MVM EGI

Water Saving Cooling Solutions for 1000MW+ Nuclear Power Plants

mvmegi.com

linkedin/mvm-egi

Dr. György Budik, COO, July 29, 2025

MVM EGI

AGENDA

1. **BRIEF INTRODUCTION**
2. Select Cooling Systems
3. Dry Cooling References in Nuclear Power Plants
4. Cooling Solutions for 1,000+MW NPP Units

ABOUT MVM EGI

Profile: Globally active cooling system provider
Consultancy, design, engineering, delivery, after sales

Manufacturing: Fully owned factory in Wuqing, CN

Founded in 1948 as EGI
GEA Group 1992-2014, ENEXIO 2014-2020

Owner: MVM Group *(100% Hungarian state owned)*
The largest power-utility company in CEE region

Headcount (FTE): 124
(68 Budapest, 24 Beijing, 32 Wuqing)
Headquarters: Budapest, Hungary

MVM EGI Factory in Wuqing, China

Global supply track record

PRODUCT PORTFOLIO

		HELLER INDIRECT DRY COOLING	AIR-COOLED CONDENSERS	EVAPORATIVE COOLING TOWERS	HYBRID DRY/WET COOLING TOWERS	DRY COOLING SPECIAL APPLICATIONS	CIRCUMIX ASH HANDLING
POWER PLANTS	COAL FIRED	x	x	x	x	x	x
	COMBINED-CYCLE	x	x	x	x	x	
	NUCLEAR	x		x	x	x	
	BIOMASS & W2E	x	x	x	x	x	
	CONCENTRATED SOLAR	x	x	x	x	x	
	DATA CENTERS	x		x	x	x	
	CHEMICAL PLANTS	x		x	x	x	
	INDUSTRIAL APPLICATIONS	x	x	x	x	x	

AGENDA

1. Brief Introduction
2. **SELECT COOLING SYSTEMS**
3. Dry Cooling References in Nuclear Power Plants
4. Cooling Solutions for 1,000+MW NPP Units

LONG OPERATION LIFETIME – DRY COOLING

Hamitabat (Trakya) **1,200 MW CCPP** (operated from 1987/1989 - 2017)

Refurbishment: new H-class power units 600 MW each; cooling towers and heat exchangers reused

New Hamitabat 1,200 MW CCPP (operated from 2017 **with the original 2 dry cooling towers and heat exchangers**)

LONG OPERATION LIFETIME – DRY-WET COOLING

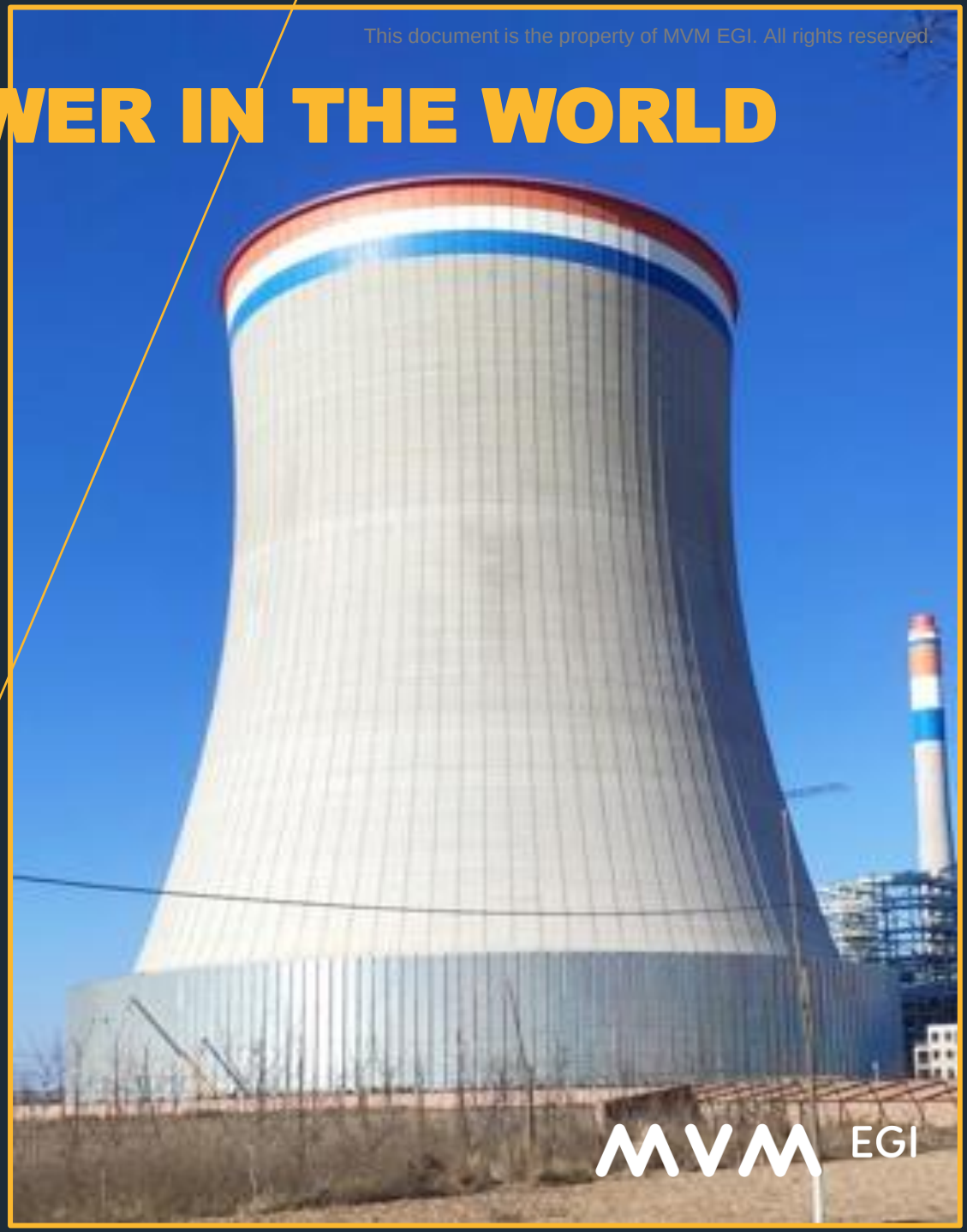
Mátra 900 MW Thermal Power Plant (Units 4&5 in operation since 1973-74)

Refurbishment: originally dry cooling, dry-wet addition in 2004

LARGEST DRY COOLING TOWER IN THE WORLD

GaoHe 1,320 MW Thermal Power Plant

- largest dry cooling tower in the world
- 220m tower height
- one tower serving 2x660 MW units



SELECT DRY COOLING REFERENCES – TURKEY

Hamitabat 1200MW CCPP

Bursa 1400MW CCPP

Gebze-Adapazari 2,400MW CCPP
(Largest dry cooled CCPP In the world at the time)

Can 320MW CFB PLANT

Tufanbeyli 450MW CFB PLANT

New Hamitabat 1200MW CCPP

MVM EGI

SELECT DRY COOLING REFERENCES – SYRIA

Tishreen 2 x 200 MW TPS (Syria)

Al Zara 3 x 220 MW TPS (Syria)

Al Nasserieh 510 MW CCPP (Syria)

Zayzoun 510 MW CCPP (Syria)

Deir Ali 750 MW CCPP (Syria)

Deir Ali 750 MW CCPP Ext. (Syria)

SELECT DRY COOLING REFERENCES – RUSSIA, ITALY

Novy Urengoy CCPP

Adler CCPP

Tereshkovo CCPP

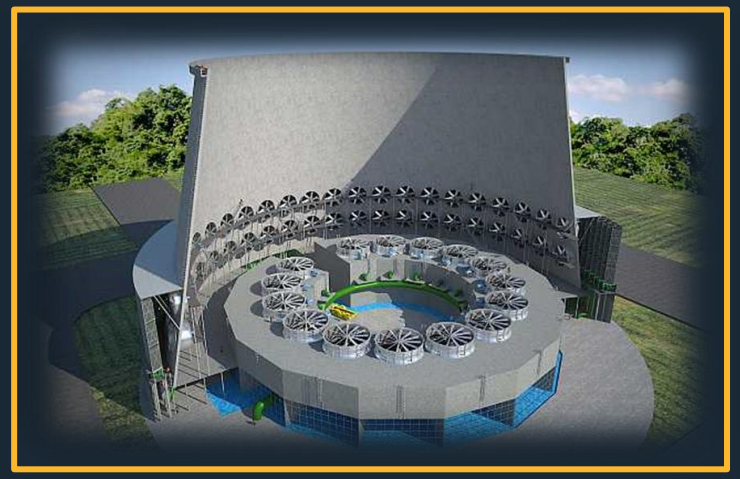
Pervomaysk CCPP

Modugno 800MW CCPP (Italy)

SELECT WET COOLING REFERENCES – HUNGARY

MVM EGI

SELECT HYBRID COOLING REFERENCES



AGENDA

1. Brief Introduction
2. Select Cooling Systems
3. **DRY COOLING REFERENCES IN NUCLEAR POWER PLANTS**
4. Cooling Solutions for 1,000+MW NPP Units

DRY COOLING IN NUCLEAR POWER PLANTS

BILIBINO NUCLEAR POWER PLANT
4×12 MW_e
RUSSIA *(North of the Arctic Circle)*
MAIN COOLING SYSTEM BY MVM EGI

