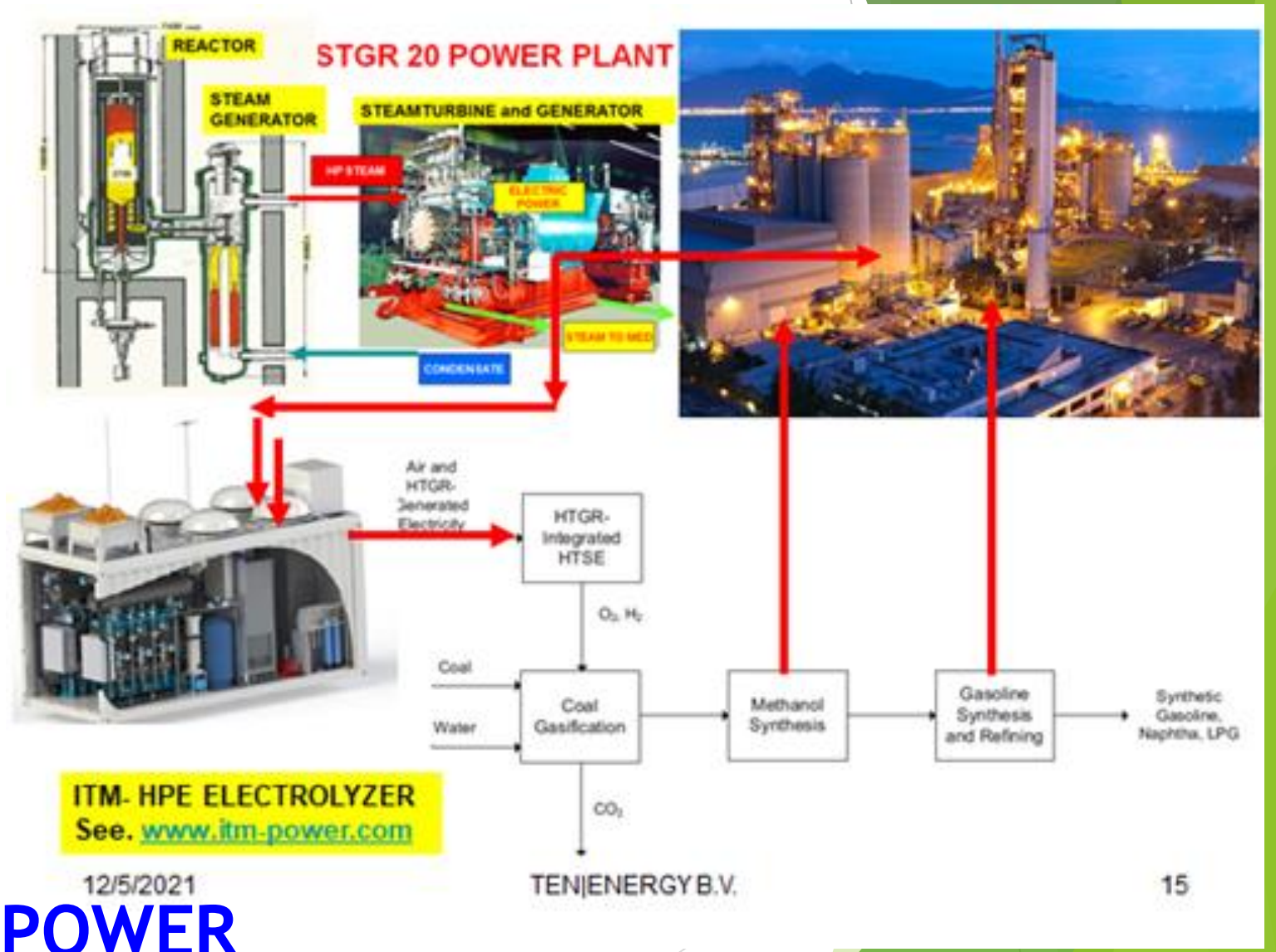
GREEN ALUMINIUM FOR $ 1.000/TON

AMTEC - Max: 480 VDC
Max Electric Efficiency
about : 60%

R&D needed for ASTGR
Advanced STGR

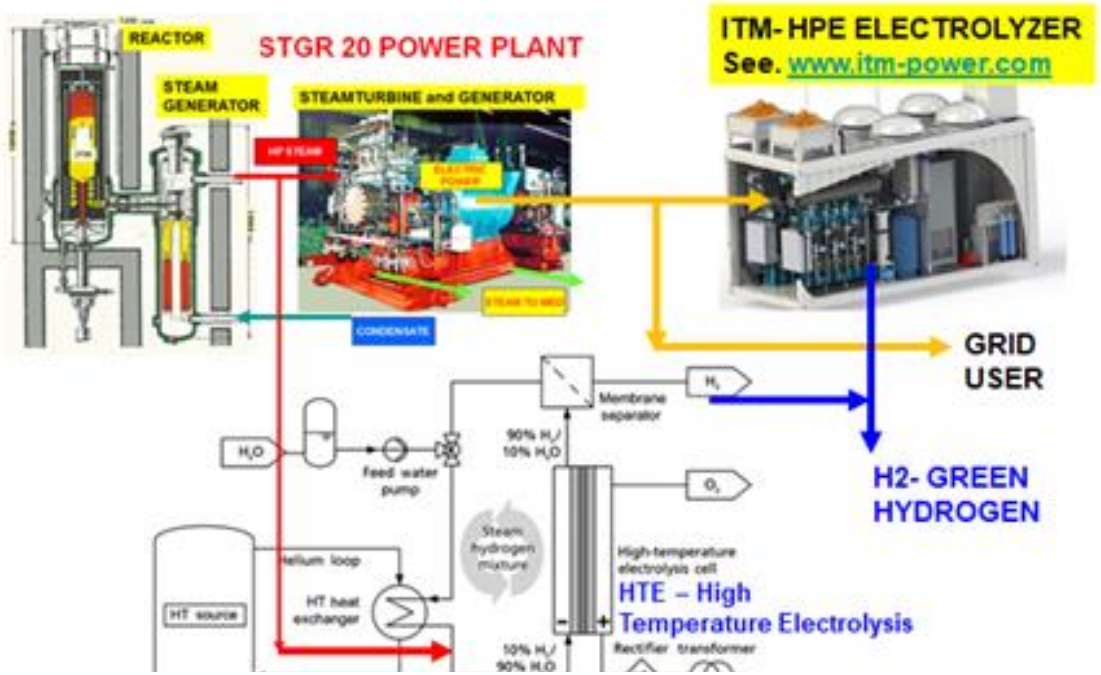
BESTE OPLOSSING VOOR ALDEL

GREEN CEMENT INDUSTRY



BESTE OPLOSSING VOOR ENCI in Samenwerking met **TU-Eindhoven en IRONPOWER**

