SARMA SARV AHURA
COOLING MACHINES

ENERGETIC AND ECONOMIC COMPARISON OF HYBRID AND CONVENTIONAL CHILLERS

AHWAZ OFFICE BUILDINGS
CONCENTRATING PROJECT

TECHNICAL PROPOSAL

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Document Subject: TECHNICAL PROPOSAL					
Company Name	**Author**	**Customer's Name**	**Purpose of Doc.**	**Requested Prod.**	**Final approval**
Sarma Sarv Ahura ltd.	Sarma Sarv Ahura engineering group		TECHNICAL PROPOSAL	Air Cooled Chiller	CEO

HYBRID SYSTEMS

AHWAZ OFFICE BUILDINGS CONCENTRATING PROJECT

The manufacturing of conventional compression chillers is very easier than hybrid systems because of the easier design and fewer installation problems of such machines. But benefits gained by this technology are so obvious in the final power consumption and economic aspects.

The current analysis is aimed to do a better comparison between hybrid and conventional technologies in compression chillers in energetic and economic terms.

This study shows that hybrid technology is more efficient than conventional air-cooled chillers, both in energy, economy and pollution points of view.

Introduction:

1. The analysis contains data to have a proper comparison between hybrid and typical air-cooled chillers.
2. In order to gather a comprehensive perspective, two climate circumstances are considerd.
3. Two chillers are considered with two separate refrigerant circuits, equipped with screw compressors.

Methods:

In order to have a correct evaluation over energy consumption values, two methods of energy efficiency analysis are considered: EER[1] and ESEER[2]. The whole comparison between the two systems is based on these two criteria.

The basis of ESEER calculation has been brought in the Table below:

[1] EER: Energy Efficiency Ratio, this parameter defines the energy efficiency of liquid chiller under standard conditions, normally available in any chillers technical cataloque.

[2] ESEER: European Seasonal Energy Efficiency Ratio, it defines the average seasonal energy efficiency under the four load conditions and with decreasing air/water temperatures to condenser.

Chiller steps, %	Condens. ambient air temp., °C	Tower water temp., °C		
100	35	30	Data workout	EER
75	30	26		
50	25	22		
25	20	18		

$$ESEER = \frac{3\,EER_{100\%} + 33\,EER_{75\%} + 41\,EER_{50\%} + 23\,EER_{25\%}}{100}$$

From graphs and tables below, one can easily observe that full-hybrid technology is more efficient than conventional air-cooled chillers in terms of ESEER and EER

