Basic Information

Welios® Sets a Good Example with Its Architecture and Its Energy

A shimmering white metallic cube arises on the edge of downtown Wels. This architectural sculpture is transected by lines of light that function as a high-profile allusion to the focus of the content at Austria's largest Science Center: renewable energy and energy efficiency. Indeed, a highly sophisticated energy concept has been built into this work of high-energy architecture.

Welios®: The Architecture

Set amidst Wels' Volksgarten park, this brand new structure interlinks two highly contrasting areas of downtown Wels: the historic old city and the grounds of the expo center. This piece of modern architecture built with energy conservation as its highest priority is a new urban highlight emblematic of the viability and sustainability of this city. The facility's architects, *archinauten / dworschak + mühlbachler zt-gmbh Architekten*, call it a bundle of energy. The façade's deep cleft delivers a clear, programmatically expressive view into the inner workings of the Welios® that, according to the architects, has been designed as an architectural counterpart of this facility's concept—a setting for experimentation amidst an open, dynamic spatial conception featuring ramps, sloping walls and flowing lines.

This Building's Guiding Principle: Energy

Energy is the substantive principle that informs this structure's function and form. The clefts built into the exterior shell provide glimpses into the interior of the exhibition spaces and also deliver natural lighting to the premises. The x-shaped configuration of the galleries allows for a flexible design of the themed exhibits—the modules can remain discrete with the focus directed internally, or the open atrium can serve as an interconnecting space. The building has a massive, concrete structural core. Drywall construction was used for the interior ceilings and walls. A compact shape

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and well-insulated exterior walls have been designed to deliver superior energy efficiency. A white, shimmering, expanded metal façade envelops the entire structure as a homogeneous shell. Glass outer walls are limited to the clefts. The window openings in the façade are blurred behind the metal curtain that simultaneously serves as a shading element. Metal bands make up a linear pattern—the so-called power lines—across the façade. Utilizing energy-saving LED lighting strips to provide the illumination behind these metal bands makes possible variable lighting effects ranging from a faint shimmer to dynamic visuals. In this way, the science center makes its presence felt after dark as well and establishes a highly distinctive image.

Statement of the Jury

"This urban architectural solution fits nicely into its surroundings. The development of the structure is convincing and appropriate for this setting. The proposed system of access routes makes it possible to interlink the inner city and the expo center. The project's configuration and spatial elaboration makes a strong urban statement, and integrates the facility into the city's network of streets and sidewalks. Situating a café-terrace at the highest point of the system of access routes constitutes a successful interface with the city and the Volksgarten park, and spatially encompasses the core of the two-story or multi-story lobby. Moreover, the potential transition to an add-on to the present expo center in a southwesterly direction remains a realistic option. The way in which access is provided to the building's main entrance and delivery entrance is well done. The position of the entrance focuses on the traffic circle in the direction of downtown and liaises into the center of the building.

The building's verticality can be described as assuming a symbolic character in its physical setting. The centrality of the lobby with its system of providing access to the rest of the facility results in an attractive space that extends right up to the top of the structure. This allows for a good spatial configuration on all levels and provides an excellent starting point for user-friendly routing of visitors through the exhibition spaces. With this system, this proposed design achieves a flexible subdivision of the premises and thus efficient space management. An intelligent energy concept utilizing solar infrastructure, a buffer storage tank and an in-ground seasonal phase storage tank for air preheating together with a district heating hook-up underscore the ecological aspect of an efficient, sustainable approach to generating and using energy. The consistent application of the façade structure over the

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building's entire exterior is an intelligent approach to dealing with display possibilities and providing the necessary illumination to the essential interior spaces."