GREEN STEEL INDUSTRY



BESTE OPLOSSING VOOR TATA STEEL

NEW AND DISRUPTIVE TECHNOLOGIES

- APPLICATIONS:

NEW TECHNOLOGIES:

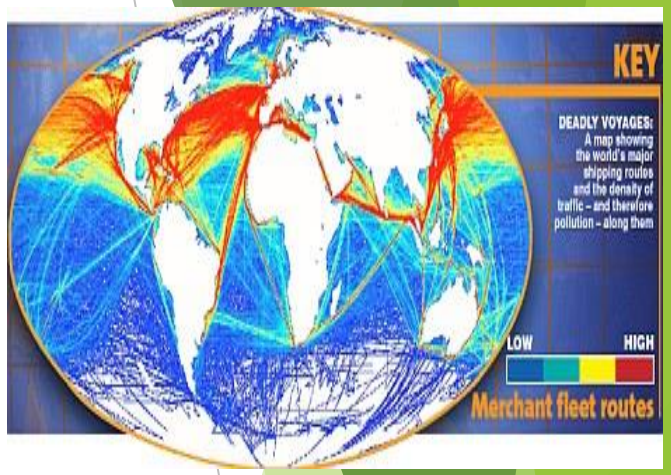
- GREEN SHIPPROPULSION WITH THORIUM AS FUEL
- LARGE SCALE (DRINKING) WATER PRODUCTION
- GREEN **BARGE MOUNTED POWER STATIONS FOR THE ISLANDS**