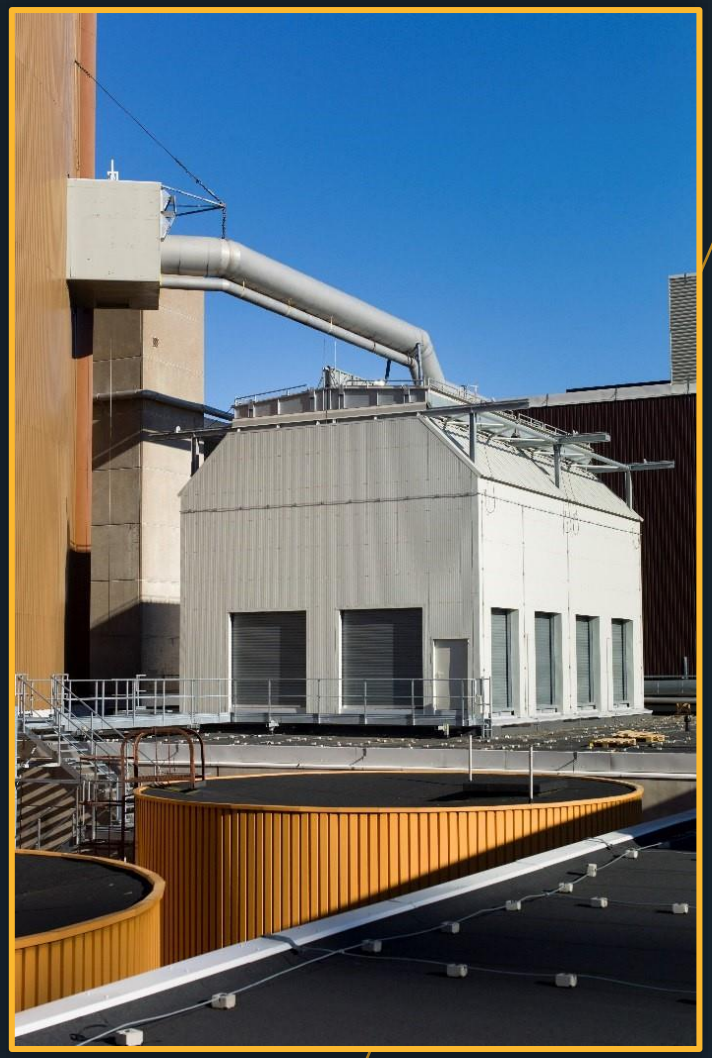
- The plant has been operating successfully since the **1970**'s and is still in operation today
- The design minimum temperature considered for the complete plant, thus also for the cooling system was -62 ºC
- Warm air recirculation possibility to protect the heat exchangers against extreme low winter temperatures

THE ONLY DRY COOLED NUCLEAR POWER PLANT IN THE WORLD

DRY COOLING IN NUCLEAR POWER PLANTS

LOVIISA NUCLEAR POWER PLANT
2x~500 MW_e VVER440
FINLAND
EMERGENCY COOLING TOWERS BY MVM EGI

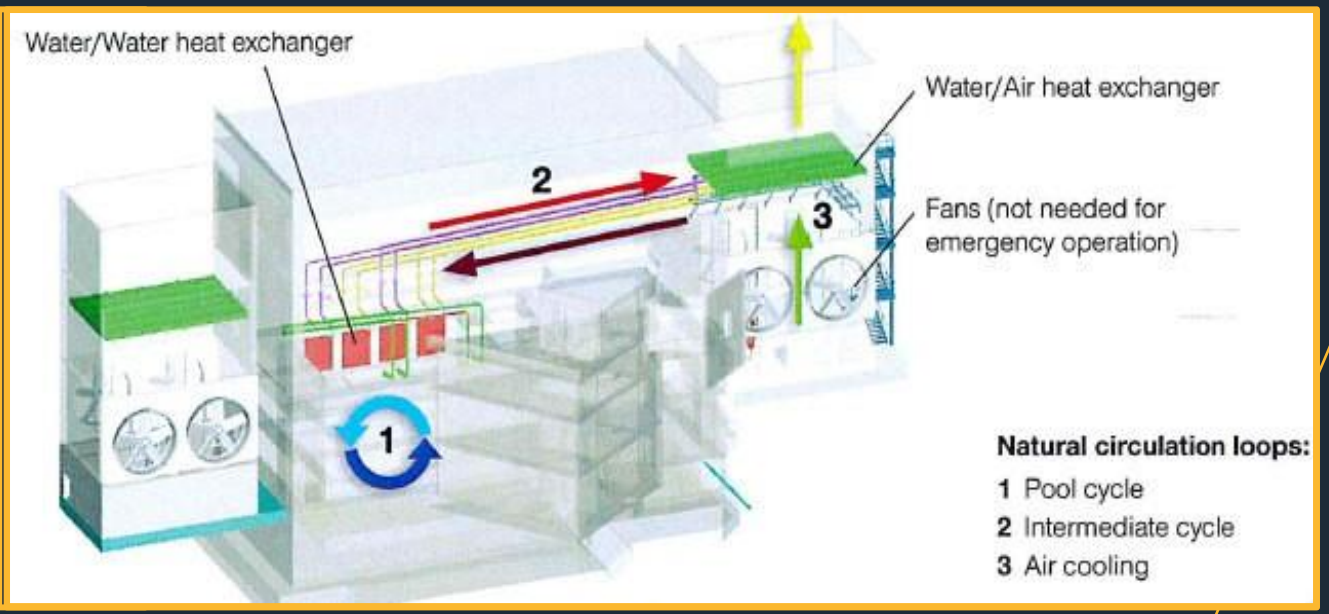
- Installed in **2015-6**, the dry emergency cooling system can be used in case seawater becomes unavailable to cool the plant's reactors and spent fuel pond (e.g. oil spill on the sea in the vicinity of the plant)
- Full conformance to the very strict requirements of Finnish Nuclear Authority STUK



MVM EGI

DRY COOLING IN NUCLEAR POWER PLANTS

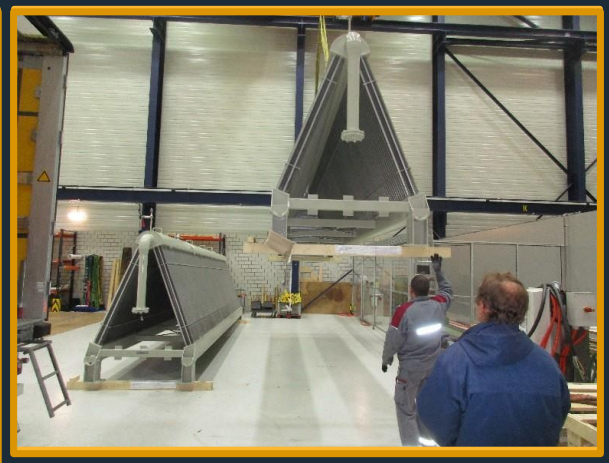
GÖSGEN NUCLEAR POWER PLANT
985 MW_e PWR
SWITZERLAND
SPENT FUEL PASSIVE HEAT REJECTION HEAT EXCHANGERS BY MVM EGI



- Installed in **2016**
- First-of a kind wet spent fuel storage facility with a passive heat removal system
- Full conformance to the very strict Swiss Nuclear Authority

DRY COOLING IN NUCLEAR POWER PLANTS

GÖSGEN NUCLEAR POWER PLANT
985 MW_e PWR
SWITZERLAND
SPENT FUEL PASSIVE HEAT REJECTION HEAT EXCHANGERS BY MVM EGI



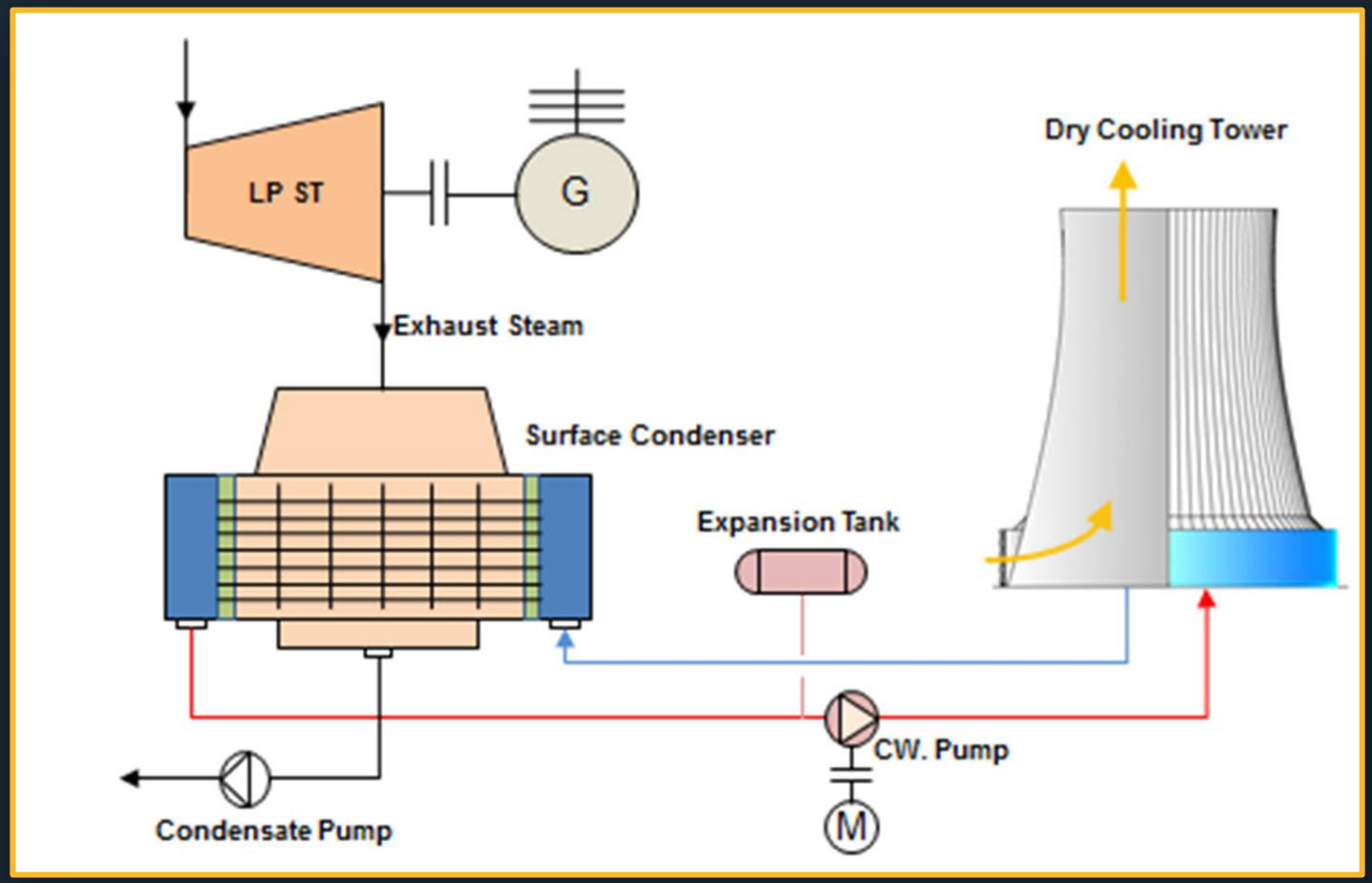
Unloading and installation of the pre-assembled passive coolers in Gösgen

