



maxwell™

In partnership with:



## Heat Transfer Fluid

**"A revolutionary cooling solution for the challenges  
of a warming planet"**

[www.emissis.com](http://www.emissis.com)

Maxwell™ is an innovative heat transfer nanofluid additive which dramatically improves the energy efficiency of hydronic cooling & heating systems. A drop in heat transfer fluid for water based cooling & heating systems that improves heat transfer by up to 15%.



## Applications

### Chillers

Maxwell™ typically increases heat transfer in the chiller evaporator by 12.5 % to 15%, reducing compressor lift (work) and electrical energy consumption.

Maxwell™ can also be used in a closed condenser circuit with a closed cooling tower, which provides for a similar increase in efficiency on the other half of the chiller's refrigerant cycle. The initial investment in a heat transfer fluid for a water-based HVAC system is insignificant compared to the cost of chillers, pumps, piping and other system components. However, an HVAC system's performance, longevity, and long-term maintenance costs can be significantly affected by the heat transfer fluid that is used. For air or water-cooled chiller systems, Maxwell™ performance increase will result in more efficient equipment selection, reduced equipment room (MER) size, electrical service sizing and more.



### Heat Pumps

Maxwell™ increases the heat transfer from the outside air or condenser fluid to the system fluid through the heat exchanger. This increase in heat transfer reduces compressor lift by 12.5 % to 15%.

In colder climates, many HVAC systems add glycol to the base fluid for freeze protection, which has the affect of reducing the thermal energy transfer which is referred to as the "glycol penalty". Maxwell™, by increasing the thermal energy transfer, will substantially offset this "glycol penalty" in existing buildings. Additionally, when Maxwell is implemented during the design phase of new buildings, it can materially reduce the size of HVAC equipment, again reducing costs.



### Energy Recovery Systems

Energy recovery systems are designed to save energy and reduce heating and cooling loads on an HVAC system. In the typical situation where no cross-contamination is required, a run-around loop is the system of choice.

When added to the run-around loop, Maxwell™ increases heat transfer at the exhaust fan recovery coil and air handler pre-heat / cool coil by 15% or more allowing the fluid pump to run on lower flow rate/power. Maxwell™ offers significant heat transfer improvement, energy savings, carbon emissions reductions and improved equipment performance in energy recovery systems.



### Pumps, Fans & Terminal Units

Maxwell™ increases thermal energy transfer throughout the hydronic system. Fan coil and air handling units, system pumps and supply fans, can operate on lower power without compromising comfort.



## What is Maxwell™

Maxwell™ is an engineered suspension of sub-micron aluminum oxide particles in a base fluid of water or water/glycol ("nanofluid"). Maxwell™ is a drop-in additive for cooling and heating systems, that works by enhancing heat transfer and thereby significantly reducing energy consumption and carbon emissions.

Maxwell™ is named after James Clerk Maxwell the pioneering Scottish scientist who in the late 19th Century discovered that adding metallic particles to water improved thermal energy transfer, thus creating the world's first heat transfer fluid.

Over a century later, Maxwell™ is our patented implementation of this discovery, allowing systems using closed hydronic loops to benefit from the thermal properties of stable suspensions of metallic nanoparticles.



## How Maxwell™ Works in a Chilled Water System

Water (or a water/glycol mix) is circulated from the chiller in a closed evaporator loop to Air Handling Units ('AHU'). Maxwell™ increases the transfer of heat in the chiller evaporation cycle, reducing compressor "lift" or work and thus, the consumption of electrical energy.

Maxwell™ also increases thermal energy transfer in the AHU coils, which allows for higher chilled water set points, and lower fluid and air flow rates through pumps and fans, reducing their electrical power consumption. Maxwell™ can also be used in a closed condenser circuit but not with an open cooling tower.



## Average Payback Period

Because of Maxwell's efficiency, the cost of a typical installation is generally paid back within 1 - 2 years, depending on the utilization rate of HVAC equipment and the local costs of electricity/natural gas.



