Quick-Construct Housing for Refugees and the Impoverished

Innovation Challenge

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Problem Statement

In the Middle Eastern desert climate, displaced families lack secure, comfortable housing that meets UN standards. Our project aims to develop rapid assembly structures tailored to these needs, emphasizing privacy, safety, and emotional security.

Constraints

1.Assembly team size **4** members

2.Shipping container limitation **5** units inside **40 ft** container

3.Water source quality

4.Eco-friendly and sustainable material

5.United Nations standards

Target Specifications

1.Assembly time **20 min.**

2. Space = **25 m^2**, with a minimum of 1 separated privacy room

- Prototype of **5 m^2** footprint (land area).
- The height should suit's an average adult.

3. Potable water production rate of **1 L/hr**.

4. Power system capable of delivering:

- **250W** (220VAC) during daylight
- **150W** (220VAC) during night

5. Wall/Roof/Floor thermal resistance (R-value) = **2 m^2K/W**

6. Capable of withstanding a wind speed of **5 m/s**

Project Impact

Economic impact:

- The project aims to provide rapid assembly housing for refugees in the Middle East, creating business opportunities and promoting sustainable construction methods.

Societal impact:

- The rapid deployment refugee housing addresses societal issues of inadequate shelter for displaced families, strengthening social cohesion and community.

Environmental impact:

- The project addresses environmental issues among displaced populations by promoting sustainable materials, renewable energy, effective water and waste management, and eco-friendly design in refugee housing construction.

Final Design

The design of the housing unit contains one independent bedroom for the adults In addition to a small kitchen and bathroom. The independent room outfitted with a retractable wall. This ingenious addition allows for smooth adaptation of the space, allowing it to be opened or closed as needed by the family, maximizing spatial dynamics. Furthermore, in recognition of the value of versatility and adaptation in modern living spaces, we incorporated multi-functional furniture such as murphy beds.

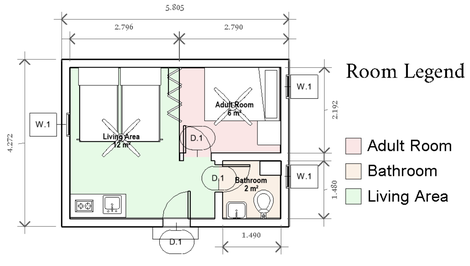

Figure 1: Floor Plan Design.

Figure 2: 3D Render.

Testing / Validation

Space

Figure1 illustrate the total are of the unit which is 5.825m*4.292m = 25m2

Power system

using the solar energy through solar panels with a total production capacity of 1000 W, charge controller, 500 W inverter and 1800 W batteries.

Withstand wind speed > 5 m/s

With an air velocity of 10 m/s, double the project's specified conditions for added safety, the larger wall of the unit endured an average pressure of 315 Pascal.

Water Production Rate

Waterdrop Under sink Water Filtration System employs an advanced UF membrane, any contaminants larger than 0.01 µm. The filtration includes the required filtration a with a 169.8 L / hr filtration rate which is > 1 L/ hr.

Assembly & package fit

A standard 40 ft container has a volume of 67 m3, with 5 packages taking 56 m3. Assembly proof is in prototype video.

R-value of 2 m2.k/W

achieved through selecting Al-Rashed Polystyrene panels thickness 10 cm

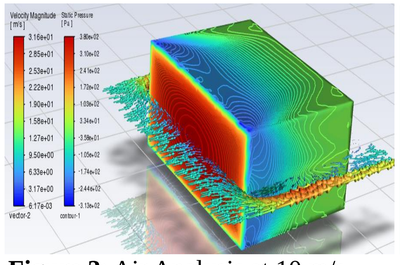

Figure 3: Air Analysis at 10 m/s

Material Name		Thickness(mm)	R-Value (m^2.K/W) calculated	R-Value (m^2.K/W) from cut sheet	U-Value (W/m^2.K)	Comments
Air film (outdoor)			0.044			Summer condition
Pre-painted galvanized steel (out)		0.42	0.0200			
White Expanded polystyrene Fire Retardant (FF) sheet with 16-18 Kg/m^3 Density		99.17	2.63	2.84	1/R-value	
Pre-painted galvanized steel (In)		0.41	0.02			
Air film (indoor)			0.120			
	Total Sum	**100.00**	**2.83**	**2.84**	**0.35**	

Table 1: R and U Values

Conclusions

A rapid deploy refugee solution for desert climates, that is durable, easy to maintain, and sustainable. Features solar panels for electricity generation and rapid water filtration, addressing environmental challenges such as extreme sun, and cold nights. Designed to international standards, transportable in standard containers, and environmentally friendly. Prioritizes refugee health, cost-effectiveness, and seamless integration with existing systems.