Jurors with expertise in architecture and engineering: Klaus Kada, Heinz-Christian Plöderl, Thomas Moser, Manfred Sabo, Karl Pany (Director of Construction, City of Wels)

Jurors representing the commissioning client: Hermann Wimmer (Deputy Mayor, City of Wels), Markus Preiner (Energie AG Linz), Manfred Meier (Kraftwerk Living Technologies), Carlo Petri (Petri & Tiemann GmbH, Bremen)

Archinauten: Salient Facts

Managing Partners

Architect Andreas Dworschak

Born in 1961 in Linz; studied architecture at the Technical University of Innsbruck; architect in Linz since 1995; partnership with Wolfgang Mühlbachler since 1999; member of the Board of Directors of afo–Architecture Forum Upper Austria

Architect Wolfgang Mühlbachler

Born in 1965 in Linz; studied architecture at the Vienna University of Technology; 1991-6, free-lance staffer at Ortner&Ortner; partnership with Andreas Dworschak since 1999

Staff

10 full-time employees: architects, engineers, construction managers

2 free-lancers doing visualizations and graphics

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The Welios® Heating & Cooling Concept: Comfort in All Four Seasons

Visitors and staff members occupy the focal point of the planning that has gone into the climate control infrastructure built into this extraordinary exhibition project. The aim is to give them a comprehensive feeling of comfort—enabling all the users of this facility to take advantage of the educational experiences offered here and to be relaxed while enjoying their time spent here. Therefore, a heating & cooling concept was developed to allow for total control independent of current weather conditions. And the combination of renewable sources of energy and manageable, transparent, user-friendly technologies is precisely what makes it possible to bring this about. The concept was created by Kurt Engelmann of Engelmann Energiesysteme GmbH.

Since the project's very inception and especially during the construction planning phase, ongoing energy balance monitoring has been performed in order to achieve energy optimization. Thanks to the design of the building itself, the glass façades shade each other over the course of the day and thereby make external heat input through the large glass surfaces nearly negligible.

Taking varying individual perceptions of comfort into consideration

Human beings' sense of thermal comfort is highly individualized. It is influenced by physiological, psychological, physical and social components, and thus poses an almost insoluble problem. However, close cooperation among the staffs of the commissioning client, the facility operator, the architects, and the engineers responsible for the building's utilities infrastructure have succeeded in fulfilling as many demands as possible and taking into account all the various aspects of the human perception of thermal comfort.

Compensating for fluctuating conditions

Since radiant heating & cooling solutions are universally perceived as exceptionally pleasant, these have been the primary approaches taken here. All exhibition areas on the 2nd and 3rd Upper Levels and in the special exhibit space are equipped with climate-control features integrated into the architecture itself. The concrete ceiling's high heat-storage capacity as well as the separate sensors in the individual spaces and integrated into the architectural components themselves facilitate reacting to fluctuating conditions. In the high-occupancy zones such as the lobby, food & beverage service

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area and office premises, heating & cooling elements offering high efficiency and quick reaction time are installed behind noise-minimizing drywall construction boards.

Low-temperature underfloor heating enhances visitor comfort

Plus, a modern, low-temperature underfloor heating system has been built into the entire ground floor, the food & beverage service area and the office premises. Since human beings' sense of thermal comfort is also very strongly dependent on ambient air temperature and the temperature of surrounding surfaces, ceiling & floor activation is used to maximize the feeling of wellbeing. The lobby makes a strong first impression that visitor comfort is a high-priority consideration—this area has been designed for step-by-step accommodation of people's habits in taking off and putting on their outer garments and getting used to the indoor climate. The efficient reactive capability of the high-performance ceiling modules makes it possible to speedily respond to changing external conditions and internal circumstances.

Water as an effective energy transport medium

An essential feature of this building's construction is that, instead of air as an energy transportation medium, this building uses water, which has more than a 60% better energy content. This means that substantially less energy is used for transportation here than in air-driven systems.