## Benefits of Maxwell™

Significant heat transfer improvement in cooling and heating systems which results in:

- Substantial energy savings.
- Carbon emissions reduced proportionally to reductions in energy consumption.
- Improved equipment performance, reducing maintenance requirements.
- Expanded capacity of existing equipment that can increase performance and output.
- The ability to use smaller, less costly and more efficient equipment in the design process of an HVAC system.
- Long useful life (10+ years), after which Maxwell™ can be recovered from the System and is fully recyclable.
- Wide operating temperature range.
- Maxwell™ is non-corrosive and non-toxic.



## Sustainability Impact of Using Maxwell™

With companies trying to meet stringent sustainability targets, Maxwell™ is a simple, low-cost method for delivering a meaningful impact across a wide range of applications and industries.

# Emissis supported by our partner Insynch are proud to be able to deliver the Maxwell™ cooling solution across the world

## Industries Benefitting from Maxwell™:

### The Solution

- Patented Innovative heat transfer nanofluid additive
- Effective in any closed - loop water or water/ glycol - based system
- Suitable for cooling, heating and process applications
- comprises only 2% of total system fluid volume

### Delivering Instant Results

- Up to 15% energy reduction
- Competitive 1 - 2 year payback period
- Lower carbon emissions
- Increase in HVAC system capacity

### Simply & Safely

- Guaranteed lifespan of 10 + years
- No downtime ... simple drop in additive
- Non corrosive and non toxic

### Intelligent Monitoring (My Maxwell)

- Cloud monitoring portal that measures in real time energy savings and emissions



### Office Buildings

Chillers, heat pumps and associated mechanical systems will operate more energy- efficiently with Maxwell™ added to the system. Maxwell™ is a simple, instant and cost-effective way for building owners and property managers to reduce energy costs and meet regulatory green initiative targets.



### Data Centers

Global energy demand for data centres exceeded 200 terawatt hours in 2021. Since cooling is the main component of data centre energy consumption, Maxwell™ can play a significant role in reducing the power consumed by chillers, pumps, and fans, especially in warmer climates where "free cooling" is not available.



### Health Care

Hospitals, research and pharmaceutical facilities require high quantities of outside air intake and generally operate 24/7/365. Maxwell™ allows chillers, heat pumps and energy recovery systems to operate more efficiently, reducing energy costs and maintenance requirements while extending equipment life.



### Manufacturing

Maxwell™ can be used in HVAC systems that provide environmental cooling and heating to manufacturing areas. Certain manufacturing processes may be able to use Maxwell™ in closed chilled water loops that serve production equipment requiring cooling.



### Warehousing

Most warehouses and logistic centres use a combination of chillers and adiabatic cooling. Any closed loop hydronic systems can use Maxwell to reduce the energy consumption of compressors, pumps and fans.



### Residential

Traditional closed-loop chilled water cooling and hot water heating systems can benefit from Maxwell™. For water-source heat pumps, Maxwell can be added to the central condenser fluid loop to reduce power consumption by the compressors and lower fluid flow rates.

# Case Studies

## ARAMCO INSTALLATION CS BUILDING 1900, DHAHRAN, KSA

### Pilot Implementation -Building 1900:

12,000 sq ft mixed use, three-story building, cooled by two 60-ton air-cooled chillers (24/7/365). Local electricity costs are US\$ 0.08 per kWh.

- Improvement in chiller energy efficiency of 16.9%
- Overall system energy savings of 15%
- Payback Period of 2.2 years (annual ROI 46% over 10 years)

### Phase II Implementation:

Maxwell™ has been included in Aramco's "Proven Technology Database" on the Board of Engineers Portal HTMS, through Saudi Aramco Energy Ventures, are now engaged in the roll-out of Maxwell with Aramco specifically and the KSA more generally:

- First three HVAC installations with Aramco identified. First industrial application for Aramco in planning. Industrial application for SABIC also in planning. Working with Tabreed (leading District Cooling provider in GCC) on demonstration in KSA.
- Kingdom-wide implementation would result in energy savings of \$600M and CO2 savings of 3M tons annually.