AGENDA

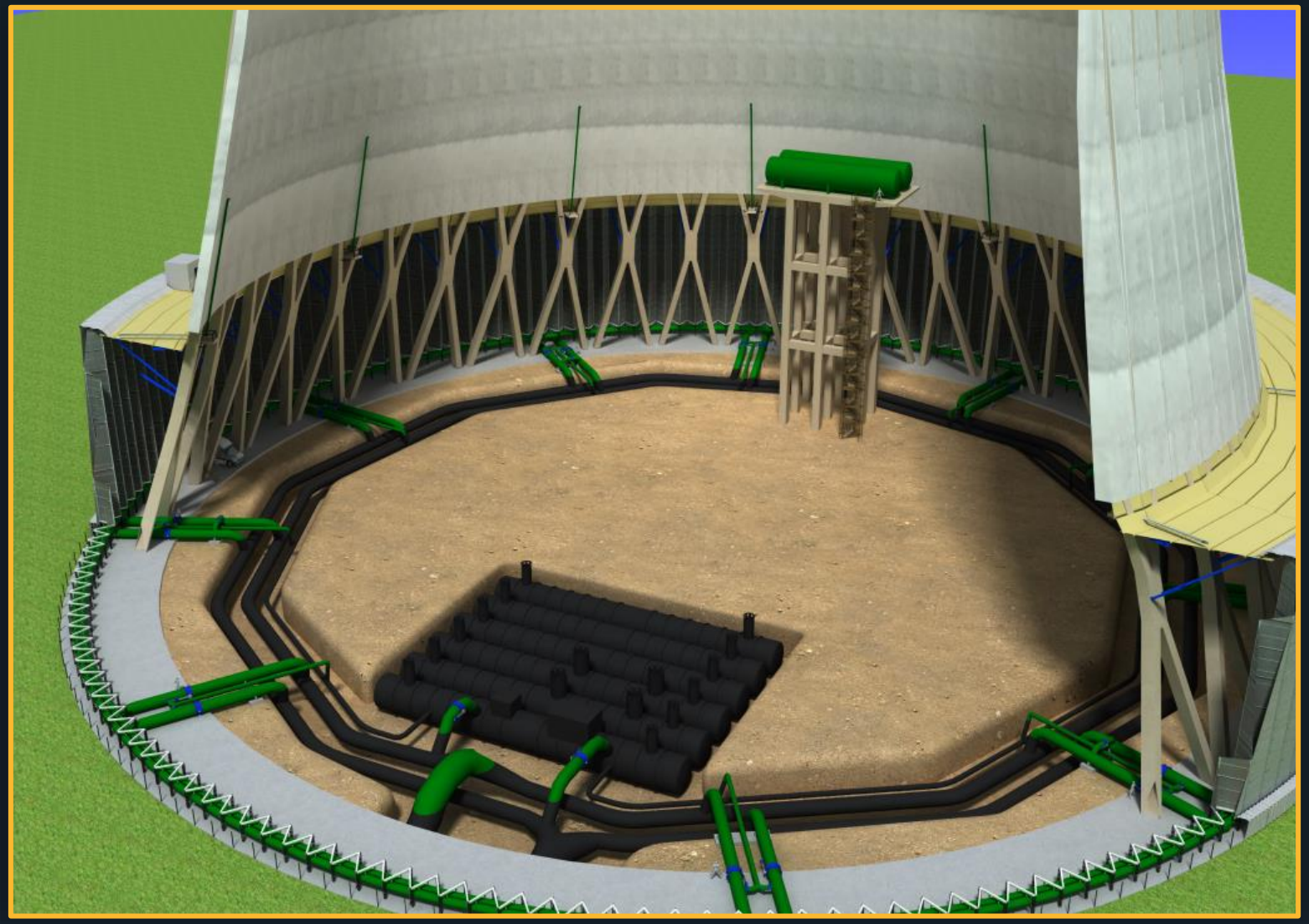
1. Brief Introduction
2. Select Cooling Systems
3. Dry Cooling References in Nuclear Power Plants
4. **COOLING SOLUTIONS FOR 1,000+MW NPP UNITS**

DRY COOLING GENERAL OVERVIEW

PRINCIPLE OF INDIRECT DRY COOLING WITH SURFACE CONDENSER



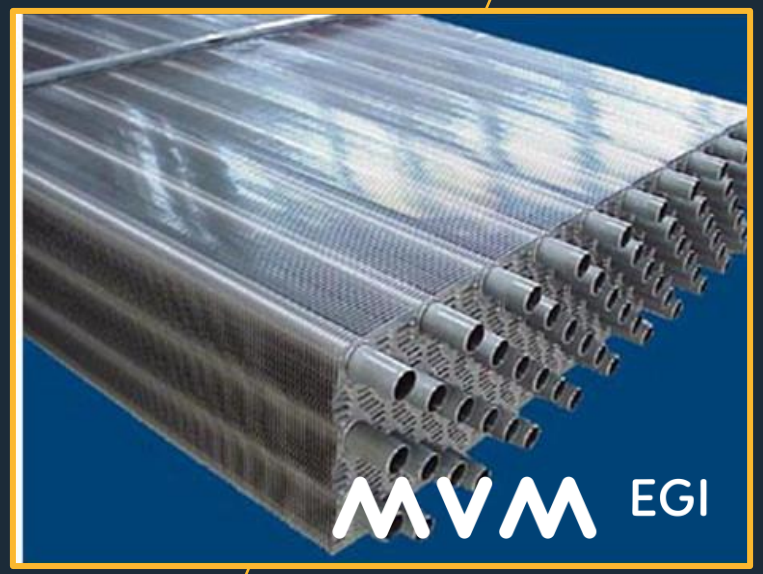
DRY COOLING TOWER ARRANGEMENT



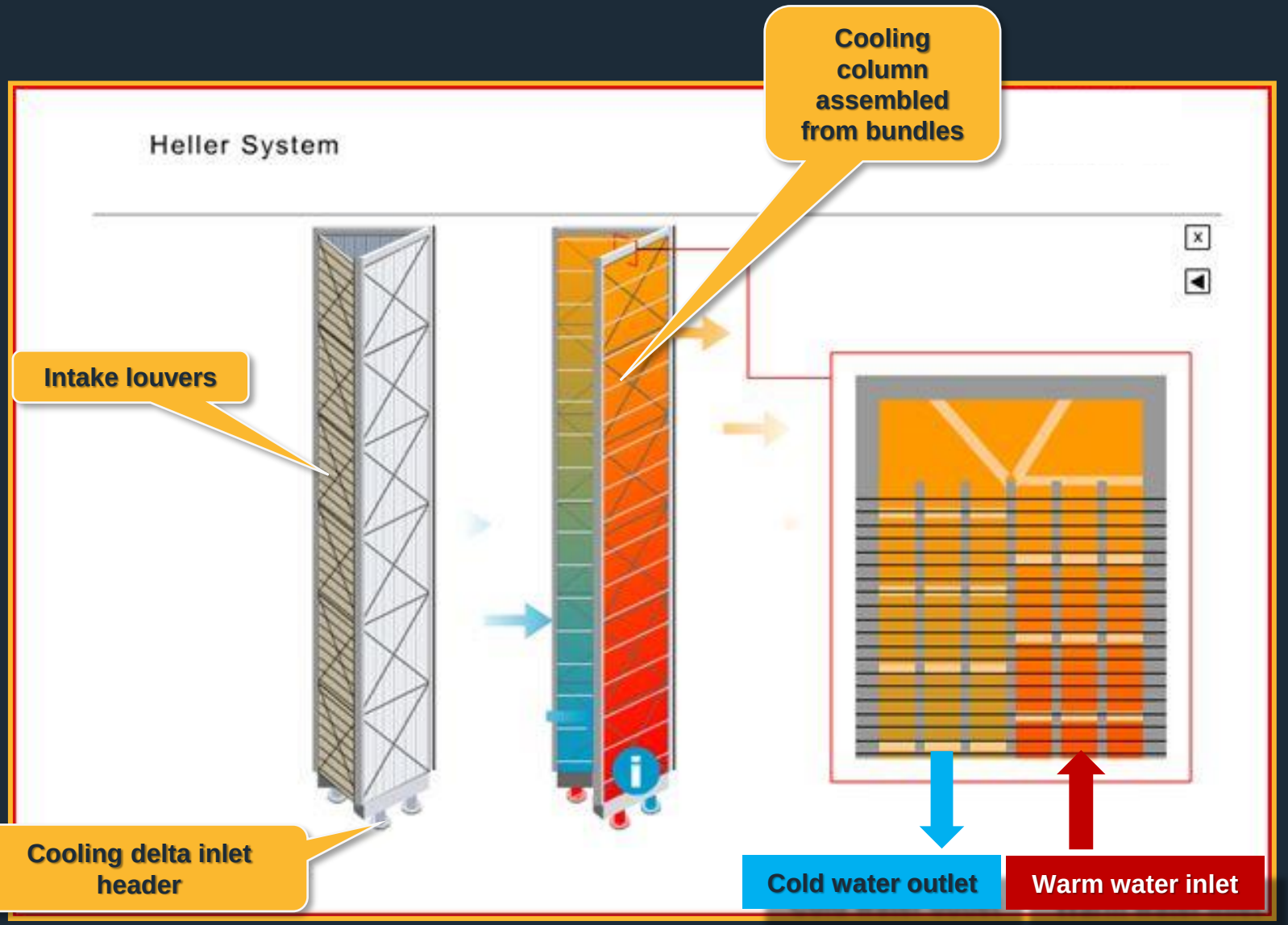
HEAT EXCHANGER DETAILS

CHARACTERISTICS:

- **single-metal all aluminum** avoids bimetallic corrosion; aluminum is inherently protected from atmospheric corrosion
- **hard fin, semi-hard tube** tube is expanded at full tube length exceeding its elastic range, creating a prestressed contact with the fins that ensures heat transfer that does not deteriorate with thermal cycling
- **fin distance** various options
- **cleanability** plate fin offers more efficient cleaning
- **lifetime** examples of 40-55 years with old plants still in operation



