Workshop for Dissemination and Promotion of ZEB (Zero Energy Building) and ZEB Family Concept

LIXIL HOUSING TECHNOLOGY - ASIA
SEIJI OSUGI
OCT 2019
INTRODUCTION

PROFILE

- Name: Seiji Osugi
- Birthday: 19th July 1967
- Date of Joining: 1st Apr 1990
- Work History: Working on the development of core window and high-performance window as a chief engineer not only in Japan but also global market since joining company.
  - Development of the most premium window “WIDE WIN” for Japan Market in 2007
  - Development of the core high insulation window ”SAMOS“ for Japan Market in 2009
  - Development of all series of products for China market since 2010 “TA Window” “TD window” ”TE window” and “TF window”
ABOUT LIXIL

- LIXIL is the most comprehensive and connected global company in the building industry

- Every person on the planet dreams of a better home. LIXIL make that possible with pioneering water and housing products.

- LIXIL is proud that its products touch the lives of more than a billion people every day, but believes it has the potential to still do so much more.
Know as LIXIL Group Since 2011, through a merger of 5 companies, LIXIL is positioned as a full service provider of Housing & Building solutions.

<table>
<thead>
<tr>
<th>Year</th>
<th>Event/Company Name</th>
<th>JS Group</th>
<th>LIXIL Group</th>
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</thead>
<tbody>
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<td>Shinnikai</td>
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<td>1936</td>
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<td>Tostem INAX Holding Corporation</td>
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<td>Company name change to JS Group</td>
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<td>Tostem Dalian plant completed</td>
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</table>
LIXIL BUSINESS CATEGORIES

LIXIL is a ¥1,668 B business consisting of the following Technology Division:

- **LIXIL Housing Technology**
  - AL Window / PCV Window
  - Entrance Door
  - Exterior products
  - Wooden products
  - ¥ 535.2 B

- **LIXIL Water Technology**
  - Sanitary
  - Faucet
  - Bathroom
  - Exterior / Interior tile
  - ¥ 715.9 B

- **LIXIL Building Technology**
  - Curtain wall
  - Interior decorating business
  - ※ not include PERMA
  - ¥ 107.0 B

- **Retail, Housing & Service, Other**
  - System Kitchen
  - Home Center
  - Housing
  - ¥ 345.8 B
OUR LOCATIONS

ASIA - PACIFIC

TOSTEM THAI CO., LTD.
LIXIL (THAILAND) Public Co., Ltd.
LIXIL Vietnam Corporation
LIXIL Global Manufacturing Vietnam Co., Ltd
PT LIXIL Aluminium Indonesia
LIXIL Philippines Ltd. Co.
LIXIL Taiwan
LIXIL Window Systems (INDIA)
LIXIL Housing Products Manufacturing
Shanghai
LIXIL Manufacturing Dalian Cooperation

www.tostem.com
Facebook.com/tostem
TOSTEM TIMELINE IN THAILAND

1987

Creative Living
Founded TOSTEM THAI Factory
2007

**P7**
The luxury-design residential line for specialty or high-end residential properties.

2013

**WE Series**
Launched WE70 and WE40 to anticipate the inner needs of value-minded consumers and mid-range large scale property developers.

2014

**Folding Door**
Combining smart design profiles and high quality for both luxury residential and commercial projects.
2015

**WE-Plus Series**
Reshape the needs of high rise market.

2016

**GIESTA**
Completing exceptional low rise business.

2017

**Exterior**
Expand exterior business
LIXIL ZEB SOLUTION

Three major energy consumption in buildings

Primary energy consumption of buildings

Energy-saving energy creation methods

2000 MJ/year/m²
- Natural ventilation
- Heat insulation and shielding
- Natural lighting

500 - 600 MJ/year/m²
- Photovoltaic power generation
- Wind power generation

0 MJ/yr/m²

Energy consumption

Energy Conservation Methods
- Cross venturi
- Ventilation using voids
- Ventilation in a single-sided opening for the room
- Airflow
- Double skin
- Vertical and horizontal fins
- Insulated Sash
- Lighting louver
- Lighting duct
- Task/Ambient Light
- LED lighting

energy creation method
- Photovoltaic power generation
- Wind power generation
- Biomass power generation
Natural ventilation (CFD analysis considering surrounding environment)

It is important to make a plan for natural ventilation.

