LU-VE GROUP

Stefano Filippini – LU-VE GROUP Technical Director
LU-VE S.p.A.
Uboldo (VA), Italia
Heat exchangers for commercial and industrial refrigeration, air conditioning and industrial applications.
- 2,400 skilled employees
- 390,200 sqm. total surface area
- More than 160,300 sqm. covered area
- 2,350 sqm. of R&D Laboratories
- More than 70% of production exported to 100 countries
- Consolidated Turnover € 258 million
July 2015  Listing on Milan Small Cap Market

June 2017  Listing on Milan Stock Exchange Market
LU-VE sells its products in more than 100 countries

Germany is its main export market (9% of total sales)

Breakdown of sales 2016 by geographical area

10 PRODUCTION FACILITIES
- ITALY (2) - UBOLDO (VA)
- ITALY - LIMANA (BL)
- ITALY - TRAVACÒ SICC. (PV)
- POLAND - GLIWICE
- CZECH REPUBLIC - NOVOSEDLY NA MORAVE
- SWEDEN - ASARUM
- RUSSIA - LIPETSK
- CHINA - CHANGSHU
- INDIA - BHIWADI (RAJASTHAN)

13 SALES COMPANIES
- AUSTRALIA - MELBOURNE
- AUSTRIA - VIENNA
- CHINA - CHANGSHU
- UAE - DUBAI
- FRANCE - LYONS
- GERMANY - STUTTGART
- INDIA - NEW DELHI
- POLAND - WARSAW
- POLAND - GLIWICE
- RUSSIA - MOSCOW
- SPAIN - MADRID
- UK/EIRE - FAREHAM HANTS
- THAILAND - BANGKOK
Market Segmentation

Refrigeration (Commercial / Industrial)
Commercial and industrial refrigeration, All fresh conservation, Freezing processes, Foodstuff processes, Storage & Logistics, Seasoning, Display case units, Cabinet units, Dispenser units, Ice makers, OEM

Air conditioning
HVAC for buildings and industry units, Data Centres, Hospitals, Transport, Heat pumps, Telecommunications

Energy & Power
Energy production, Chemical cooling, Motor cooling
Products and applications

Mobile applications

AIR CONDITIONING FOR TRAINS

MOBILE AIR CONDITIONING

REFRIGERATED TRANSPORT
Products and Applications
Unit Coolers for Refrigeration

Storage of fresh foods in general and fast freezing of perishable foods
Products and applications
Air cooled Equipment - Air Conditioning

AGORA Shopping Center
Bytom (Slesia) POLAND

Air conditioning for Frankfurt Exhibition Centre - Dry coolers for Hall 4 and 11
Products and Applications
Air cooled Equipment - ENERGY

ORC Condenser - Spain

Motor cooling plant - Bangladesh
The basis of the industrial philosophy of the LU-VE Group is the principle that:
“IT’S THE GREY MATTER THAT MATTERS MOST!”
«Less raw material, more brain power»
C.F.D. method (Computational Fluid Dynamics)
The use of C.F.D. to increase the understanding of the fluid dynamic phenomena

Calorimeter room tests
The results of the C.F.D. analyses have consistently been confirmed in experimental tests

Fin performance tunnel
To study optimized specialized surfaces

Tube performance device
To study and optimize grooved tube technology

CO2 TEST
To study in detail the behaviour of CO2 in the heat exchanger
LAB – Reverberation Acoustic Room

- Used to take away the sound pressure or power level.
- The test is complying with EN 23741 specifications, which agree measures with reference sound source.
- The measured band pressure levels shall be corrected for the influence of background noise level ($\Delta < 10$ dB).
- The values of sound pressure can be determined to octave band or 1/3 octave band, from 63 Hz to 8000 Hz.
- The sound power is calculated with A-weighted whether in “free field” or in “semi-reverberation field”.
- Measurement uncertainty is less then $\pm 2$ dB.

![Sound power level chart](chart.png)
LAB – Dry Coolers Plant

- Used to determinate the heat performance of dry-coolers in accordance to the ENV1048 specification

- The tested unit will be positioned on an external area and it will be connected with the hot producing plant that consists of a boiler, a heat exchanger, a tank and other measure equipment

- The boiler unit has a capacity of 230 kW; the tank has a capability of 3.500 l, while the heat exchanger has a maximum power of 205 kW
Increase of the external heat transfer coefficient $H_f$

Comparison with same tubes and rows interaxes, fin thickness

![Graph showing the comparison of heat transfer coefficient $H_f$ for smooth, waved, and LU-VE fins at different air flow speeds $V$ (m/s).]
## Comparison between API 661 condenser and LU-VE solution

<table>
<thead>
<tr>
<th>Actual geometry</th>
<th>LU-VE pattern</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>• n° bay: 42</td>
<td>• n° bay: 64</td>
<td>-12%</td>
</tr>
<tr>
<td>• Foot print: 4129 m²</td>
<td>• Foot print: 3633 m²</td>
<td>+58%</td>
</tr>
<tr>
<td>• U: 29,64 W/m²K</td>
<td>• U: 46,8 W/m²K</td>
<td>+21%</td>
</tr>
<tr>
<td>• Air flow: 44,952,000 m³/h</td>
<td>• Air flow: 35,379,200 m³/h</td>
<td>-73%</td>
</tr>
<tr>
<td>• Internal volume: 155,2 m³</td>
<td>• Internal volume: 64,7 m³</td>
<td>-17%</td>
</tr>
<tr>
<td>• External surface: 509,157 m²</td>
<td>• External surface: 422,217 m²</td>
<td>-85%</td>
</tr>
<tr>
<td>• Weight: 1,528,200 kg</td>
<td>• Weight: 353,543 kg</td>
<td>-8%</td>
</tr>
<tr>
<td>• Power consuption: 3,780 kW</td>
<td>• Power consuption: 3,435 kW</td>
<td></td>
</tr>
</tbody>
</table>

### Constant parameters:
- **TOT capacity:** 292,500 kW  
- **Air inlet temper. 29°C**  
- **Fluid: propane**  
- **Propane inlet temper. 66,3°C**  
- **Propane condens temper 60,3°C**
Water spray solution are common in HVAC industry; it has been successfully tested also a R134a ORC demonstration plant.

Water spray condenser is fin-and-tube heat exchanger, operating with dry surface when the ambient temperature is lower than a selected design value.

For higher ambient temperatures, the water spray system is activated, allowing significant performance improvements.
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SOUND PRESSURE LEVEL
ENERGY CONSUMPTION

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THANK YOU!
Stefano Filippini – LU-VE GROUP Technical Director