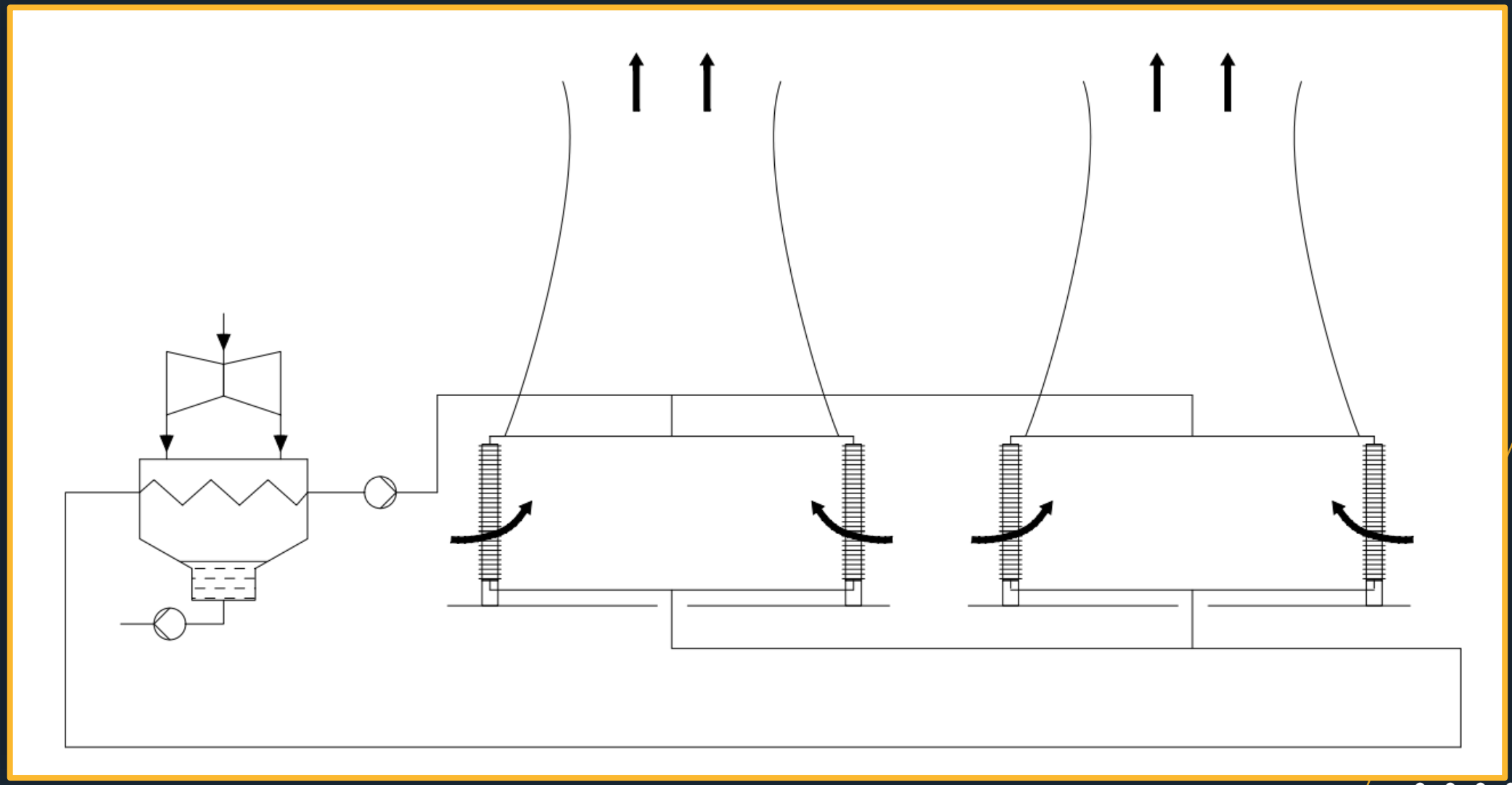
HEAT EXCHANGER DETAILS



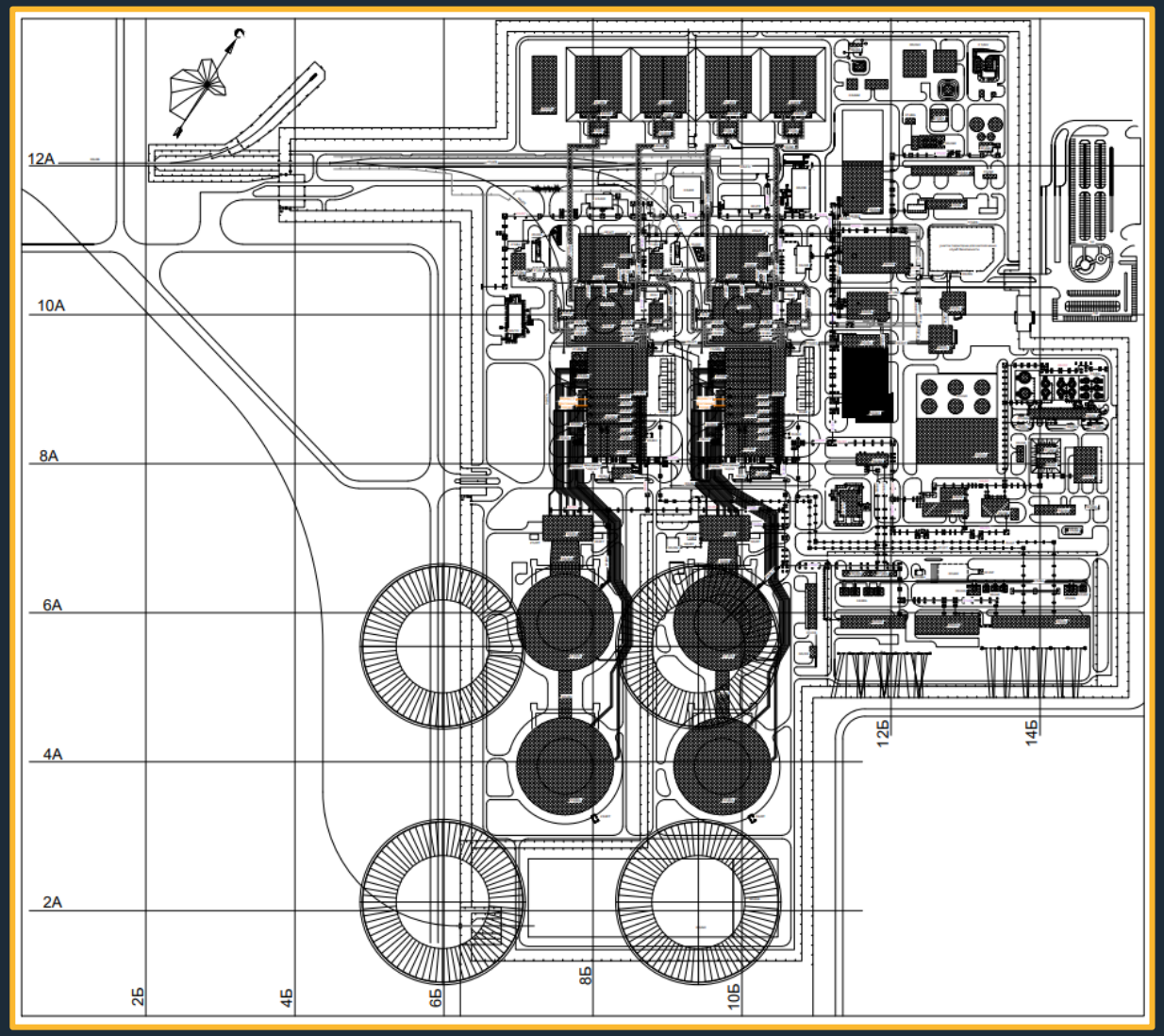
HEAT EXCHANGER CLEANING

- Semi-automatic delta cleaning system
- Works independent from the cooling tower
- One cleaning equipment serves all the cooling deltas around the cooling tower
- Use once a year (in spring), or twice if heat exchangers become dirty
- The washing equipment and the washing car move on fixed rails, controlled by the operator. On the washing car, a set of vertically installed nozzles are moved rotationally within the preset angle range by an electric motor.