High standards for hygienic air quality as a reaction to varying comfort demands

Air is our prime requisite for life; we can't do without it for more than a couple of minutes. Even minimal changes in air quality (oxygenation, temperature, humidity, odor, draftiness, etc.) are perceived as unpleasant and annoying. The maximum occupancy authorized for this exhibition facility is 1,000; therefore, it has been equipped with a mechanical ventilation system featuring heat recovery via rotary heat exchanger. Air quality is monitored by calibrated sensors and the information used to adjust the ventilator fan speed in order to provide fresh air as needed. The building is subdivided into zones and the ventilation system equipped with a volume flow regulator, which makes it possible to quickly react to visitors' varying comfort demands. The installation of a slow-running rotary heat exchanger permits—in addition to a high degree of heat recovery—the use of humidity in the air inside the building to humidify incoming fresh air that happens to be too dry. Heat is delivered by a hookup to the local district heating network.

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Separate ventilation zones in high-occupancy areas of the building

The food & beverage service area is treated by a separate ventilator with cross-flow heat recovery. This makes it possible to respond to intensive heating & cooling demands due to the large number of people congregating in this area at peak hours. Additional floor induction devices for heating and cooling are installed in high-traffic areas of the lobby and the multifunction space. These devices can be used to introduce hygienically prepared fresh air (that can also be treated afterwards through water-fed vents if needed). This allows conditions to be quickly and individually adapted to a wide variety of uses and the circumstances resulting from them.

Boosters as discreet distribution regulators

Air circulation is by means of hygienically cleanable, galvanized air ducts. The low-inductance air intake is via so-called booster ventilators. This construction makes it possible to "gently fill" the various sectors of the building while practically eliminating drafty areas. Each air booster can be individually controlled and thus exactly set to the level desired for both heating and cooling. The smoke exhaust outlets, a necessary security feature installed to remove smoke in case of fire, are also used in conjunction with the circulation system for cooling on summer nights. Cold air and drafts are prevented from flowing into the lobby near the front entrance by a strategically positioned partition.

Groundwater as a cost-saving energy source

Since groundwater is plentiful here, most of the required energy is available practically free of charge. The energy for pre-heating and cooling is provided by an underwater pump and delivered via a large plate heat exchanger. The ideal temperature level of the groundwater system supplies all cooling surfaces as well as the cooling elements of the ventilation equipment. When the outside temperature is very low, the cold external air is pre-warmed with groundwater by a special air heating register. Even when it's frigid outside, only very minimal supplementary heating is necessary thanks to efficient heat recovery.

Precious drinking water is used sparingly

To make sensible use of potable water—one of the world's most precious resources—all of this facility's urinals are the waterless type that use biodegradable fluid. Thus, water isn't wasted; it's

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used as necessary. Furthermore, all toilets are flushed with water from a separate plant providing water for industrial uses and fed with local groundwater.

Full automation guarantees independence from weather conditions

Regulating and controlling the equipment is completely automatic and hooked in to the City of Wels' Control Technology System. Interior comfort is monitored and regulated by an external weather station (measuring wind, temperature, humidity and precipitation) and a network of temperature, humidity and air quality sensors distributed throughout the building. This assures comfort on the part of visitors and staff alike.

Security systems

In case of an emergency, the building is equipped with all necessary security systems: fire alarm, smoke ventilation, sprinkler system, wall-mounted hydrants, escape route & security lighting, fire compartments & barriers.

Trailblazing with a complex low-energy design concept

This is the first structure of this magnitude with an extremely low-energy design built into it. This very sophisticated system includes solar & photovoltaic equipment, well-water cooling and solar district heating.

Photovoltaic: 20 KW in the facade, in photovoltaic glass and on the roof; produces 15,000 kWh/year, the approximate amount needed to power three single-family homes. The rest of the facility's electricity requirements are covered by ecological power provided by Wels Strom; 100% clean energy
Solar energy: 20-m² solar thermal plant to provide warm water
Solar District Heating: Located on the roof of the expo center only 100 meters away is what is currently the largest evacuated tube solar collector, which produces 1.6 GWh of heat per year. Its output is fed into the City of Wels' district heating network and thus supplies Welios® as well.