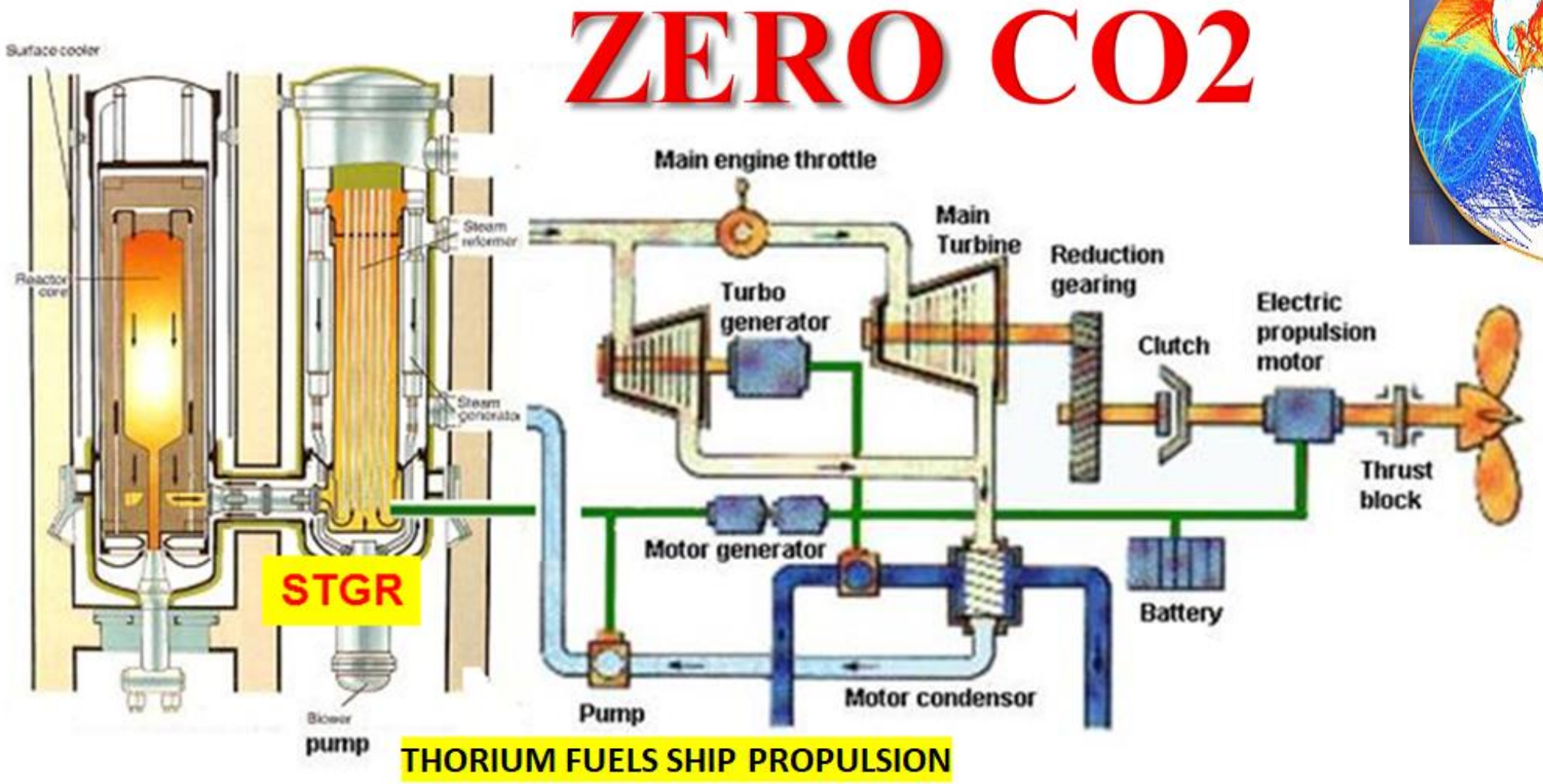
USED PEBBLES AND HEAT AND GAMMA RAYS SOURCE:

