WELCOME

- ENERGY CONSERVATION- ABSORPTION CHILLER

Integrating Energy & Environment
Sustainable solutions for Business Improvement

COMPANY PROFILE

- A 40 year old value based organization
- Manufacturer of Industrial Boilers, Air Pollution Control Equipments,Absorption Chillers and Chemicals
- From $ 0.5 million in 1966 to $ 1 Billion + in 2011
- Total Manpower: 4000
- World wide network of 13 offices, 5 subsidiaries and > 100 distributors/reps
- 50,000 installations for various businesses in more than 75 countries
- World class manufacturing plants (> 1 million square feet)
- Quality assured manufacturing to international codes
- Tradition of intensive R&D
- Thermax: 3rd best company to work for in India: BT Mercer Survey
- Featured in Forbes ‘Asia’s best under a billion’ : 2005,2006 & 2007
- Most comprehensive range of absorption chillers
- License agreement - Babcock & Wilcox (for utility boilers)
- Technology and Manufacturing Licensing Agreement – Georgia Pacific Chemicals
- Business tempered by social responsibility

Businesses

THERMAX

Boilers & Heaters	Cooling & Heating	Power Generation	Chemicals & Water	Air Pollution Control	Renewable

Boiler & Heater
- Large capacity power boilers
- Thermal oil / water heaters
- Package boilers
- Energy recovery systems

Cooling
- Exhaust & Multi-energy fired chillers
- Steam fired chillers
- Hot water fired chillers
- Direct fired chillers

Heating
- Steam/Hot water power plants
- Packaged solid/oil/gas fired boilers
- Fired thermic fluid heaters
- Exhaust waste heat recovery boilers

Turnkey Power Plants
- Solid fuel based
- Gas based combined cycle
- Waste heat recovery based
- RE based incl. Biomass, Bagasse, solar, etc.
- O&M of power plants

Chemicals
- Ion exchange resins
- Cooling water chemicals
- Fireside chemicals
- Polyelectrolyte

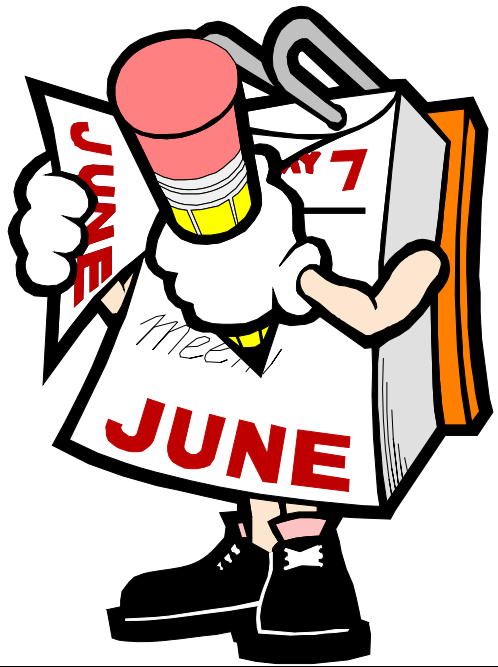
Water and wastewater
- Wastewater & Effluent water treatment systems
- Water recycling
- Waste management

Enviro
- ESP & Bag filters
- Scrubbers
- Air purification
- Retrofit & Revamp

Solar
- Heating
- Cooling

HISTORY OF ABSORPTION MACHINES

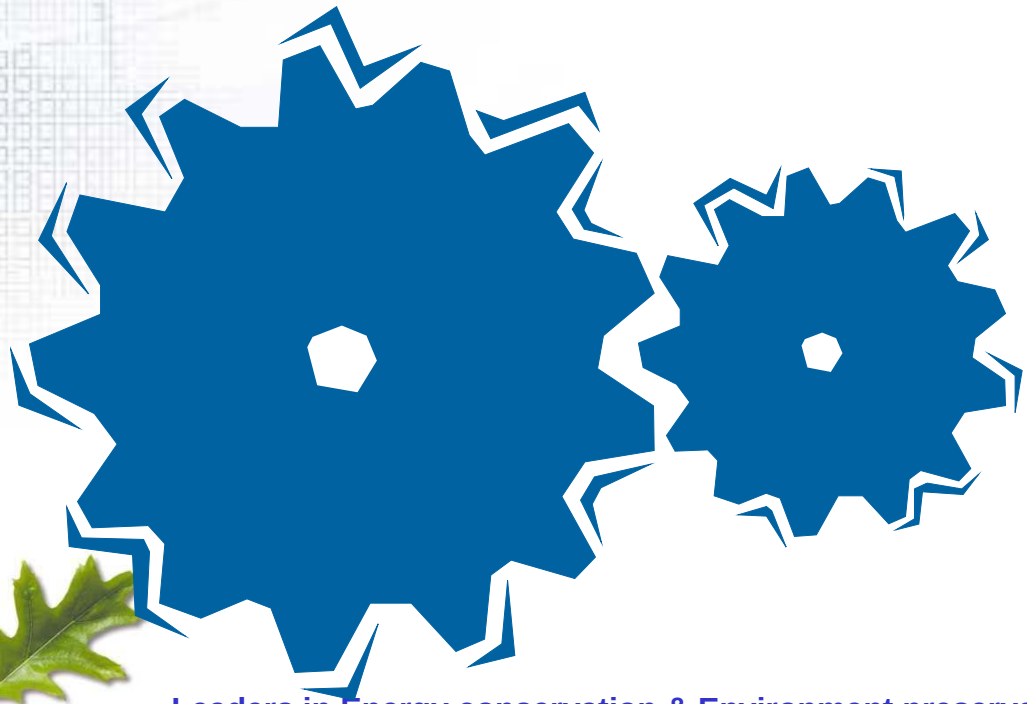
A STEP INTO THE PAST



VAPOUR ABSORPTION TECHNOLOGY & ITS EVOLUTION

1890

Ferdinand deCarre develops First Absorption Machine



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The Electrolux Refrigerator

VAPOUR ABSORPTION TECHNOLOGY & ITS EVOLUTION

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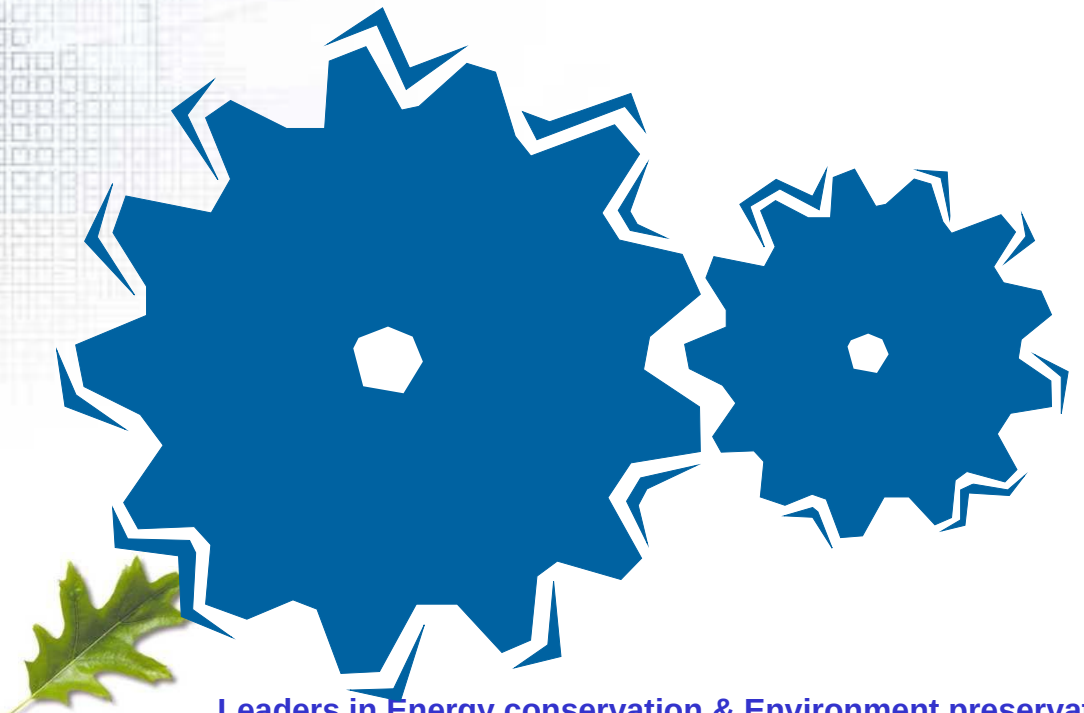
The Electrolux Refrigerator

1950-60

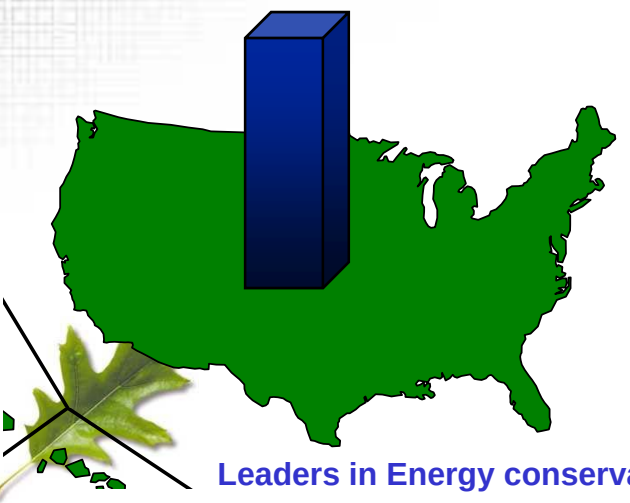
Commercializationof Single Effect Machine by Carrier