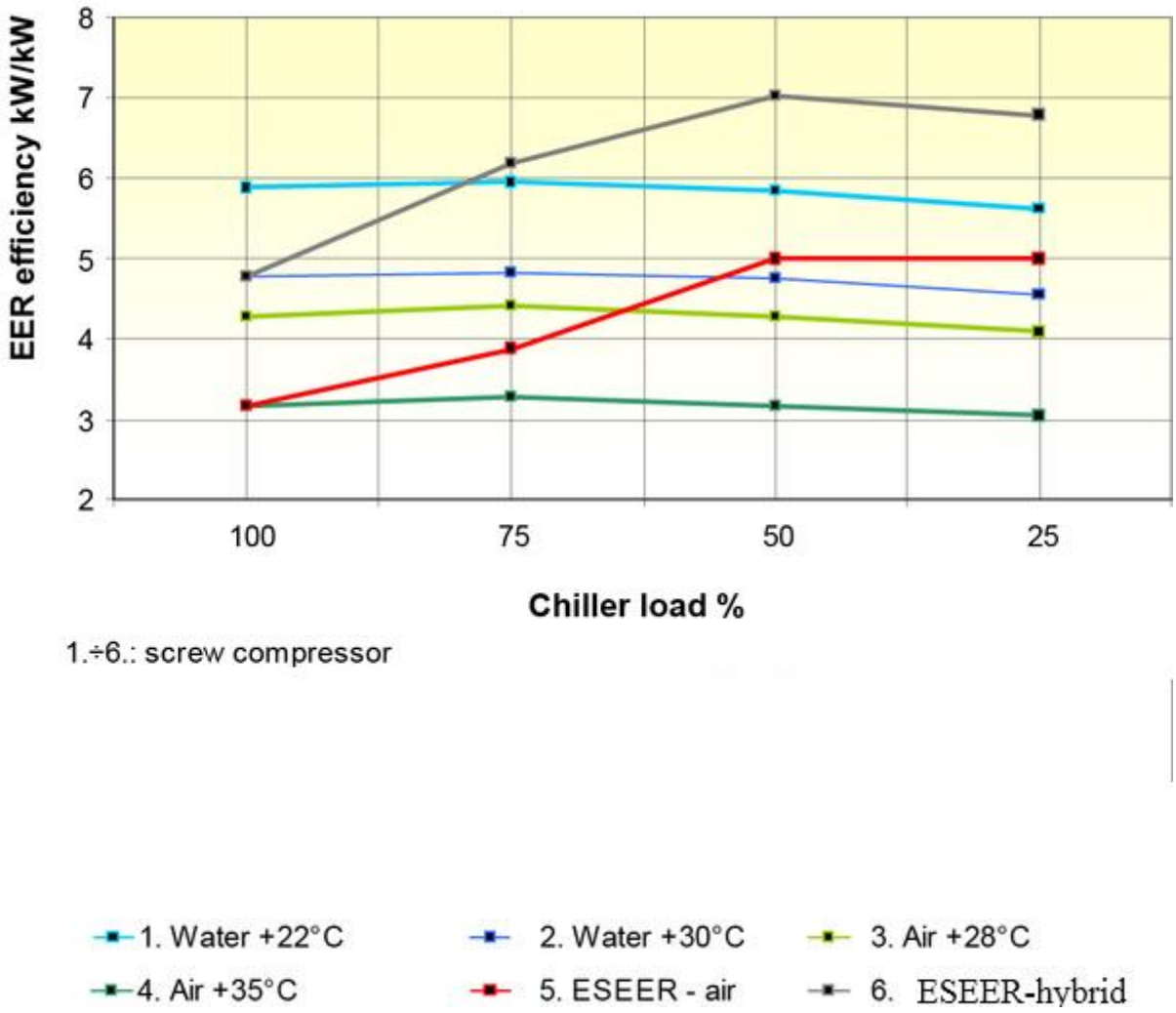

Figure 1 Energy efficiency of 600 kW liquid chillers, hybrid vs. air condensation