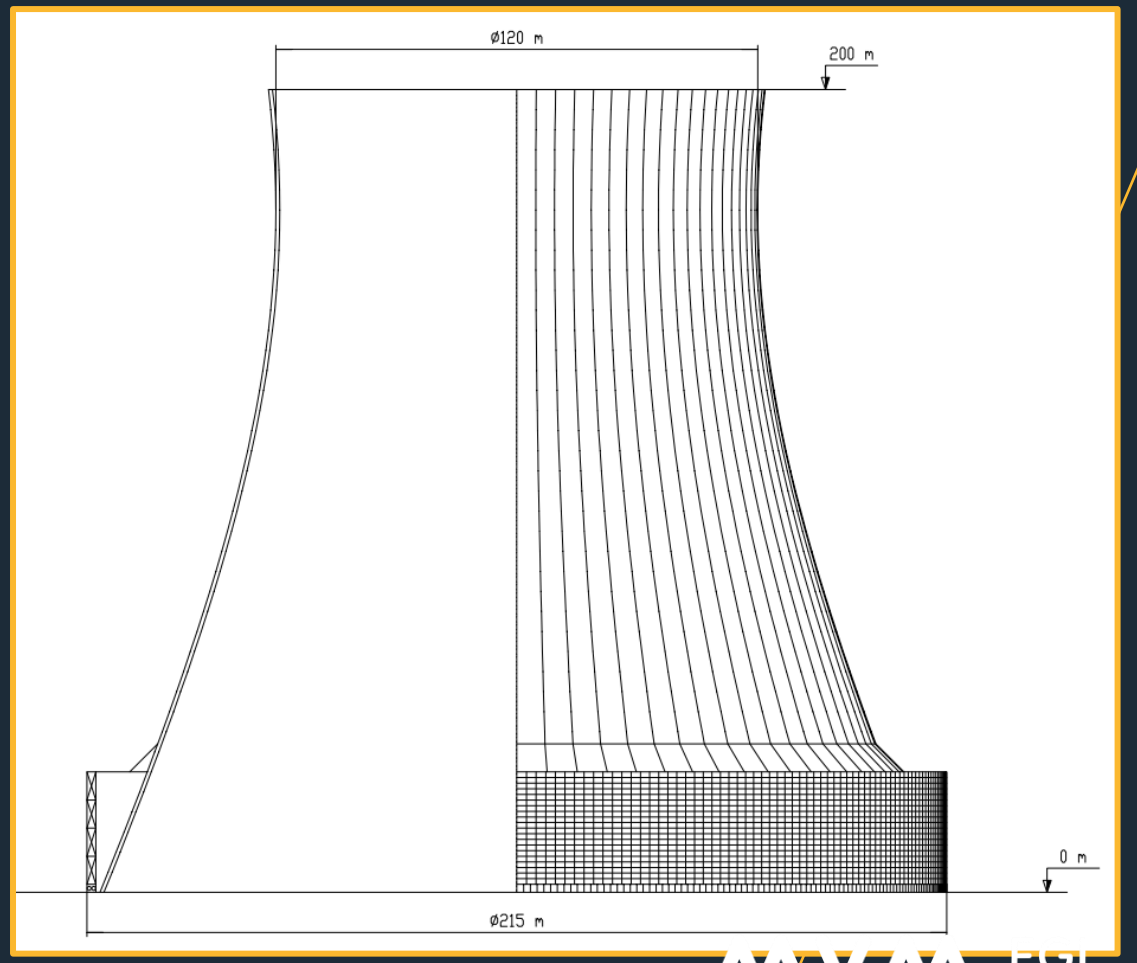
DRY COOLING FOR 1200 MW NUCLEAR PP



DRY COOLING FOR 1200 MW NUCLEAR PP

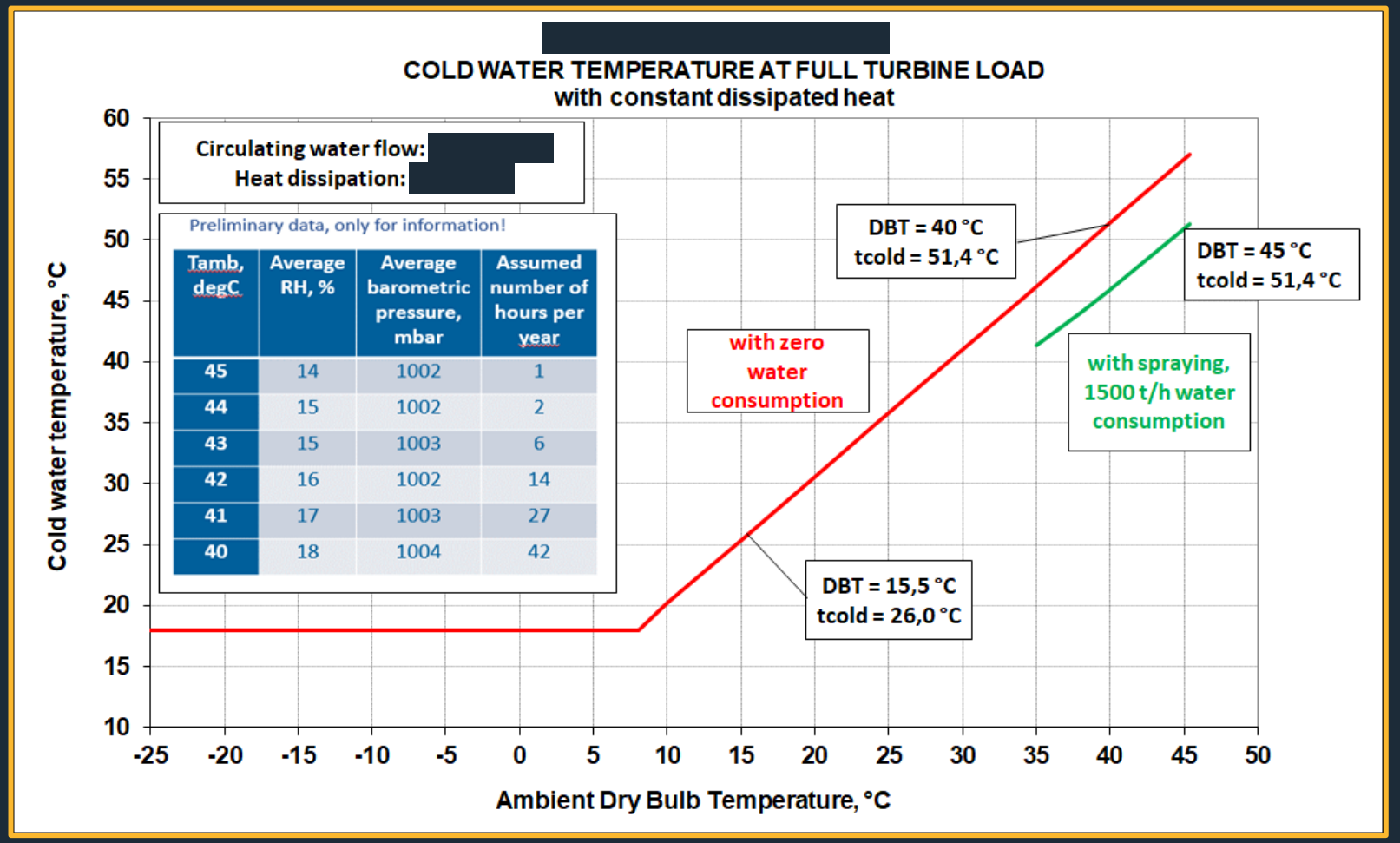


2x1200 MW_e UNITS



DRY COOLING FOR 1200 MW NUCLEAR PP

Effect of spraying on heat exchangers at warm summer ambients:



Design data:

- T ambient maximum = +45°C
- 4m/s wind speed at 10m level
- 51.4°C cold water at +40°C ambient in dry operation
- 51.4°C cold water at +45°C ambient sprayed operation

DRY COOLING FOR 1200 MW NUCLEAR PP

Effect of wind on cold water temperature:

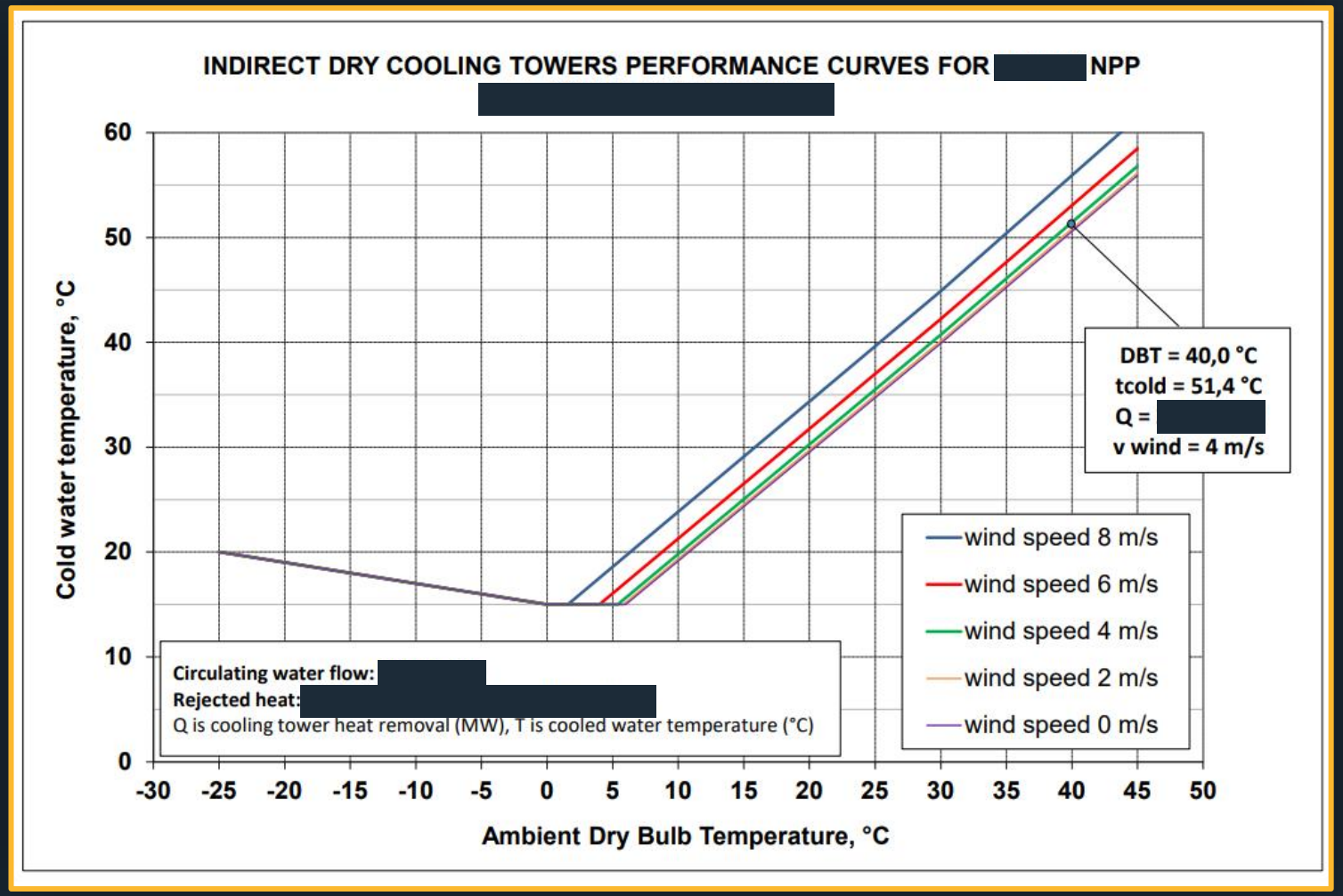
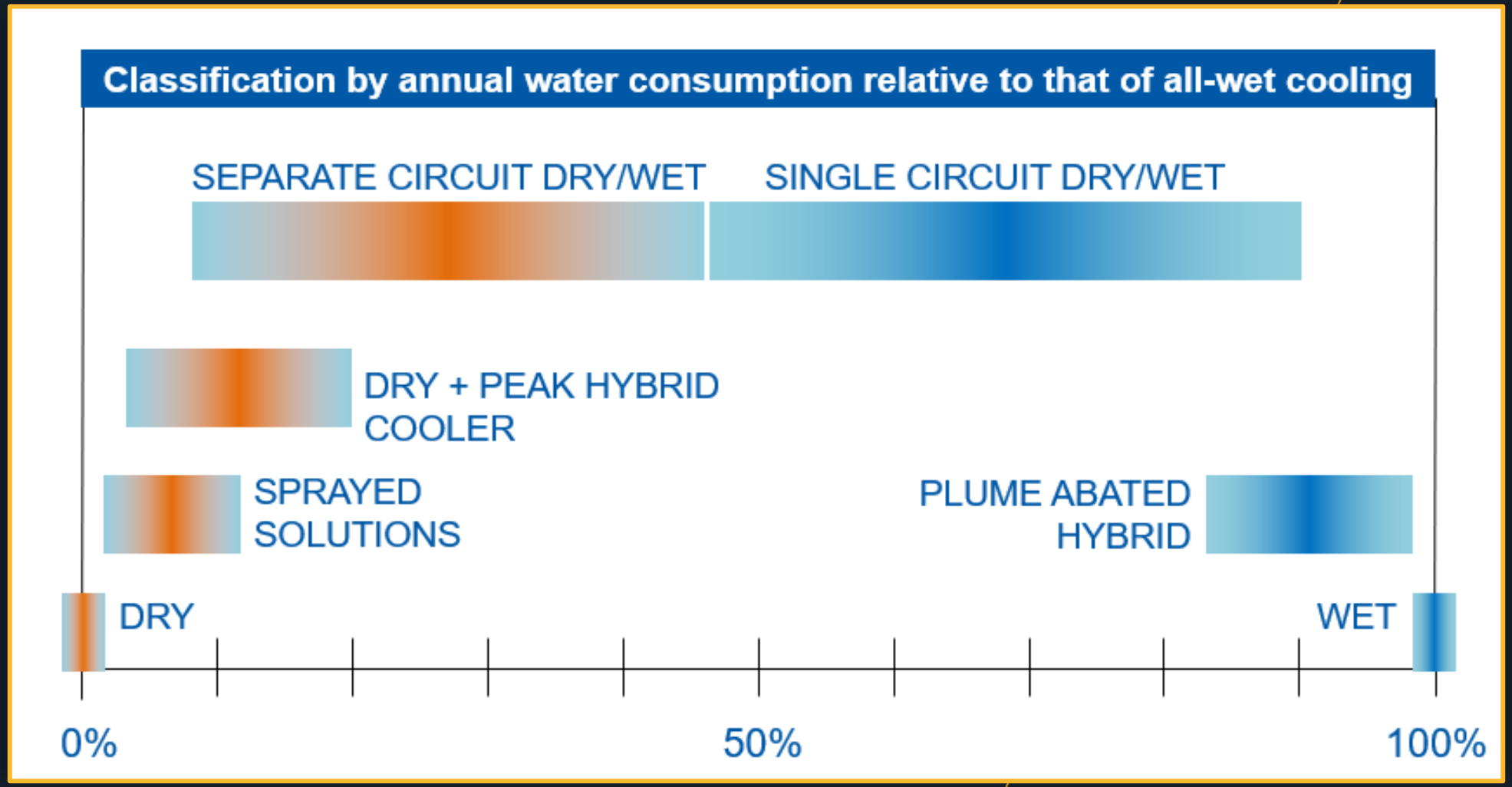