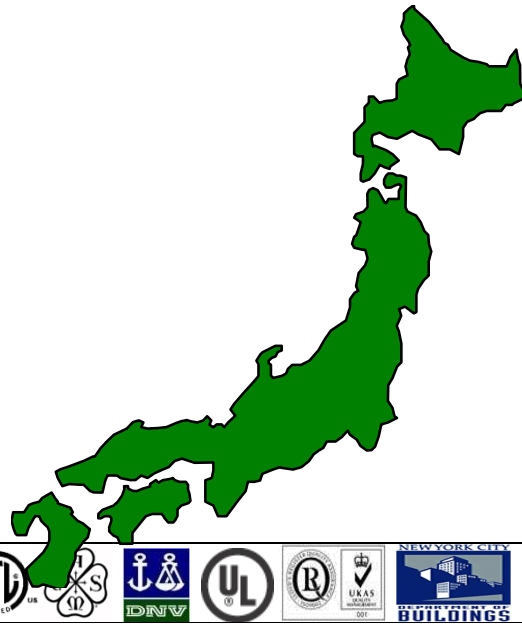


VAPOUR ABSORPTION TECHNOLOGY & ITS EVOLUTION

1970

Japan adopts technology from USA





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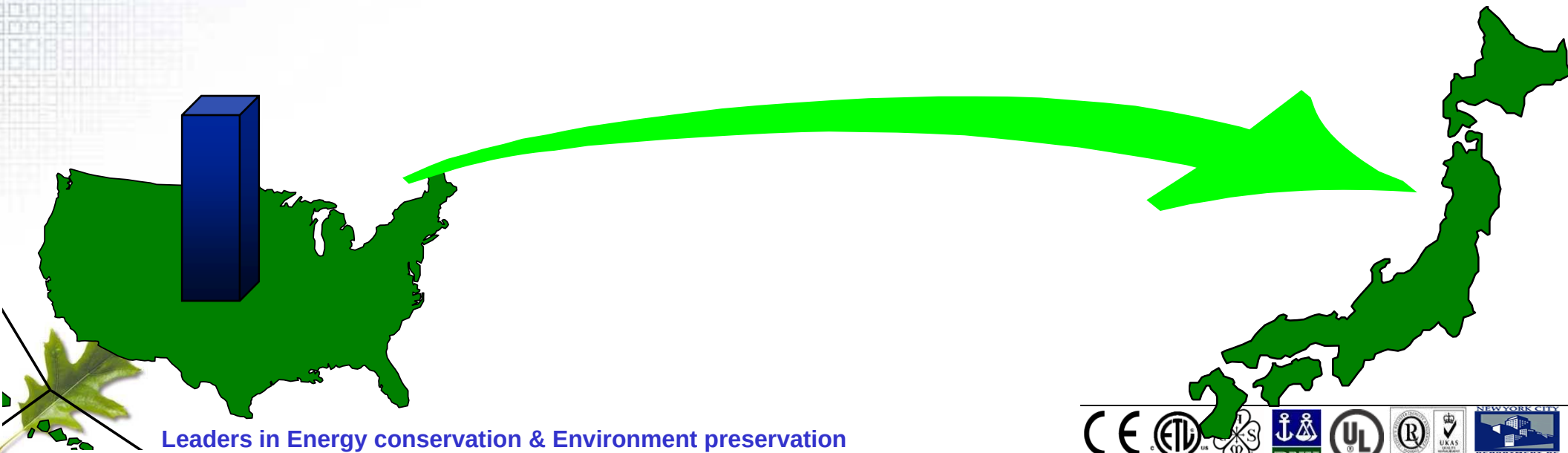

VAPOUR ABSORPTION TECHNOLOGY & ITS EVOLUTION

THERMAX

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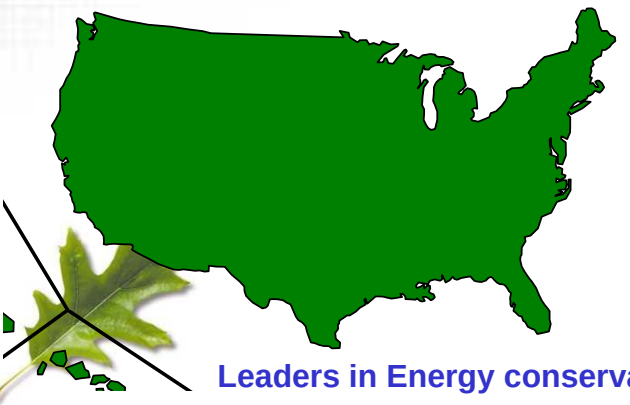
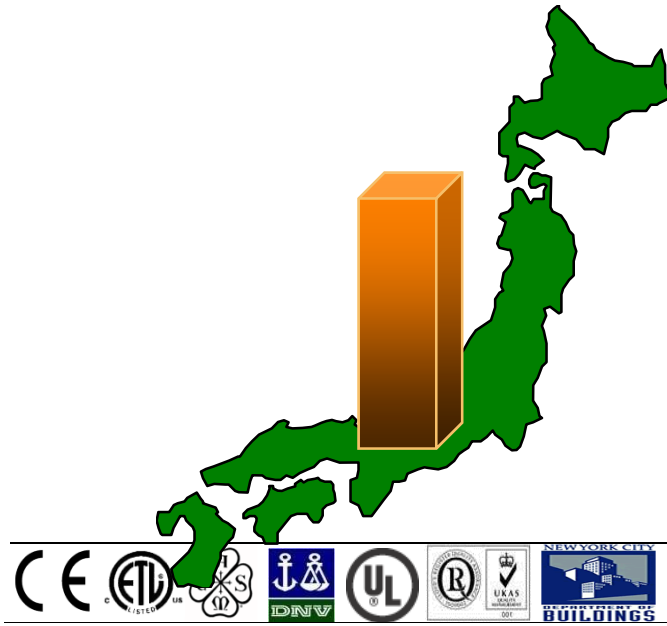
Japan adopts technology from USA

1970-75

Innovation of Double Stage Machine from Japan





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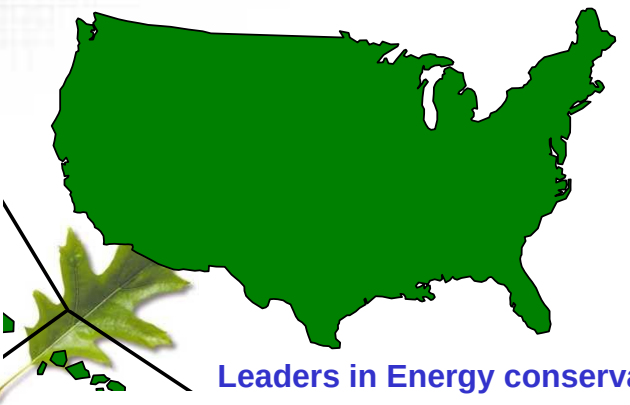
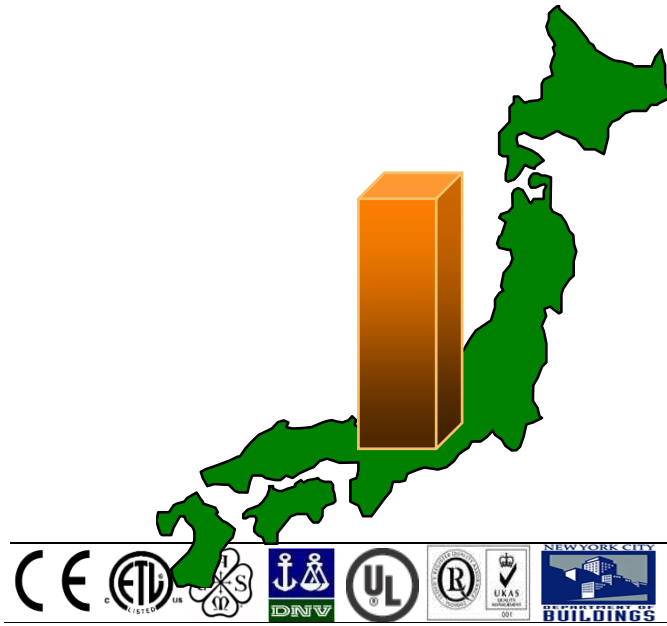
Innovation of Double Stage Machine from Japan