AGRICULTURE, HEALTHCARE, FOOD PRESERVATION, COMBAT DISEASES

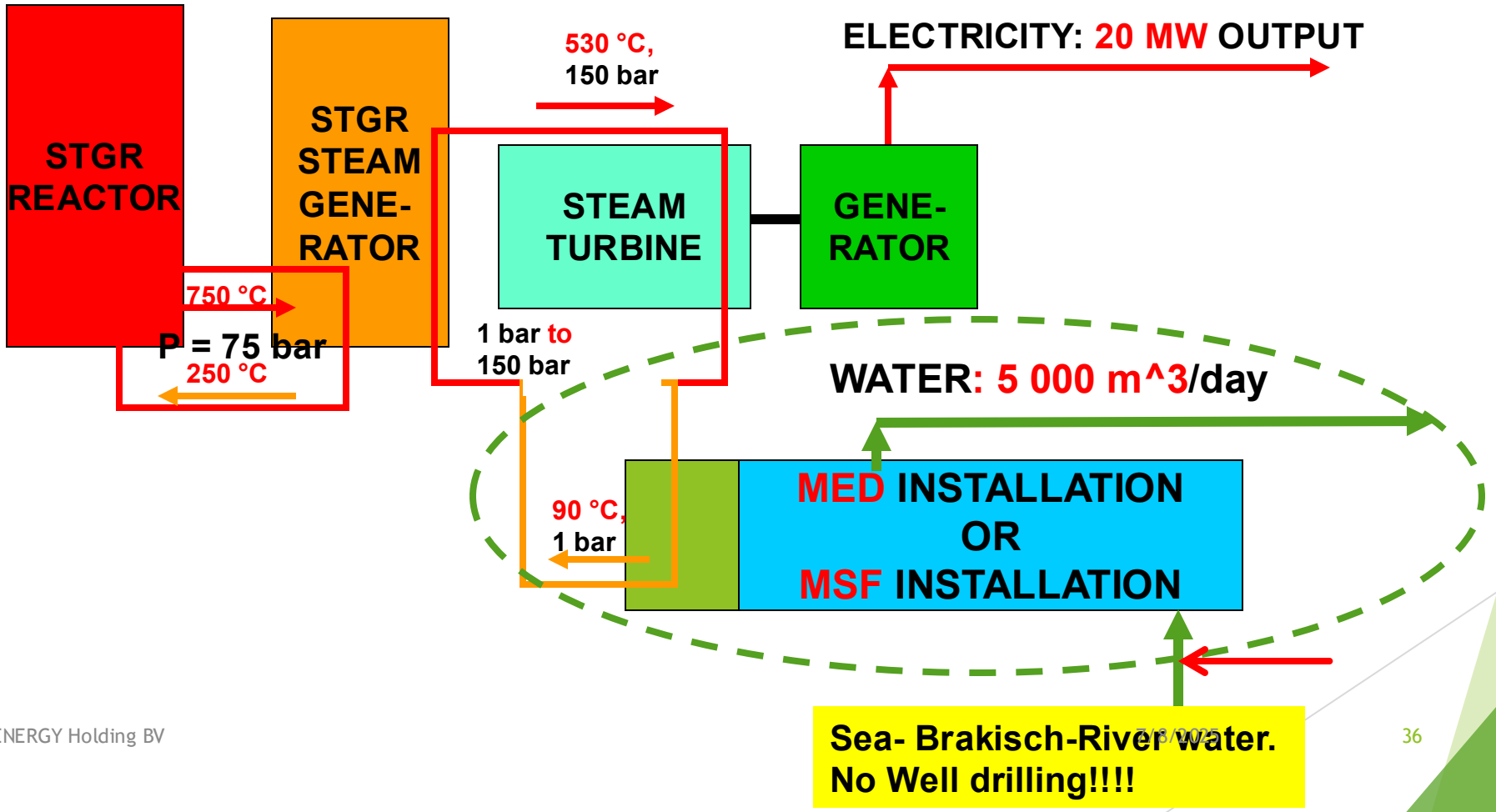
DAMEN AS CENTRE FOR NEW, CLEAN SHIPPROPULSION. (Maritime shipping: largest air polluter)

See: How 16 ships create as much pollution as all the cars in the world | Daily Mail Online





PURE WATER PRODUCTION FOR INDUSTRIES AND DRINKNG WATER WITH MED OF MSF INSTALLATION IN COGENERATION STGR PLANT



STGR POWER AND DRINKINGWATER BARGE FOR GLOBAL GREEN INDUSTRIAL REVOLUTION

- Data:
  - LxWxH/: 145x36x10 meter
  - Power max. 100 MW electricity
  - Water max. 25.000.000 ltr/day
- Advantages:
  - Quick response to location
  - Minimal infrastructure
  - Easy to move anywhere

ONYX – 700 MW GREEN INDUSTRIAL REVOLUTION POWER STATION AS KNOWLEDGE CENTER FOR THE WORLD.