### Assessment of Roll-out plan:

Aramco engineers conducted a company-wide evaluation of the cost / benefit for implementing Maxwell™ in all non-industrial closed-loop chiller systems (totaling 63,000 tons).

- Aramco would achieve annual energy savings of US\$ 4.64M with an installation cost of US\$ 10.2M
- CO2 savings est. 25,000 tons annually

## J&J INSTALLATION MENTOR BUILDING, IRVING, TX

### Pilot Implementation – Mentor Building:

- J&J's Mentor Building is a single-story, 60,000 sq ft production facility with two 210-ton parallel air-cooled chillers, operating 16/7/365. Local electricity rates are \$0.06 kWh.
- The reduction in energy consumption and improvement in operating efficiencies achieved with Maxwell™ resulted in:
  - An IRR of 45% and a Payback Period of under 3 years
  - Increased operating efficiencies and improved system capacity.
  - Allowing J&J to take one chiller off-line for all, or substantially all of the year.
- Other highlights of the J&J installation:
  - Reduced energy consumption of 4.6 M kWh resulting in a reduction in CO2 emissions of 2,000 tons

### Pilot Implementation – Mentor Building:

- Reduced system flow rates resulting in lower pumping power and energy consumption
- Reduced maintenance costs and longer equipment life, extending chiller replacement by 5 years
- Maxwell™ and the results of the installations at Mentor were presented to J&J's Global Sustainability Group in Mar '22

## REGENERON INSTALLATIONS BUILDINGS NO. 2 & 4, CORP. HQ, NY

### Pilot I & II – HQ Building 2 & 4:

- Two multi-story, 60,000 sq ft research facilities with rooftop Energy Recovery Units ('ERU'), operating 24/7/365
- The energy improvements resulted in a 22% increase in thermal energy recovery and a reduction of 13.6% in energy consumed by the circulating pumps

### Implementing Roll-out Plan:

Next installations for Regeneron's HQ are in planning:

- 3,800 L (\$25k) secondary Chilled Water System. Installation in May '22
- Additional secondary Chilled Water System loops of 24,000 L (\$159k)
- Stand-alone Air-Cooled Chiller Systems of 30,000 L (\$212k)