1990-94

Reverse flow of technology from Japan to USA





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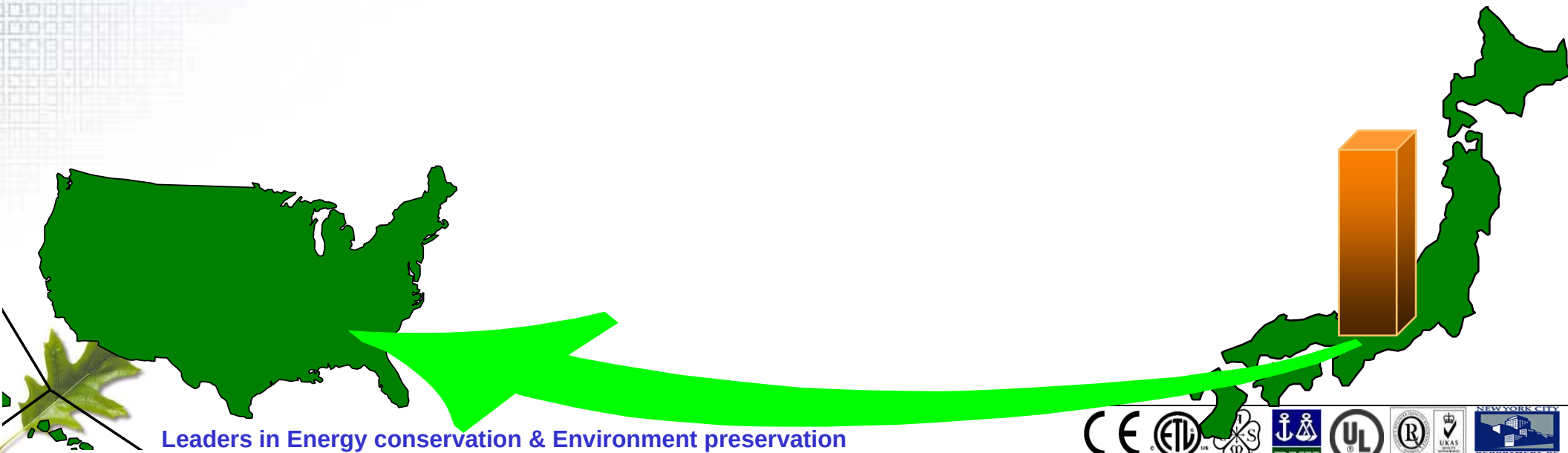
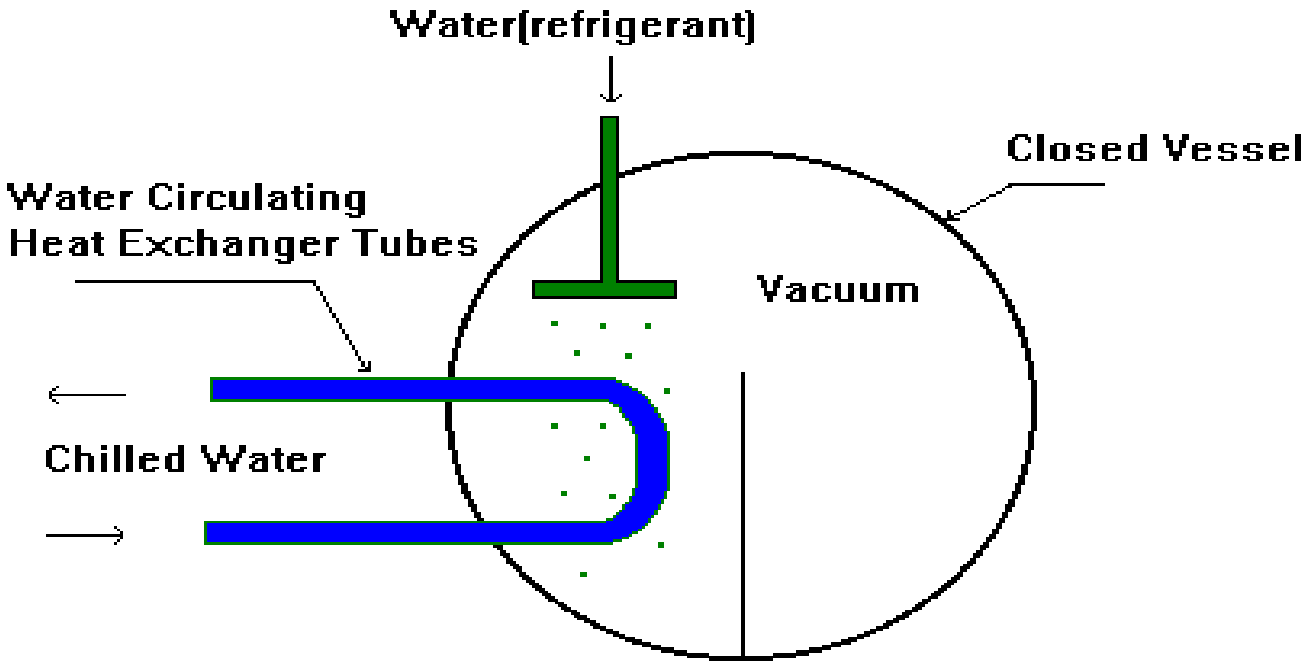


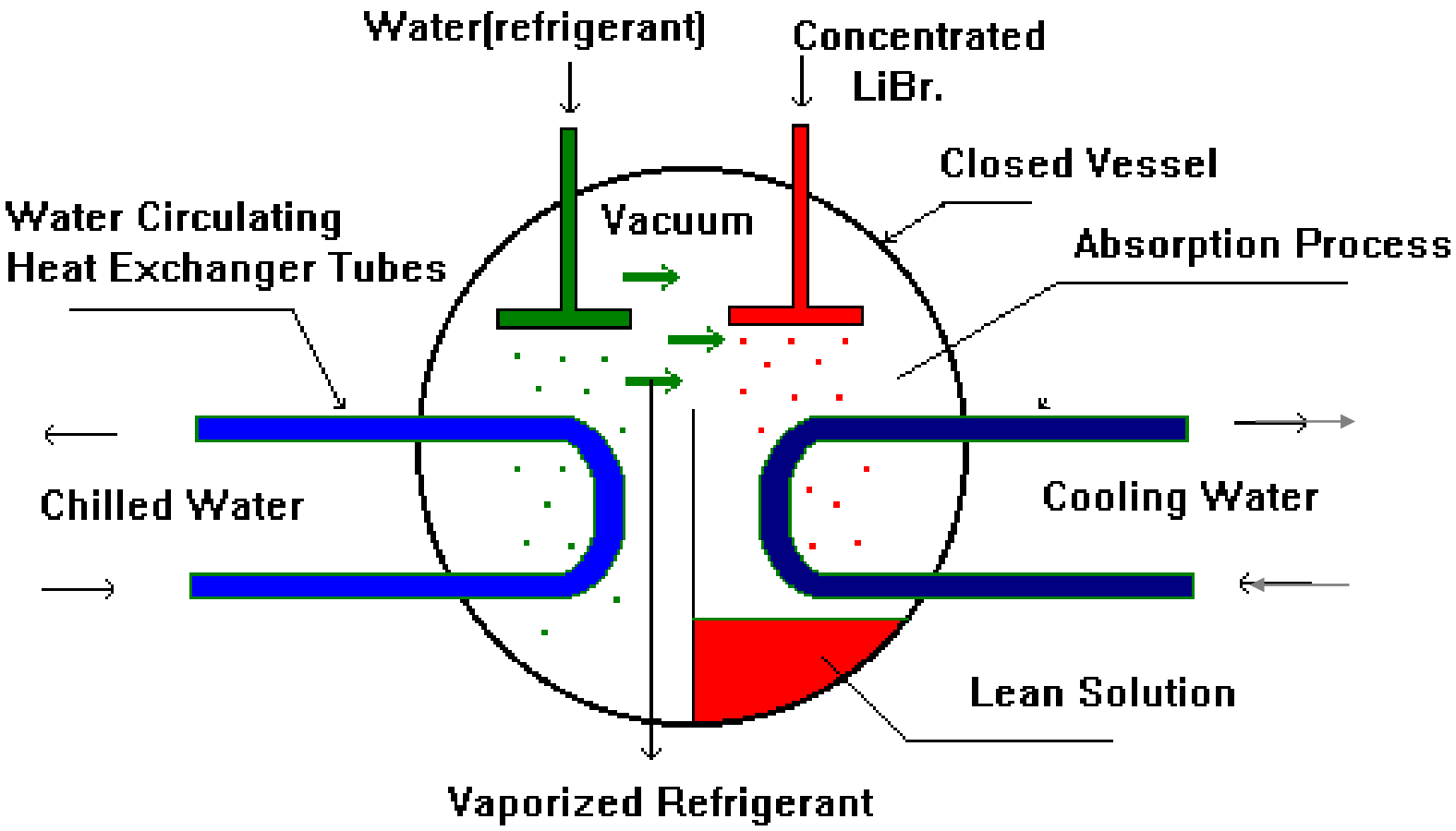
ABSORPTION –Working Principle

How do the chillers work ?