Diagram indicates dry operation only

WATER SAVING IN POWER GENERATION COOLING



WATER SAVING IN POWER GENERATION COOLING

DRY-WET COOLING FOR NUCLEAR POWER PLANTS

Why use dry-wet combinations for nuclear power plants?

Key benefits compared to wet cooling:

- **Significantly reduced water consumption**
- **Less emissions** (less plume into air, less blow-down water)
- **Flexibility for site selection** (higher independence from water resources)

Drawback compared to wet cooling:

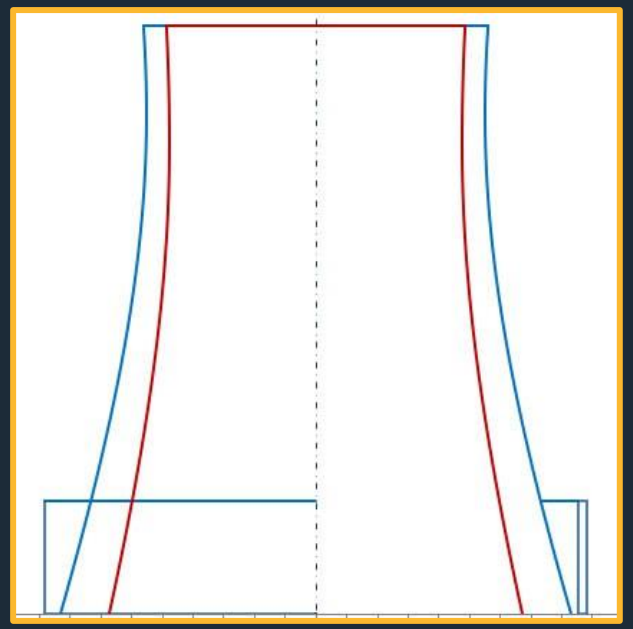
- **Slightly lower power generation** (~0.5% lower annually)

DRY-WET COOLING FOR 1200 MW NUCLEAR PP

COMPARISONS FOR 1200 MW NPP UNITS WITH DIFFERENT WATER AVAILABILITY

Compared cooling solutions:

Natural Draft Wet Cooling (WET)

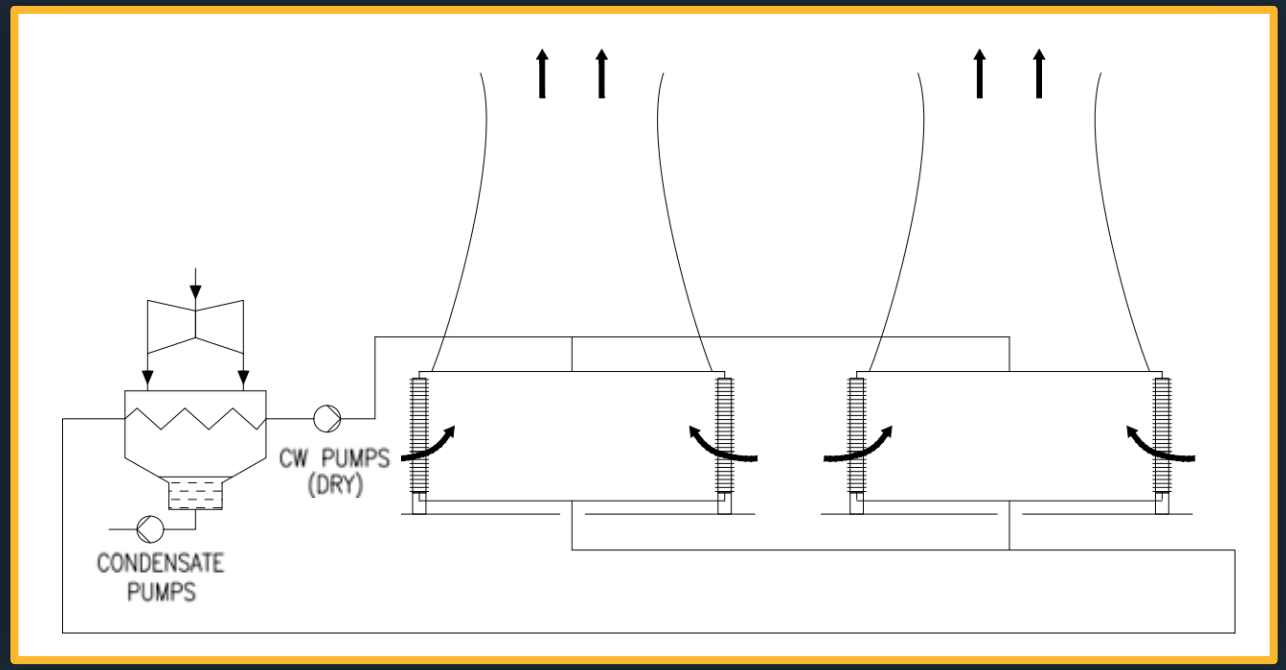


Dry – Wet Cooling (DRY-WET)

DRY-WET COOLING FOR 1200 MW NUCLEAR PP

CONFIGURATION EXAMPLE FOR DRY COOLING SYSTEM WITH SPRAYING AT PEAK SUMMER

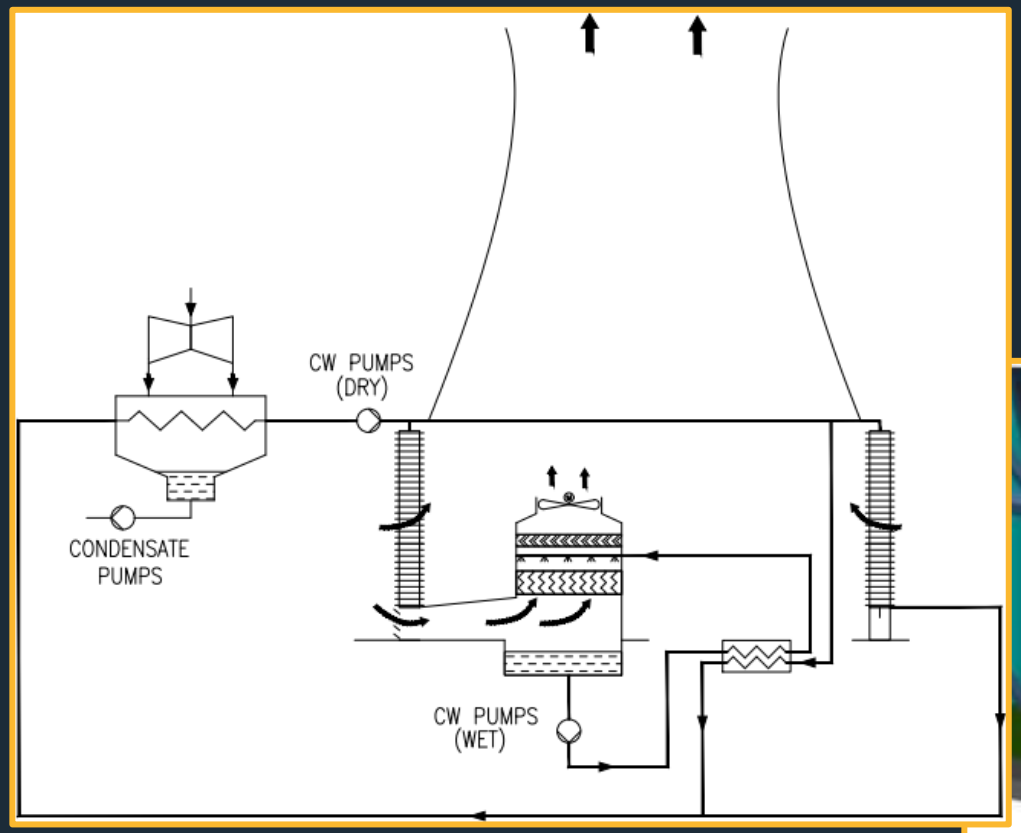
WATER CONSUMPTION ~5% (compared to all wet cooling) (2 towers per 1200 MW unit)