2023 Installations under discussion are:

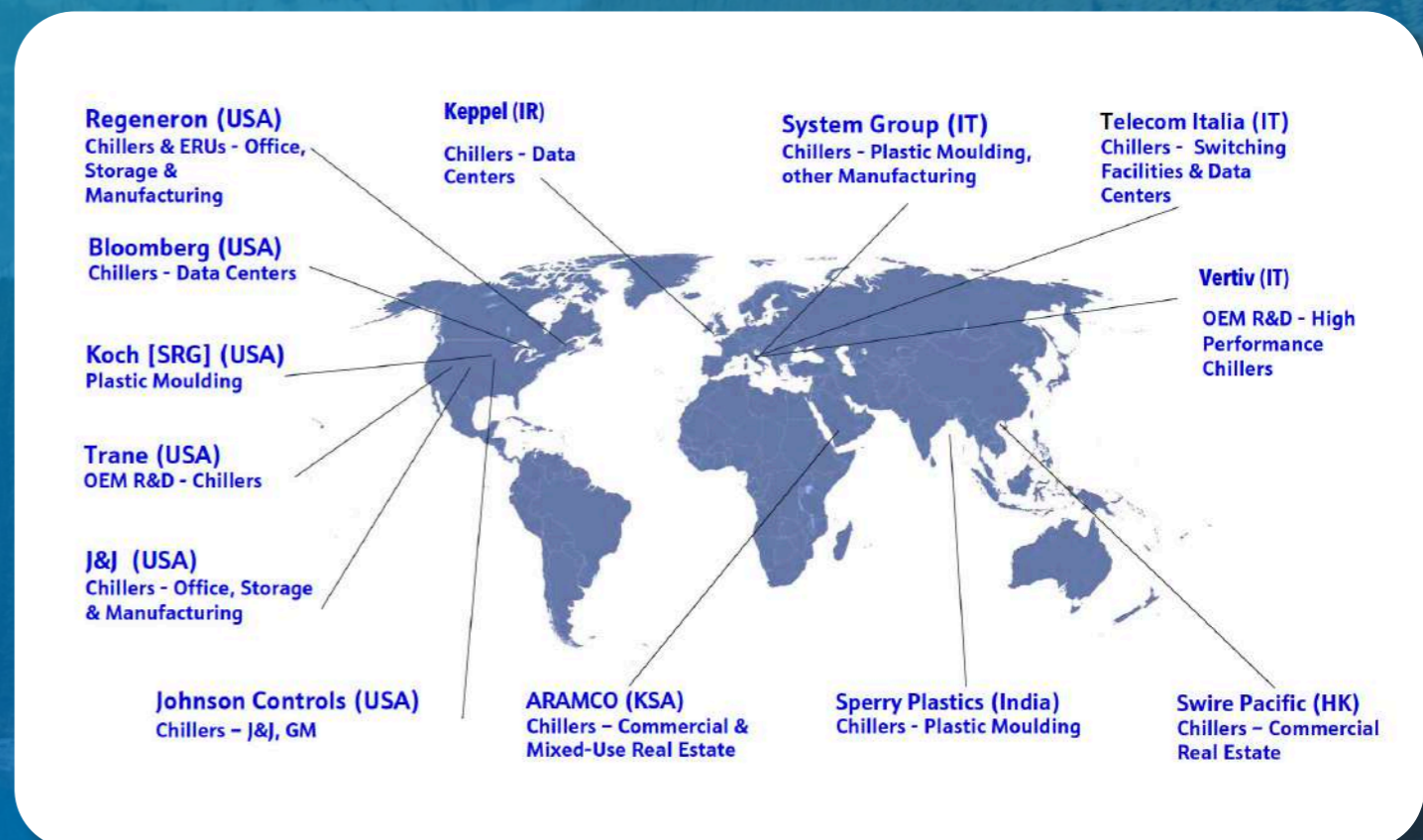
- 151,000 L (\$1,060k) Central Chiller primary cooling loop
- 76,000 L (\$530k) Central Heating loop

Potential Maxwell™ sales at Regeneron's HQ Campus of \$2M, with an estimated payback period of 3 years

Regeneron intend to convert the Central Chiller primary cooling loop from water-only to water/glycol with Maxwell™:

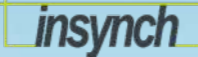
- Objective is to negate the "glycol penalty" and dramatically reduce O&M costs during winter operation.
- This application will be of significant interest to users in colder climates.

## Geographical Coverage





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## Next Steps:

To assess the savings potential and ROI that Emissis Maxwell can deliver for your organisation the following data is required to conduct an initial assessment:

### 1. System & Site info to complete initial desktop assessment:

- Type and location of facility (Pharmaceutical, Hotel, Data Centre, Office, etc)
- Brief description of the chiller (Chiller, heat Pump, Energy Recovery Unit)
- Manufacturer, model number and size of Chillers or Heat Pumps
- Square footage of site/facility

### 2. Additional Data that would be required once the assessment has been completed:

- Description of load served by the circuit
- General sequence of operations the system (cooling/heating)
- How many litres of fluid are used in the circuit
- Manufacturer and model number of the circulating pumps including type of pump seals
- Composition of system fluid including approx % of glycol (PG or EG)
- Provide small sample of system fluid for detailed analysis by HTMS (1 or 2 litres only)
- Chiller/Heat Pump operating schedules
- Temperature set points for operation of system components
- Commissioning or start up reports on equipment
- Full set of mechanical drawings, equipment schedules
- Photos of the plant/mechanical room
- P & ID's for the plant
- Any historical data on performance

**System & Site Data -> Desktop Assessment ->  
Detailed Data -> Site survey -> Energy Reduction proposal**

Emissis Maxwell in partnership with Insynch Energy services are an authorised Maxwell distributor

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