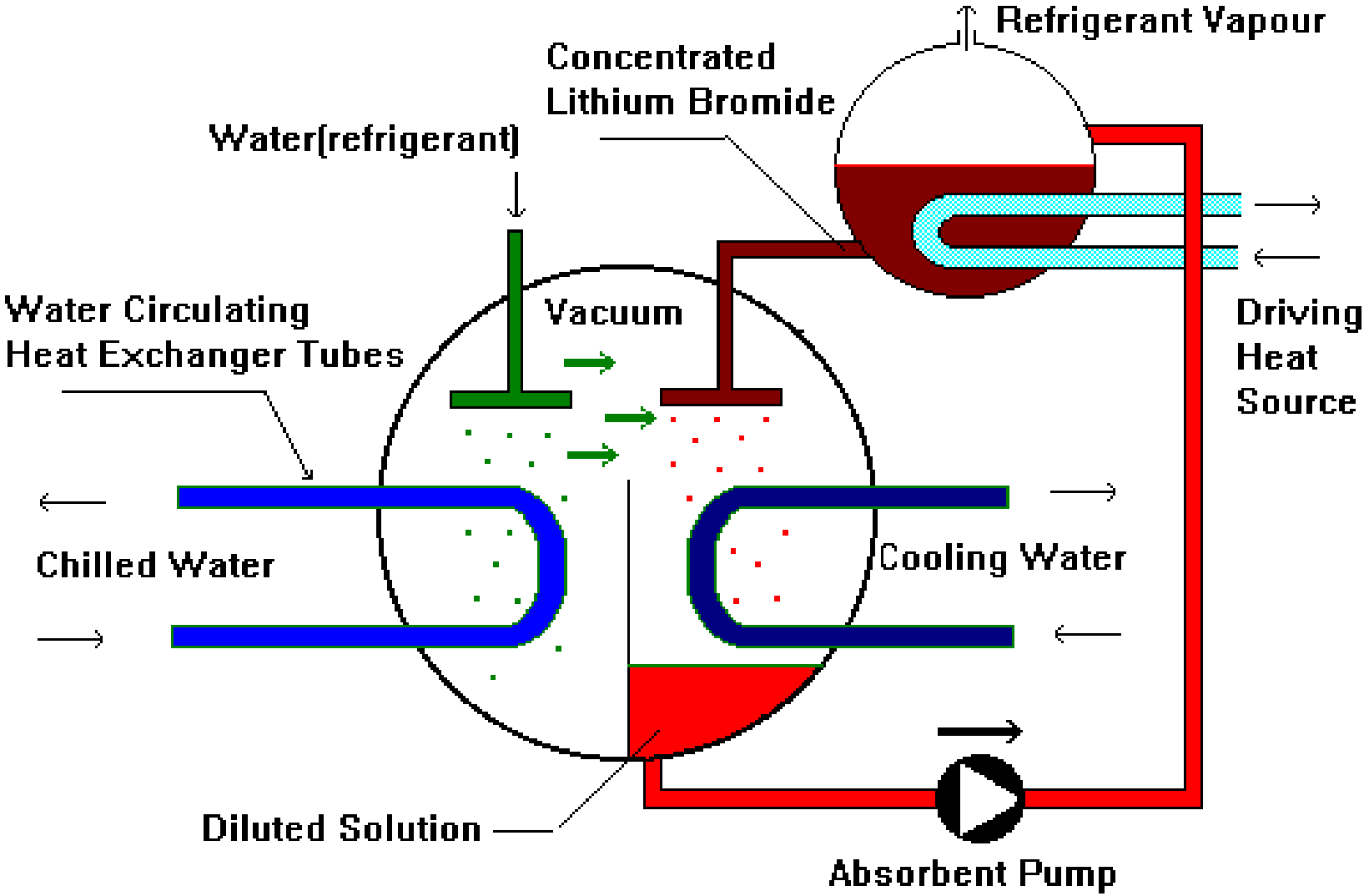
1. Boiling point of the water is a function of pressure. At atmospheric pressure water boils at 100 deg. C. When maintained at high vacuum, water will boil and subcool itself. The boiling point of the water at 6 mmHg (abs) is 3.7 deg. C.

How do the chillers work ?



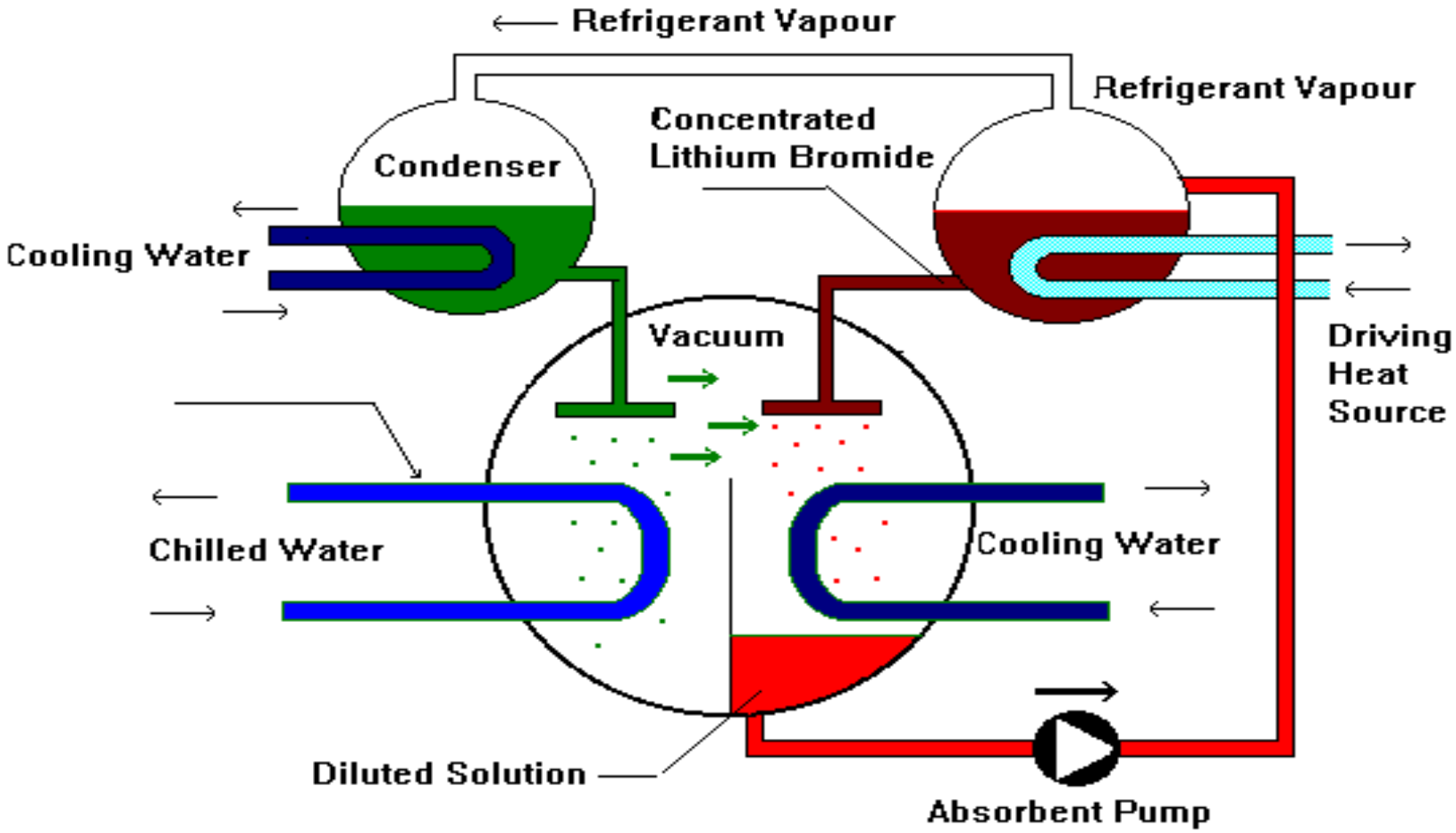
2. Lithium Bromide (LiBr) has the property to absorb water due to its chemical affinity. At higher concentration and lower temperature LiBr absorbs water vapour (refrigerant vapour) very effectively.

How do the chillers work ?