- Consideration of the surrounding environment of the construction site
- Consideration of Seasonal Wind Direction based on Weather Data
- Consideration of wind speed by building height

Consideration of the **surrounding environment** of the construction site

Consideration of **wind direction** from meteorological data

- Ambient Temp
- Wind Speed
- Wind Rose

Consideration of **wind speed** by building height
Natural ventilation Method

Choosing the right ventilation method can contribute to energy conservation.

**Cross ventilation**
Supply air from the windward side and exhaust air from the leeward side.

**Void type ventilation**
Supply air from the exterior wall and exhaust at the top of the void.

**Ventilation for room in a single-sided opening**
By attaching casement windows with different opening directions top and bottom, guides wind into the room and exhausts it from the other side to the outside.

**Hybrid ventilation**
Reducing Air conditioning load by introducing outside Air while operating air conditioning in the room.
To realize ZEB > "windows" are important for energy conservation

Hot air from outside penetrates 73% through the window. Improving the performance of windows leads to a healthy and comfortable life.

<table>
<thead>
<tr>
<th>Energy conservation</th>
<th>Reduce energy consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Products outside</strong></td>
<td><strong>Equipment inside</strong></td>
</tr>
<tr>
<td>Window</td>
<td>Light bulbs</td>
</tr>
<tr>
<td>Glass</td>
<td>Air conditioners</td>
</tr>
<tr>
<td>Wall</td>
<td>Elevator</td>
</tr>
<tr>
<td></td>
<td>Outlet</td>
</tr>
<tr>
<td></td>
<td>Personal computer</td>
</tr>
</tbody>
</table>

ZEB refers to energy conservation and energy creation.

**Thermal insulation performance**

**Airtight performance**

No countermeasures for thermal insulation

**Comfortable**

Cooling/Daytime

Ventilation: 6%

Wall: 7%

Floor: 3%

Roof: 11%
Window to ZEB > Thermal Insulation Performance

How to improve insulation performance?

Use a high-performance frame: Materials

aluminum sash

- Thermal conductivity: 3.49 W/ [m·k] ※

PVC composite sash

- Thermal conductivity: 1.03 W/ [m·k] ※

PVC sash

- Thermal conductivity: 0.79 W/ [m·k] ※

※ガラス等条件による
Window to ZEB > Insulation Performance

How to improve insulation performance?

Use high performance Glass

**Thermal insulation performance**

<table>
<thead>
<tr>
<th>single glass</th>
<th>double glazing</th>
<th>Low-E Double</th>
<th>Triple glass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal Conductivity 5.9 W/㎡/K</td>
<td>Thermal Conductivity 2.8 W/㎡/K</td>
<td>Thermal Conductivity 1.1 W/㎡/K</td>
<td>Thermal Conductivity 0.59 W/㎡/K</td>
</tr>
</tbody>
</table>

*5FL Glass

Common Double glass (3-16-3)

Low – E Double glass (3-16-3) With argon gas

Double Low – E glass (3-10-1.3-10-3) With krypton gas

Special Metal coat

Special Metal coat

*For reference: AGC Glass Plaza

High thermal insulation
Even if the frame is the same material, making the frame that is easily affected by heat thinner can improve thermal insulation performance.
For ZEB realization > Thermal insulation performance

In summary, the combination of high-performance sash and high-performance glass is the key to improving insulation performance.
How to improve the airtightness of a building?

Thermal insulation performance is also improved by enhancing airtightness performance of window while suppressing inflow of cold air and warm air.

Airtight performance

- Airflow per hour in 1㎡ sash (㎥/h)
- The higher the grade, the less draft.

[airtightness of the window]
It indicates how much air leaks from the frame or between panels of sash.

- Airflow per hour in 1㎡ sash (㎥/h)
- The higher the grade, the less draft.
A common sash that uses mohair
JIS A -2 120 m3/h/m2

A draft of 120 m3/h flows into the room
From Sash with poor airtightness in one hour per square meter.

High-performance sash with airtight materials
JIS A -4 8 m3/h/m2, m2

Use a highly airtight sash

Under certain circumstances
cooling load is about 1/15 between class A -4 and class A -2 windows
For the realization of ZEB

In summary, in order to save energy, it is important to use a window with high heat insulation and airtightness.
BREAK THE NORM WITH FINE LINE OF DESIGN & FUNCTION.
INNOVATIVE PROFILE AND HARDWARE DESIGN

Conventional

GRANTS

Allow seamless transition between outdoor and indoor
No screw hole or caps appearance.
GRANTS

Innovative Ideas