Warm water primarily from solar power and via energy efficiency

Warm water is provided to the food & beverage service area and the rest rooms by a hygienic, high-performance storage tank and a 20-m² thermal solar plant on the building's roof. To keep

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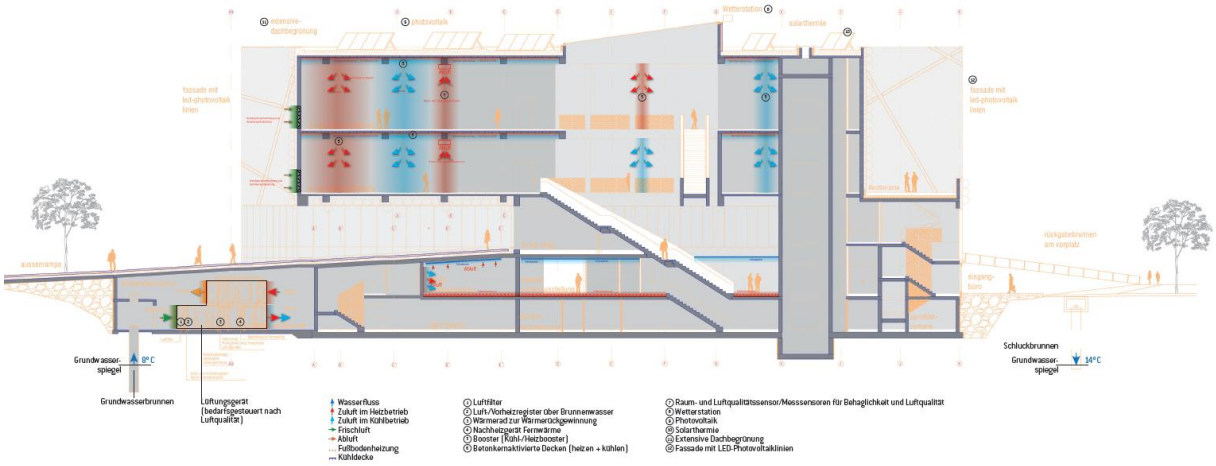
distribution loss to a minimum and maintain the highest possible hygiene standards, additional under-sink water heaters have been installed at distant locations around the building. All decentralized warm-water production units are shut off by the central control system outside of regular opening hours.

The lighting concept is also based on energy efficiency

As a matter of principle, only light fixtures providing energy-efficient illumination are used. In the offices, lobby and shop, dimmable fixtures that react to the level of daylight have been installed. All lighting fixtures are controlled by a central system featuring visualization of overall lighting usage and a central shut-off command—i.e. when the last staff member exits the building (as determined by the alarm system), a shut-off command is issued to all lighting clusters throughout the facility.

Graphic Depiction



The Welios® energy concept achieves superior energy efficiency by means of complex interaction of the building's construction, air regulators, water as a transport medium and systems designed to optimize usage in the areas of water, light and ventilation/exhaust. © Engelmann

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Facts & Figures

Energy index	28.6 kWh/m²a
Heating load, exhibition area	209 kW
Cooling load, exhibition area	392 kW
Heating load, food & beverage area	21 kW
Cooling load, food & beverage area	57 kW
Energy delivery (district heating from E-Werk Wels)	
District heating transfer station, heating	345 kW
District heating transfer station, warm water	45 kW
Thermal ground water usage	
Cooling	18,8 l/s
Heating	10,2 l/s
Ventilation system, exhibition area	45.000 m³/h
Heat recovery, rotary heat exchanger	71 %
Moisture recovery	50%
Pre-heater/Cooler	109 kW
Sequential heater	173 kW
Food & beverage area	
Ventialtion system, food & beverage area	14.000 m³/h
Heat recovery: cross-flow heat exchanger	57 % (moisture)
Pre-Heater	66 kW
Sequential Heater	61 kW
Cooler	59 kW
Energy distribution	Approximately 4.600 m² air channel
Underfloor Heating	2.500 m²
Concrete core activation	Approximately 3.230 m²
Cooling Ceiling, modular design	Approximately 920 m²
Fllor induction equipment	37 units
Central building control system	Approximately 500 data measurement points
Ventialtion system with volume flow & air quality controllers	

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