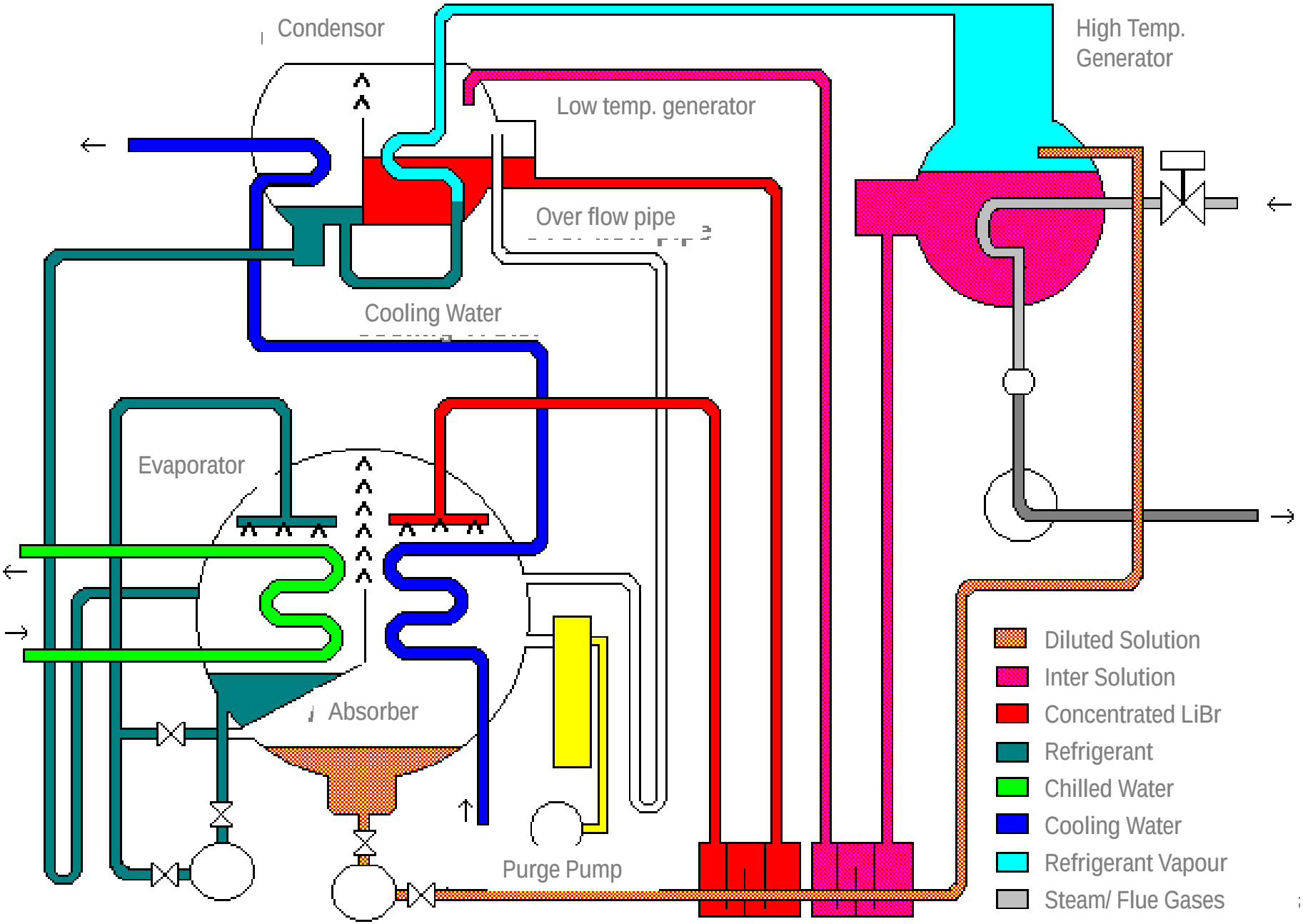
3. As Lithium Bromide becomes dilute it loses its capacity to absorb water vapour. It thus needs to be reconcentrated using a heat source. Heat source may be Steam or Flue gases or even Hot water.

How do the chillers work ?



4. The heating causes the solution to release the absorbed refrigerant in the form of vapour. This vapour is cooled in a separate chamber to become liquid Refrigerant.

How do the chillers work ?



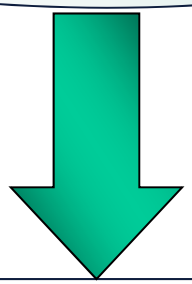
ABSORPTION CHILLER – VACUUM READINGS

	Gauge Pressure (kg/cm^2 G)	Absolute Pressure (kg/cm^2 G)	Temp. (°C)	Remarks
Pressure	10	11	183.2	
	8	9	174.5	Driving pressure for double effect type
	5	6	158.1	
	1	2	119,6	Driving pressure for single effect type
	0.5	1.5	110.8	
1 atm.		760 mmHg	100	Atmospheric Pressure
Vacuum		650.0	95.5	High Temp. Generator Pressure
		525.9	90.0	
		167.6	62.6	
		92.5	50.0	
		61.0	41.5	Condenser Pressure
		31.8	30.0	
		29.4	28.6	
		9.2	10.0	
		6.54	5.0	Evaporator Pressure
		5.68	3.0	

TYPE OF ABSORPTION CHILLERS

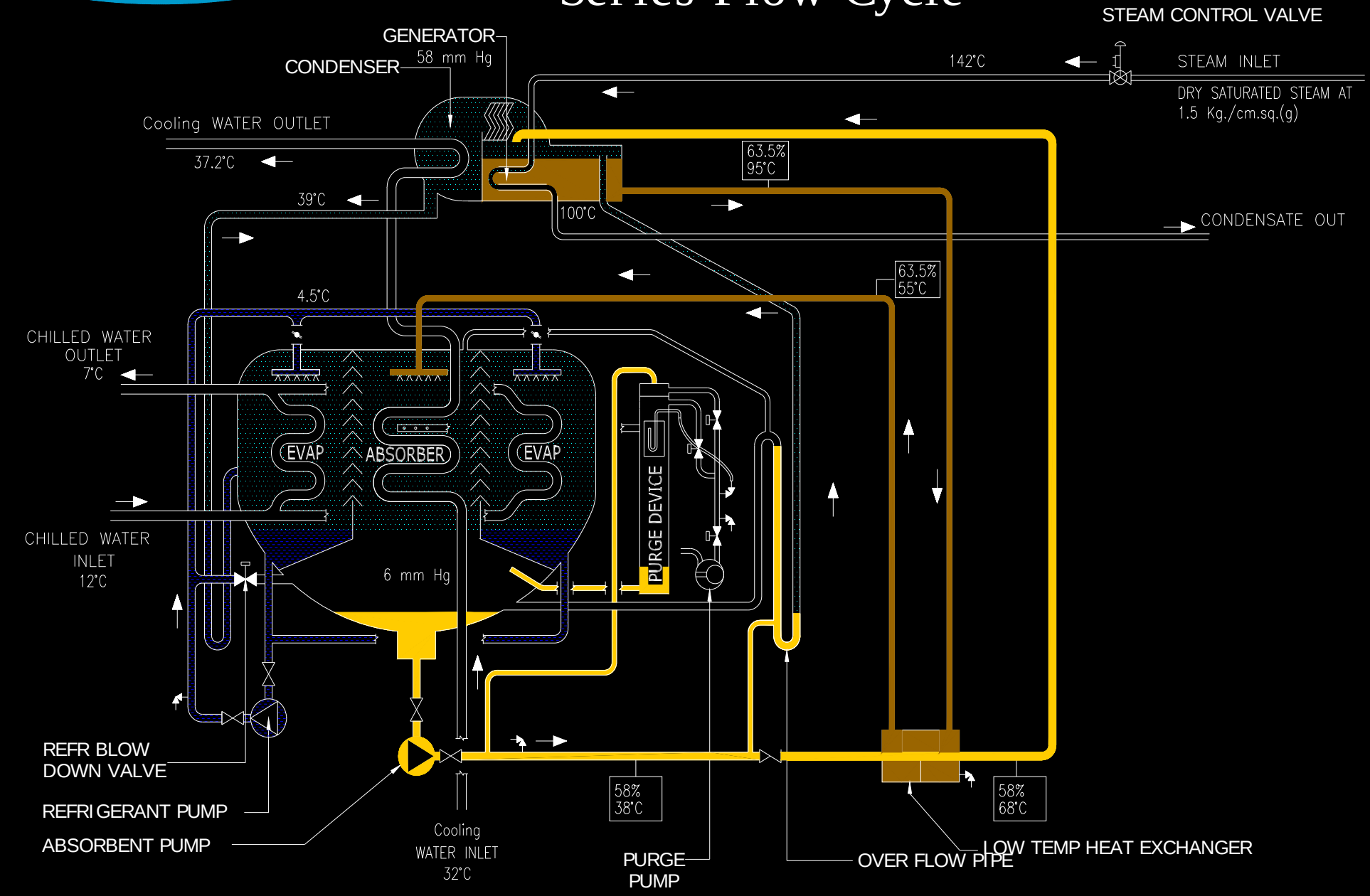
Based On No of Stages

Single Effect



Concentration Gain takes place in single stage - Only One Generator

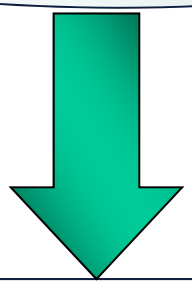
Single Effect Steam Driven Series Flow Cycle