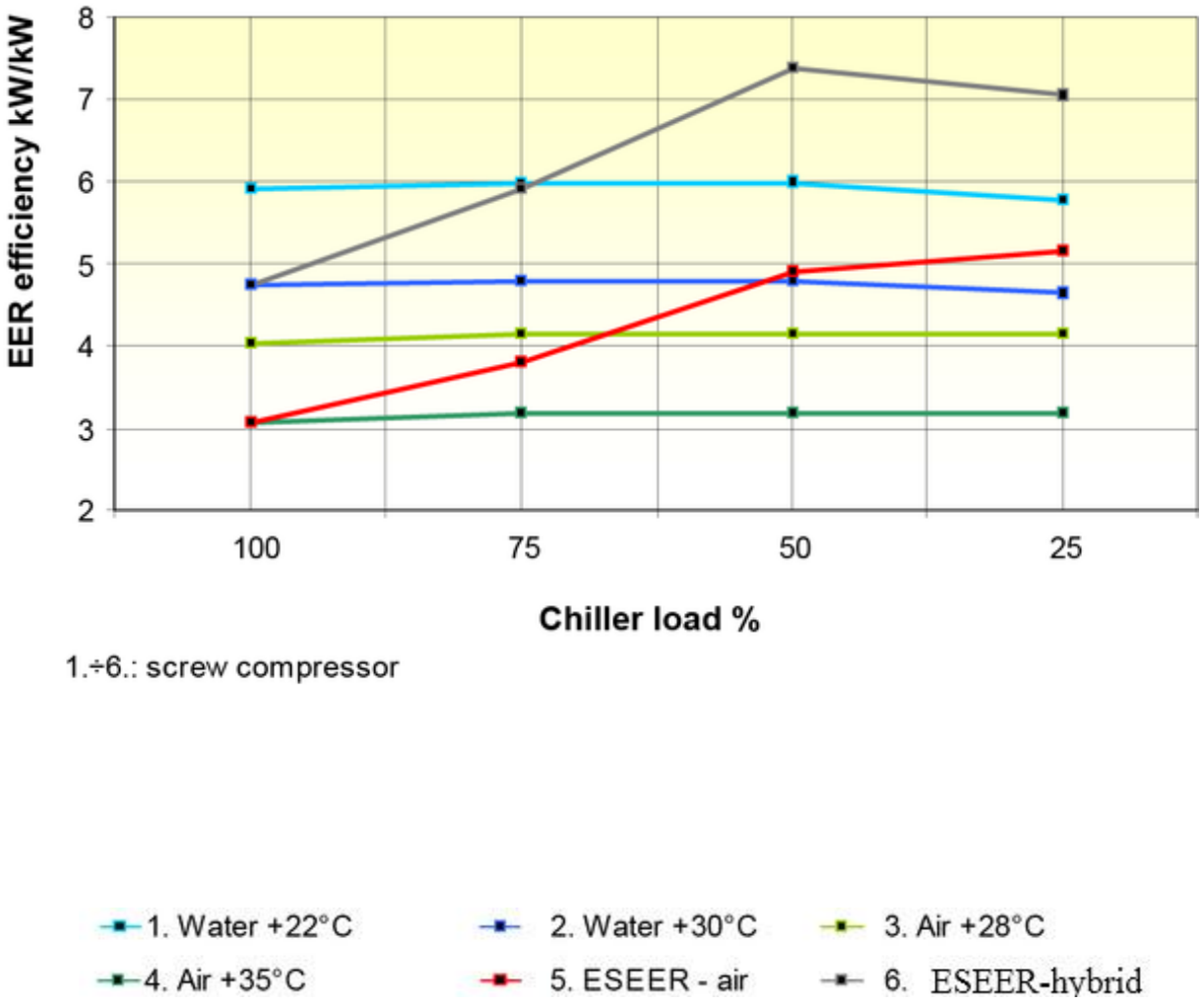

Figure 2 Energy efficiency of 1200 kW liquid chillers, hybrid vs. air condensation

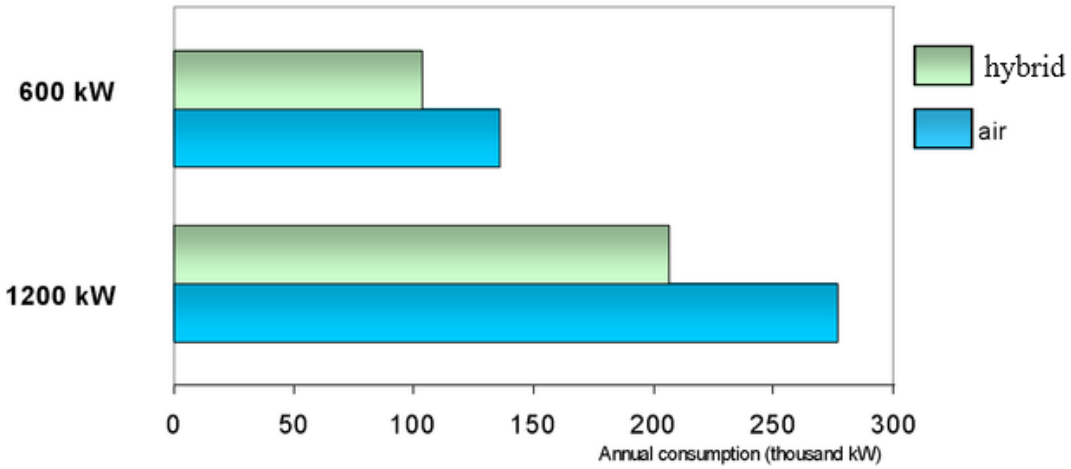

Figure 3 Liquid chillers, air/hybrid. ESEER conditions: annual consumption (kW)