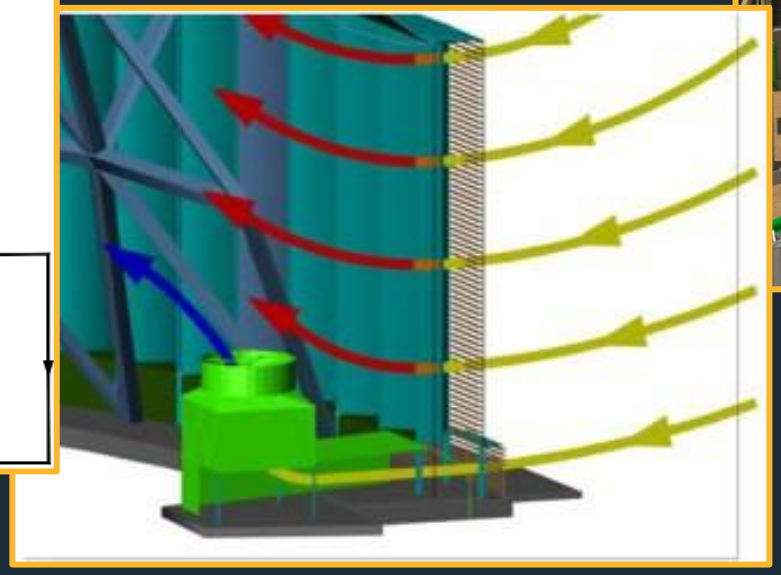


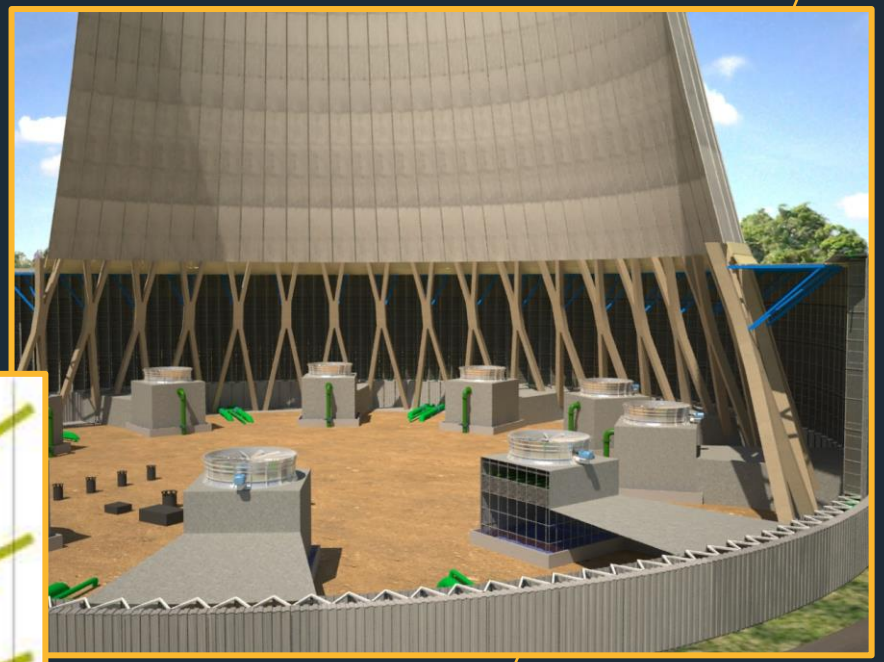
DRY-WET COOLING FOR 1200 MW NUCLEAR PP

CONFIGURATION EXAMPLE FOR 20-30% WATER CONSUMPTION DRY-WET COOLING SYSTEM

WATER CONSUMPTION ~20-30% (compared to all wet cooling) (2 towers per 1200 MW unit)