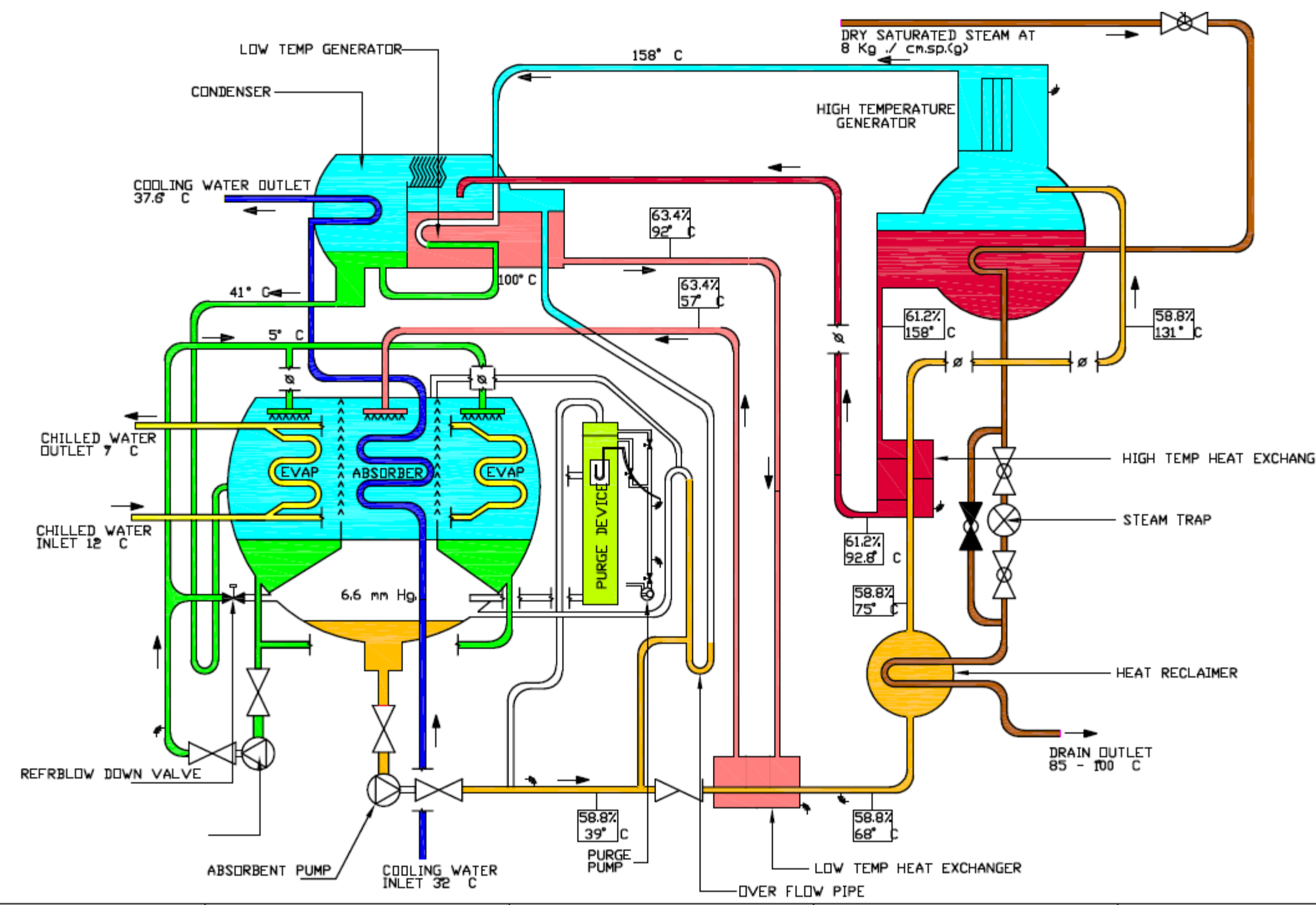
(ALL FIGURES ARE INDICATIVE)

Based On No of Stages

Double Effect

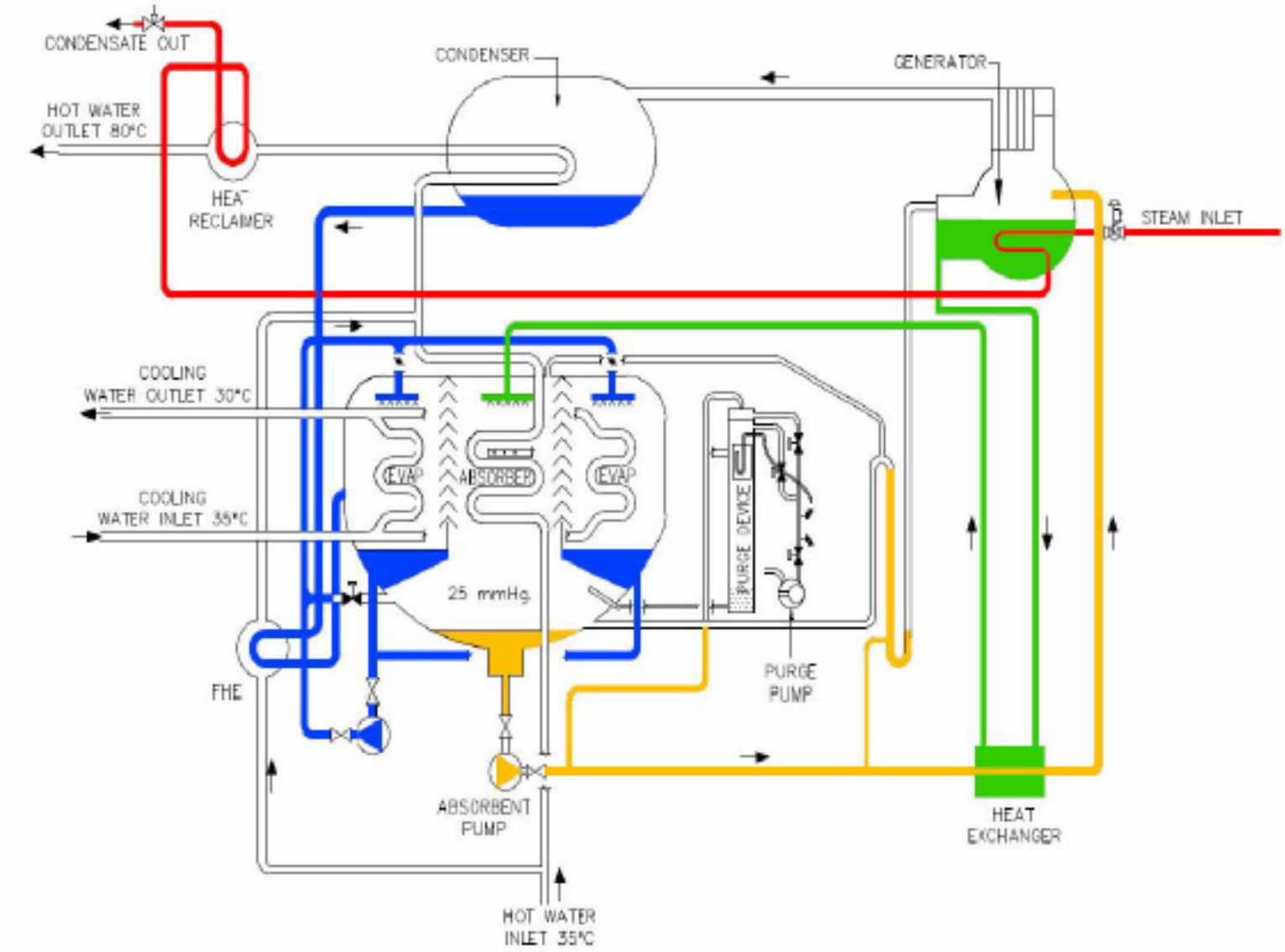


Concentration Gain takes place in Two stages - Two Generators, High Temperature & Low Temperature



CONCENTRATED ABSORBENT	REFERIGERANT	DIAPHRAGM VALVE	BALL VALVE (CLOSE)	STEAM TRAP
INTERMIDIATE ABSORBENT	VAPORIZED REFRIGERANT	SERVICE VALVE	CHECK VALVE	
DILUTED ABSORBENT	ISOLATION VALVE (CLOSE)			CONTROL VALV

ABSORPTION HEAT PUMP



SCHEMATIC CYCLE DIAGRAM OF HEAT PUMP

CATEGORIES-ABSORPTION CHILLER

- SINGLE EFFECT

- Low temperature hot water chiller(75-120 ºC)
- Medium temperature hot water chiller(115-150 ºC)
- Low pressure steam fired chiller(0.6-3.5 bar)

- DOUBLE EFFECT

- High pressure steam fired chiller(4-10 bar)
- Direct fired chiller(gas, diesel, kerosene etc)
- High temperature hot water chiller(155-185 ºC)
- Exhaust gas fired absorption chiller

ADVANTAGES OF ABSORPTION COOLING SYSTEMS

CHEAP TO OPERATE...

IT IS VERY ECONOMICAL TO USE LOW COST HEAT SOURCE LIKE

Steam

Hot Water

Natural Gas

Oil

To Run These Machines

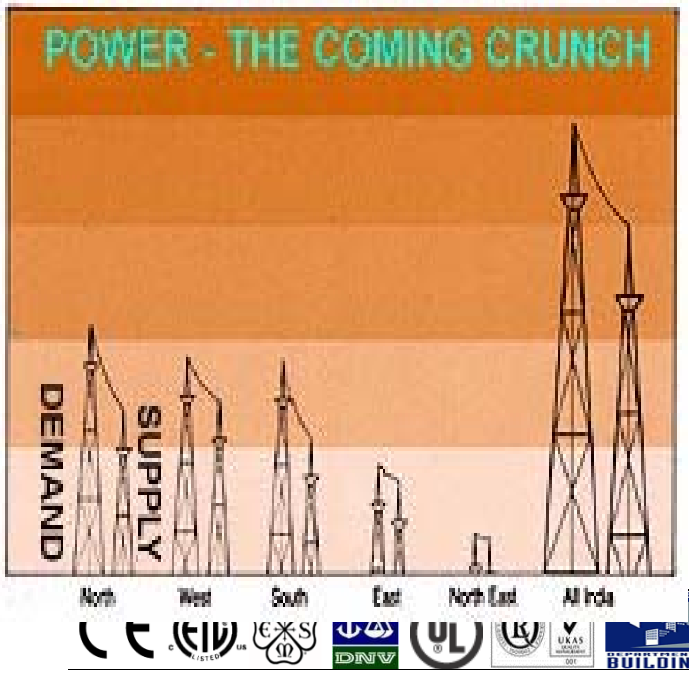
NO DEPENDENCE ON ELECTRICITY...

Freedom From H. T. Power.

Transformer Becomes Redundant

Reduction in Electrical Accessories Such as Cabling, E B Deposit, MCC Etc.