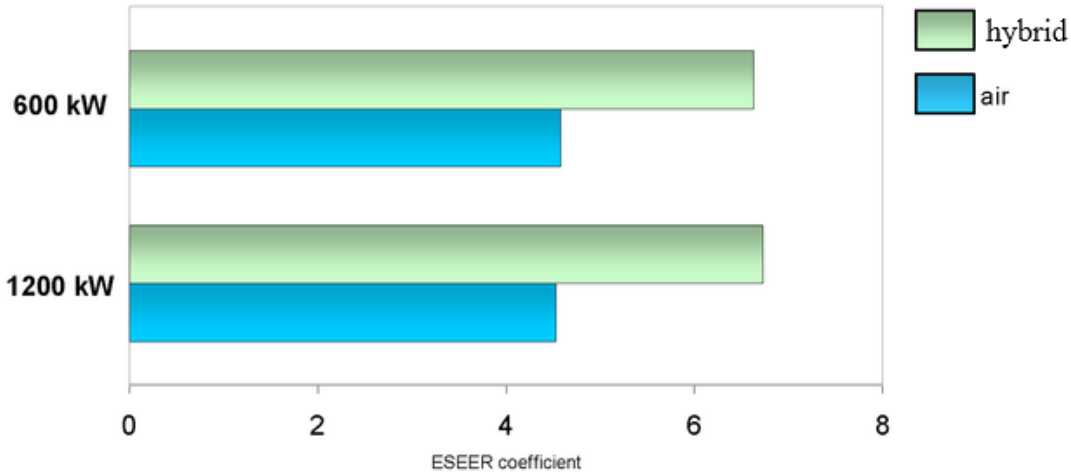

Figure 4 Energy efficiency at ESEER conditions. Air/hybrid condensation technology

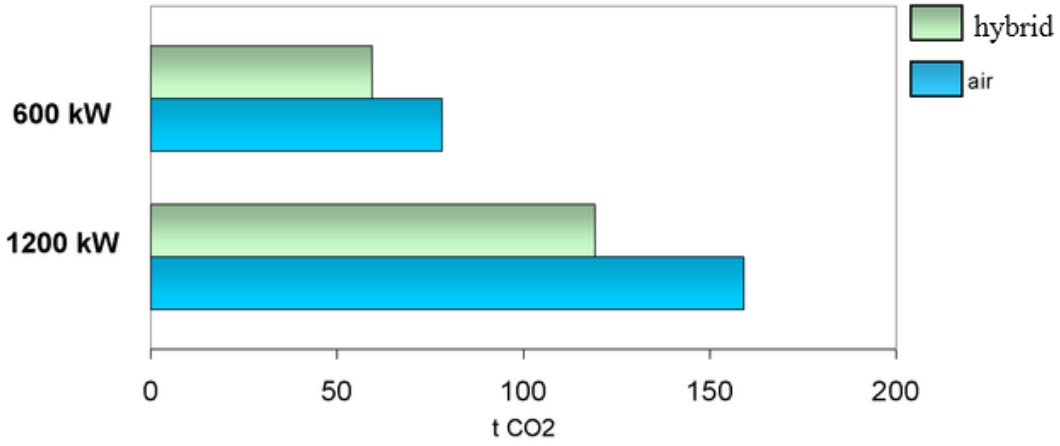

Figure 5 CO 2 Emissions at ESEER conditions: air/hybrid condensation technology

Discussion

To avoid any possible misunderstanding, it must be highlighted that the values shown in the charts are referred to different calculation methods:

EER values (operation with hybrid and air) are at constant temperatures and different from the ESEER ones;

There's no liquid chiller operating under these conditions, as both air and water continuously vary during the day, the months and the year;

Such information, shown in any commercial catalogue, can lead to assessment mistakes, as it doesn't represent the chiller real working conditions, which depend on the effective ambient situation;

ESEER values are to be applied for a correct technical selection.

The analysis of performance, consumption and energy efficiency shows a big difference between hybrid condensed and air-cooled liquid chillers. The substantial differences are the annual electricity saving (kWh/year) and consequently the less CO2 emissions into the environment.

The use of hybrid chillers shows an evident economical advantage. Furthermore, as the average plant life is over 15 years, the total saving can be easily assessed.

Results:

- Decreasing in electrical power consumption
- Gaining higher Cop
- Avoiding from chiller high-pressure failure in regions like Khuzestan.
- Better performance
- Longer lifespan for components

WARNING:

THIS HYBRID SYSTEM IS DESIGNED AND MANUFACTURED FOR THE FIRST TIME IN SARMA SARV AHURA CO IN IRAN BY COMPLETE ENGINEERING METHOD. ANY MISUSE OF THIS METHOD BY OTHER COMPANIES, INCLUDING INAPPROPRIATE CHOOSING OF WATER-COOLED CONDENSER, WILL LEAD INTO MALFUNCTION OF THE WHOLE SYSTEM.

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