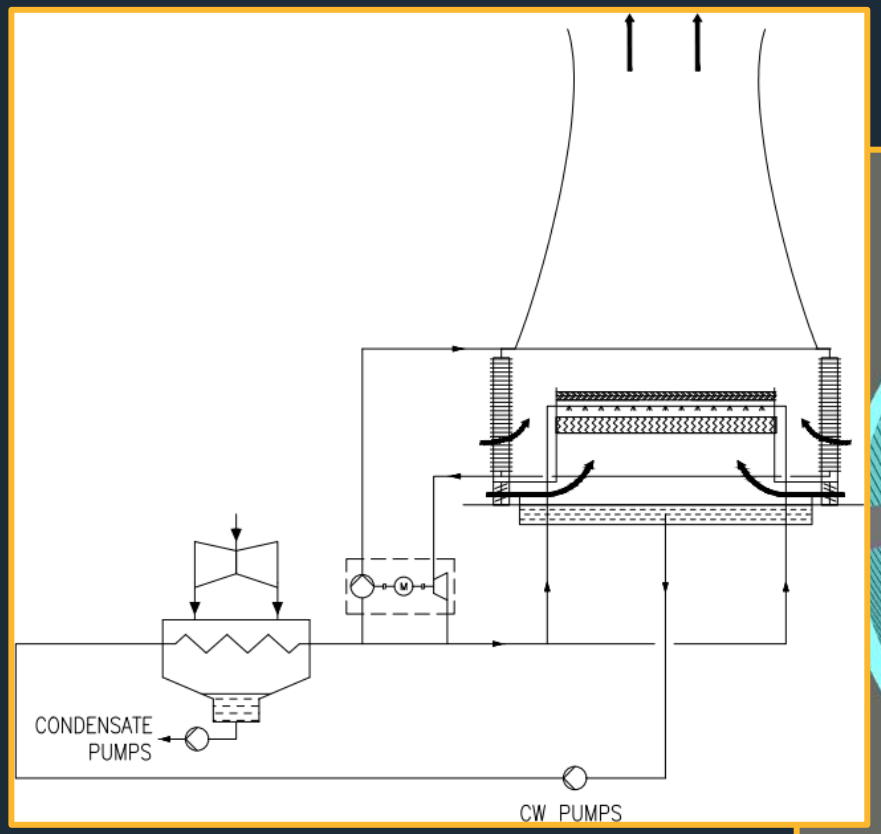


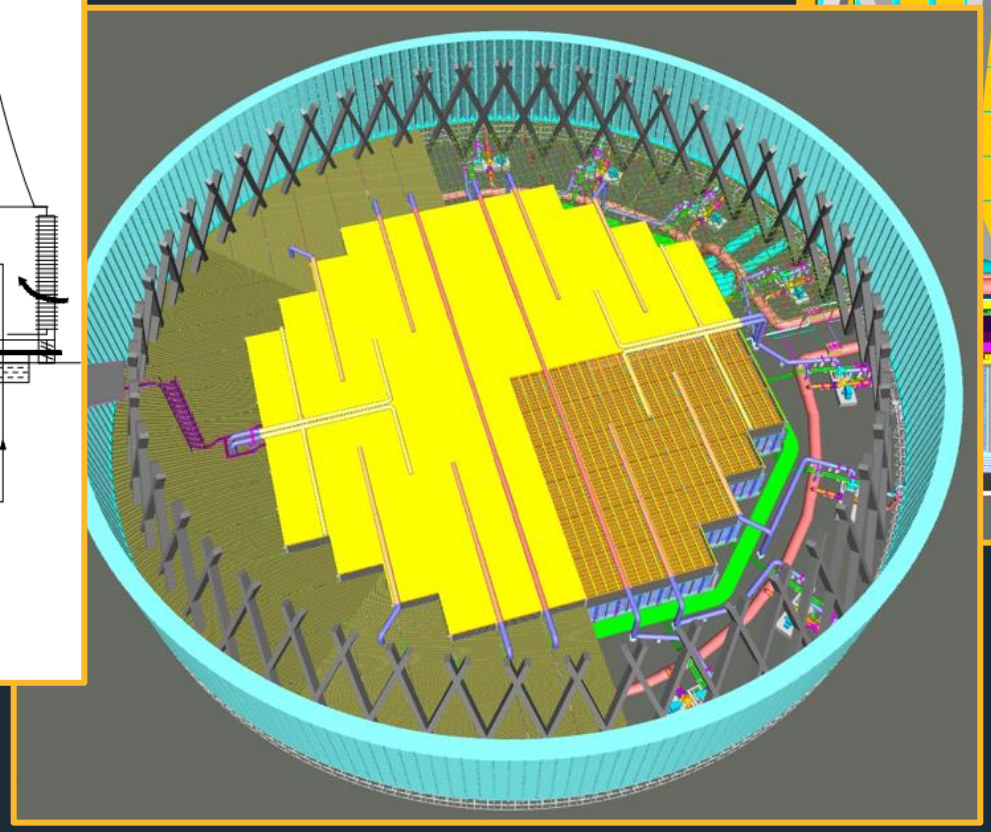


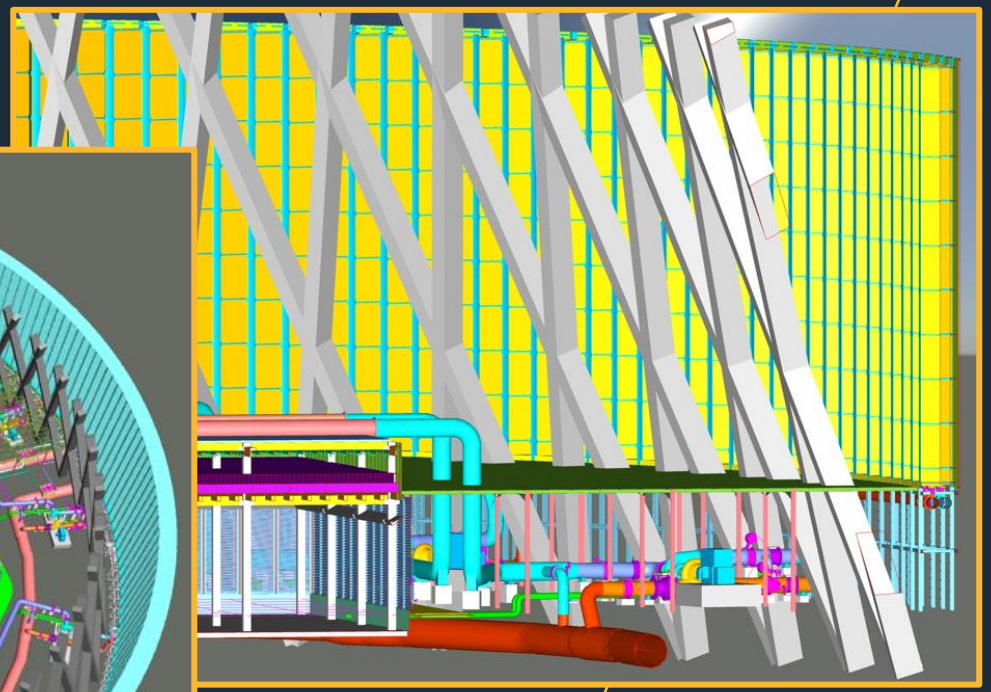
DRY-WET COOLING FOR 1200 MW NUCLEAR PP

CONFIGURATION EXAMPLE FOR 50% WATER CONSUMPTION DRY-WET COOLING SYSTEM

WATER CONSUMPTION ~50% (compared to all wet cooling) (1 tower per 1200 MW unit)







DRY-WET COOLING FOR 1200 MW NUCLEAR PP

ARRANGEMENT EXAMPLE

CAN 320 MW TPP

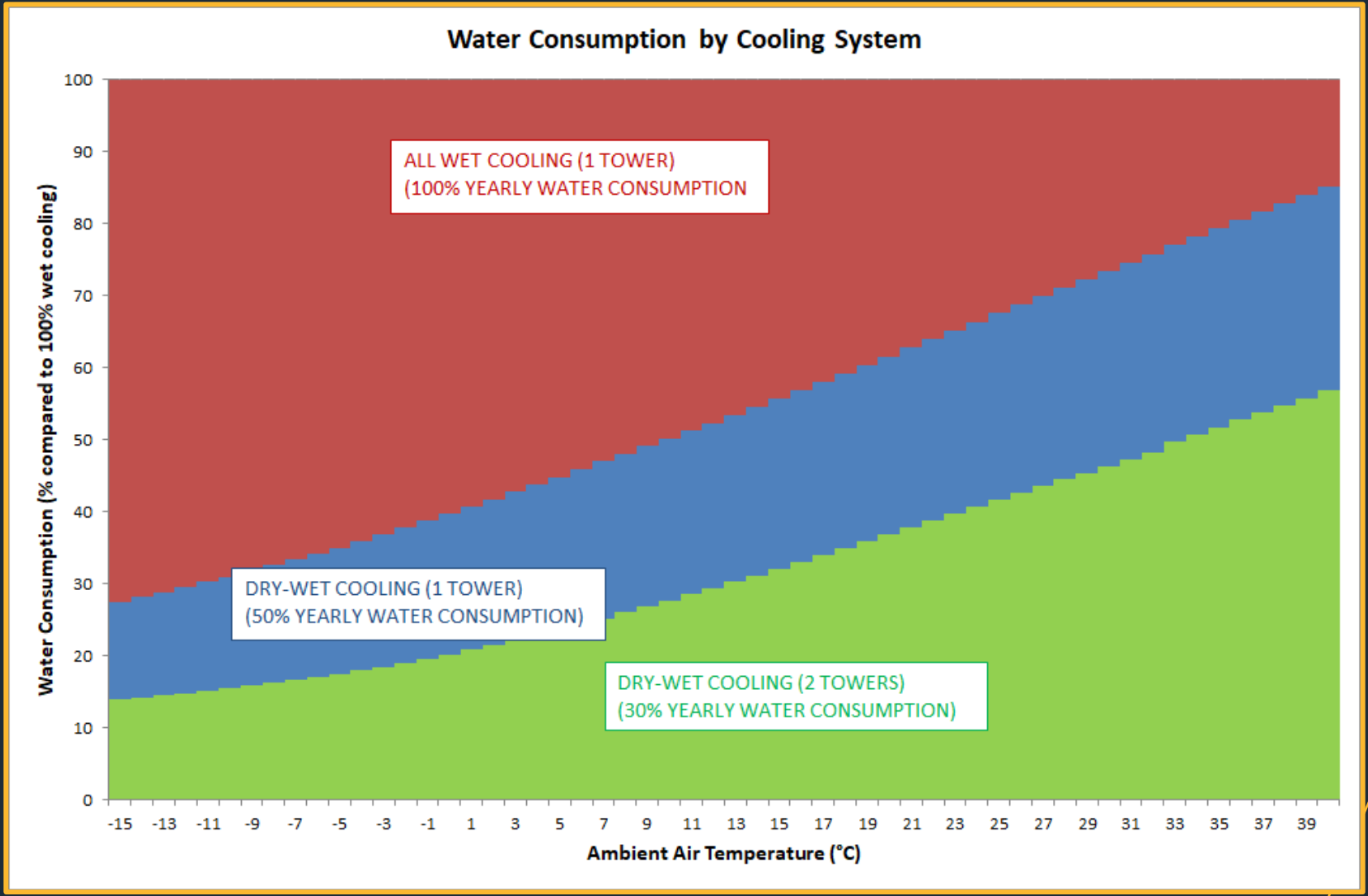
BURSA 1,200 MW CCPP

DRY-WET COOLING FOR 1200 MW NUCLEAR PP

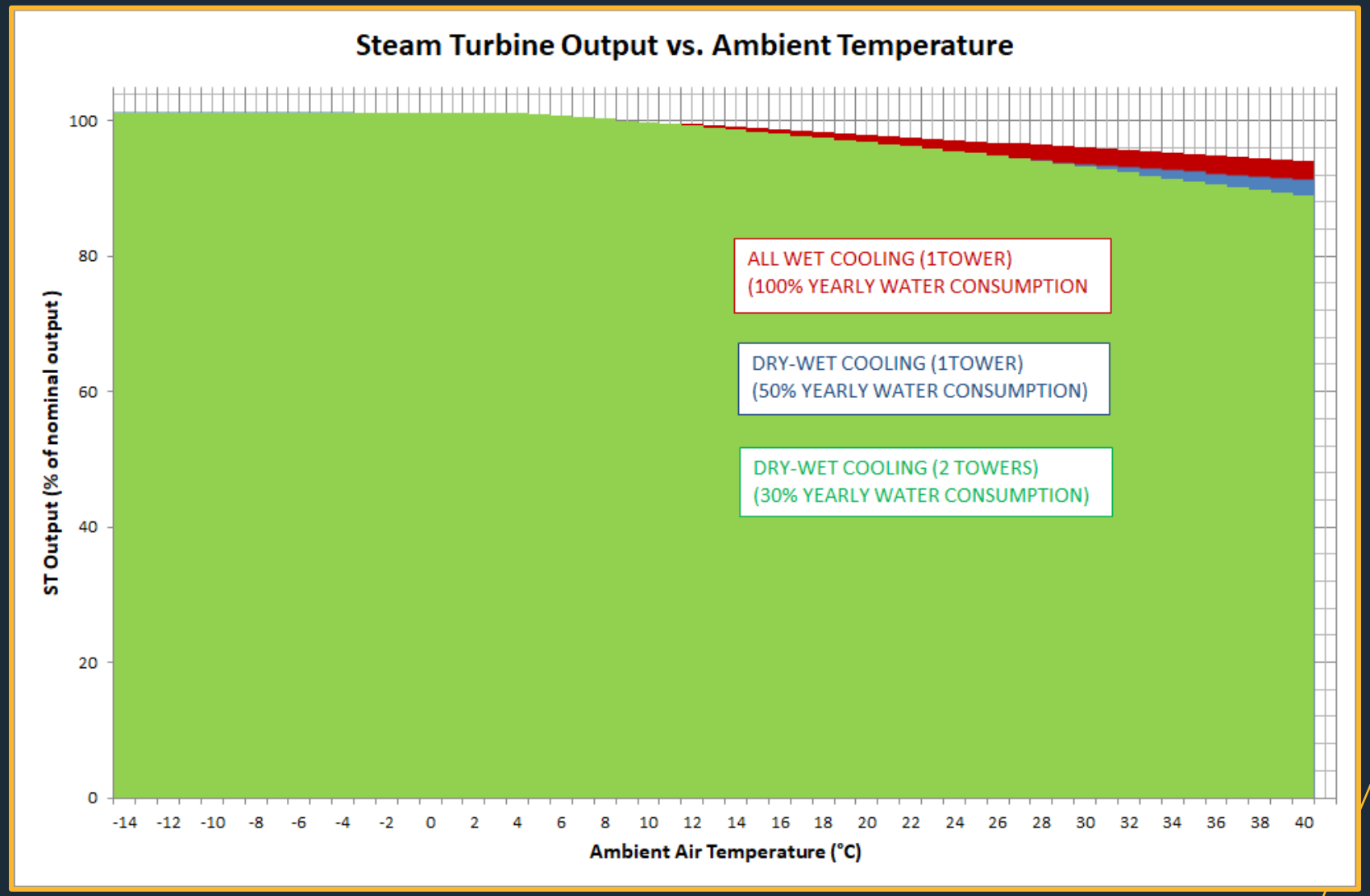
ARRANGEMENT EXAMPLE

TUFANBEYLI 450 MW TPP

DRY-WET COOLING FOR 1200 MW NUCLEAR PP



DRY-WET COOLING FOR 1200 MW NUCLEAR PP



CONTACTS

MVM EGI Zrt.

www.mvmegi.com

E-mail: info@mvmegi.com

Tel.: +36 1 225 6100

Office: Irinyi József str. 4-20,
Budapest, Hungary 1117