DG Back-up is Considerably Reduced

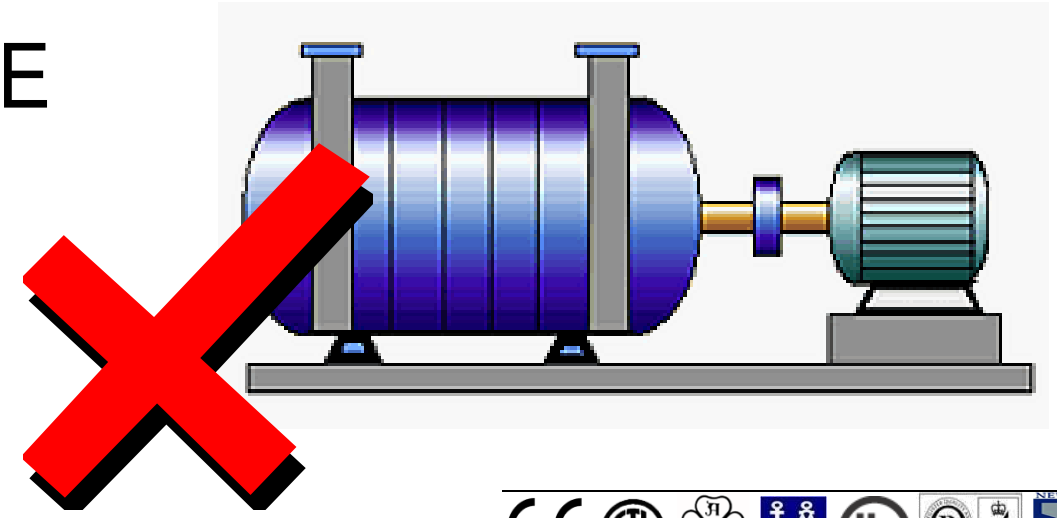


NO MOVING PARTS

VAPOUR ABSORPTION MACHINE DOES NOT USE BIG COMPRESSOR OR MOTOR FOR ITS OPERATING CYCLE.

NO WEAR & TEAR

LESS DOWN TIME



No

VIBRATION

NO DYNAMIC LOADING.

FLEXIBILITY OF INSTALLATION

ROOFTOP INSTALLATION

SAVING OF FLOOR SPACE

FOR COMMERCIAL USE.

SILENT OPERATION

NEGLIGIBLE MAINTENANCE

- NO MOVING PARTS
- NO REFRIGERANT LEAK
- NO TOP-UP REQUIREMENT
- NEGLIGIBLE MAINTENANCE

ENVIRONMENTAL SCENARIO

Rising concern over use of CFCs/HCFCs

Planned phase out of the CFC/HCFC based refrigerants

No proper substitute found

Costly *Scarce*

Reduced Efficiency

Higher global warming potential

Growing concerns over *GLOBAL WARMING*

EFFECTS Of OZONE LAYER DEPLETION

HUMAN

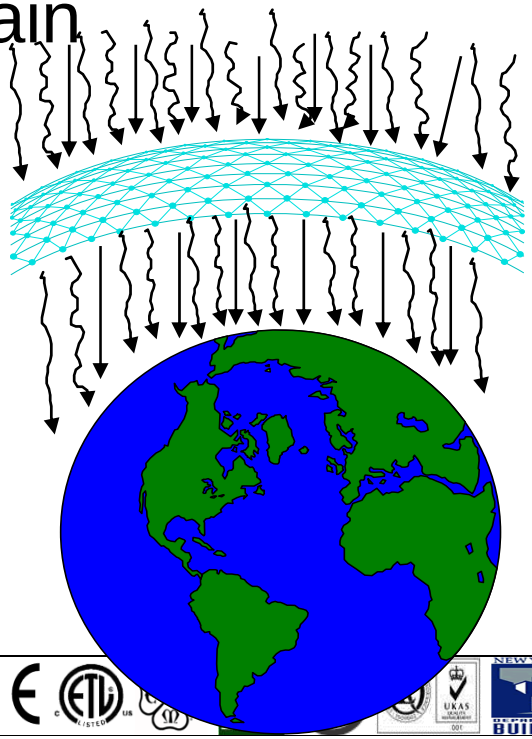
Cataracts, Accelerated Ageing, Wrinkling & Skin cancers. Reduced immune response leading to susceptibility to infectious diseases

MARINE LIFE

Effect on growth of phytoplankton, the mainstay of the ocean food chain

PLANTS

Interference with photo synthesis leading to lower crop yields



USES WATER AS REFRIGERANT

Zero Ozone Depleting Potential

No Future Conversion Cost

LESS GLOBAL WARMING POTENTIAL

No Global Warming Potential

Reduces Green House Gas Emissions By 50 %

APPLICATION- ABSORPTION CHILLER

COMFORT & PROCESS COOLING

ABSORTION CHILLERS CAN BE USED IN COMFORT AND PROCESS COOLING LIKE OTHE VAPOR COMPRESSION CHILLERS ARE USED

SPECIAL APPLICATIONS

ABSORPTION CHILLERS CAN BE USED WITHOUT ANY ANCILLARY EQUIPMENTS WHERE HIGH RANGE OF TEMPERATURE AND HIGHER DELTA “T” REQUIRED. For eg.35 C TO 20 C.

PETROCHEMICALS AND REFINERIES

ENERGY CONSERVATIVE APPLICATIONS WHERE MOST OF THE LOW PRESSURE BLEED STEAM/ QUENCH(HOT) WATER WASTE HEAT CAN BE RECOVERED TO ENHANCE THE PRODUCT OUTPUT

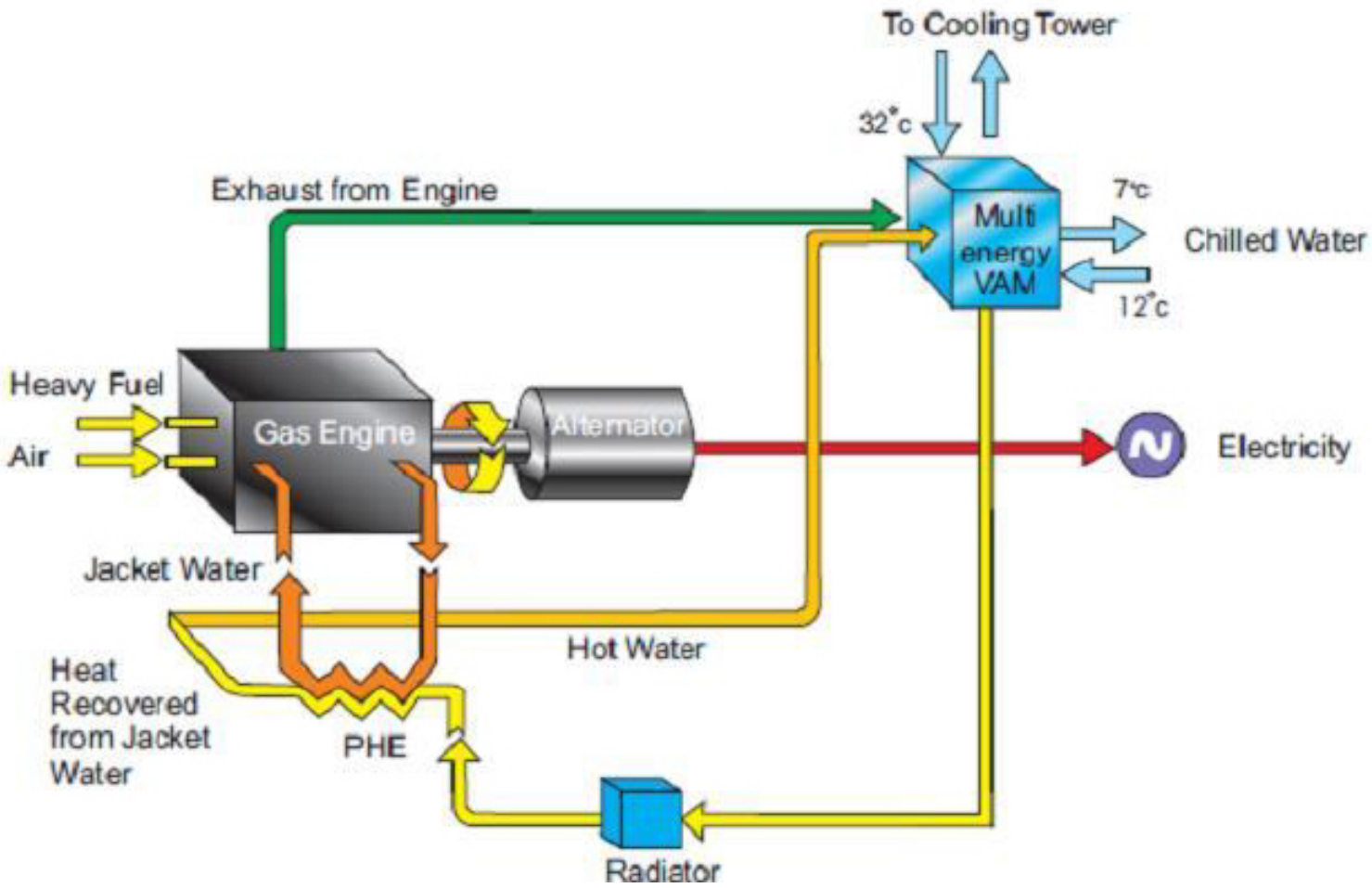
COGENRATION /TRIGENERATION

THERMAX

THERMAX

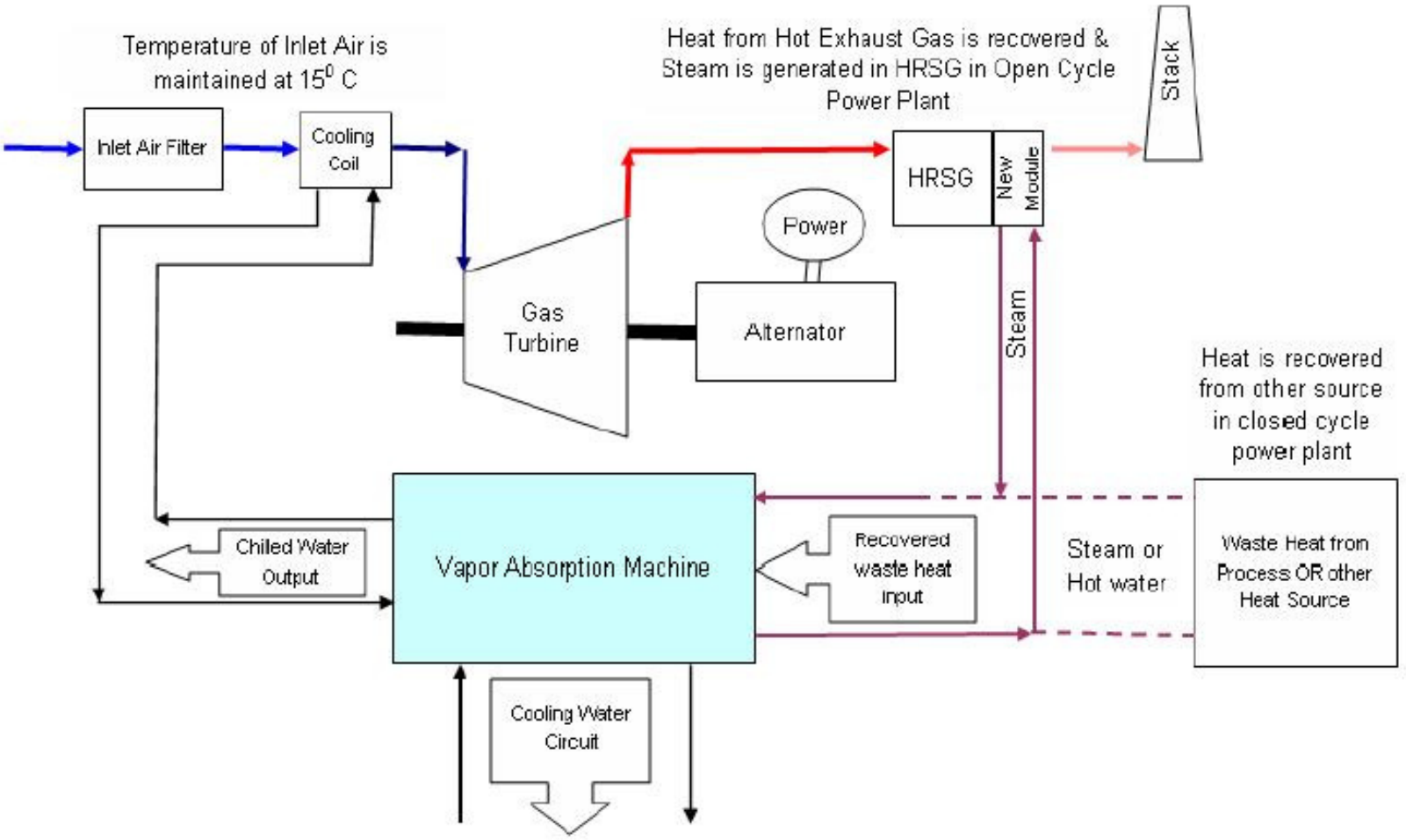
Tri-generation

Cooling ... (New concept)

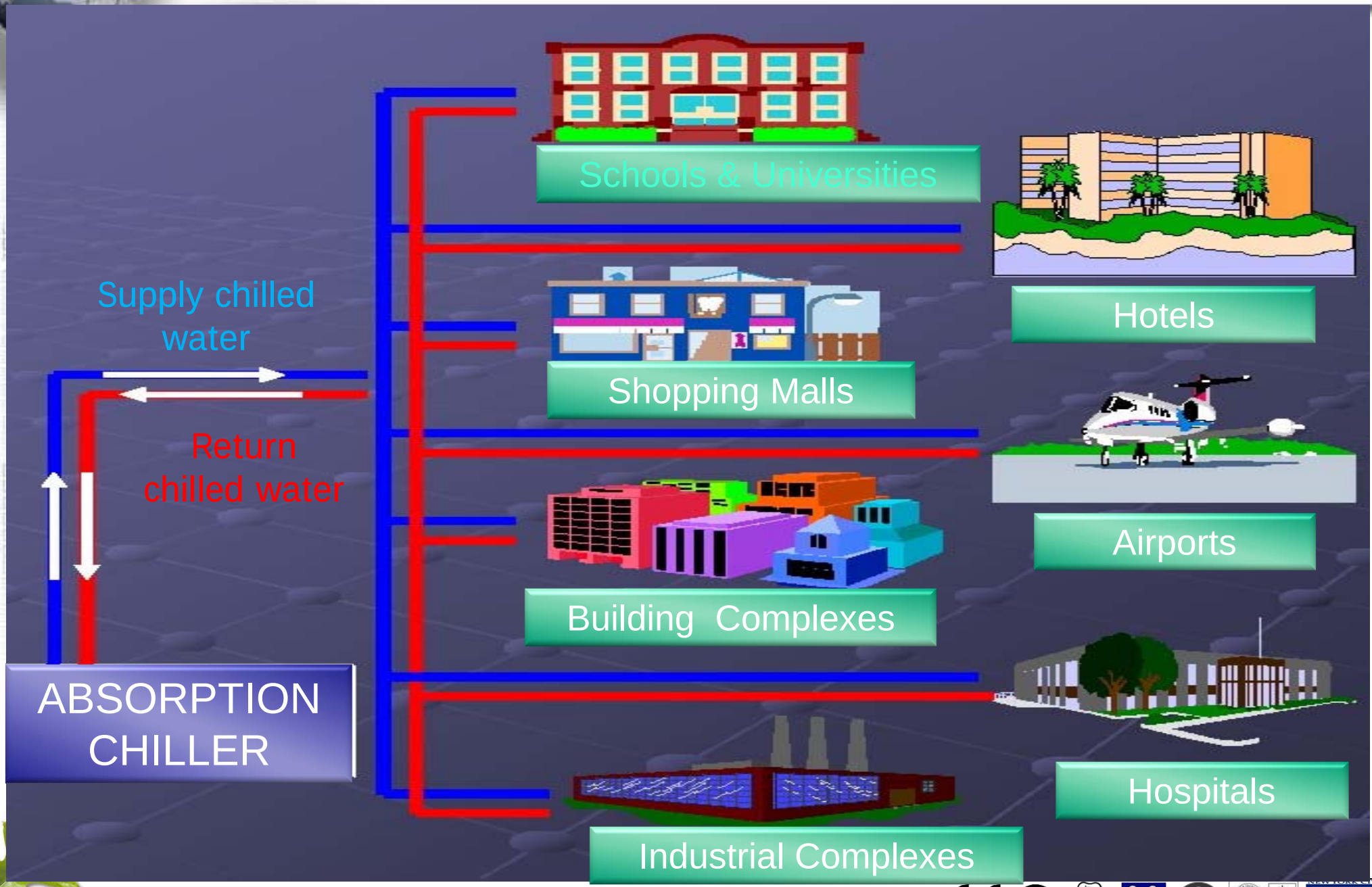


INLET AIR COOLING(TURBINE INLET COOLING)

Scheme of inlet cooling with VAM for Gas Turbine



DISTRICT COOLING

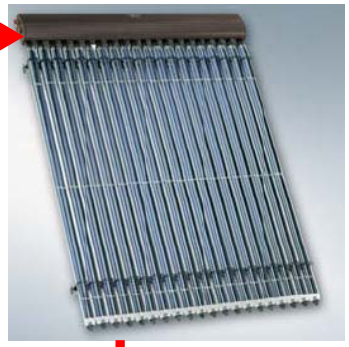


RENEWABLE ENERGY-SOLAR COOLING

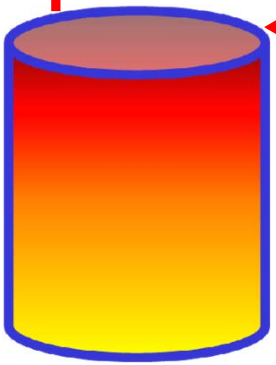
THERMAX

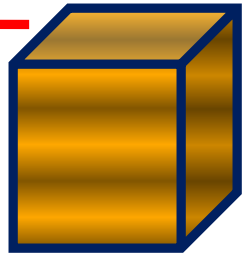
Cooling tower

Absorption chiller



Solar Panels





Back-up heater

Hot storage

User point

Improving Your Business is Our Business

Leaders in Energy conservation & Environment preservation

Q&A