



Vietnamese Market Study & ZEH Consideration

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Zero Energy House Consideration

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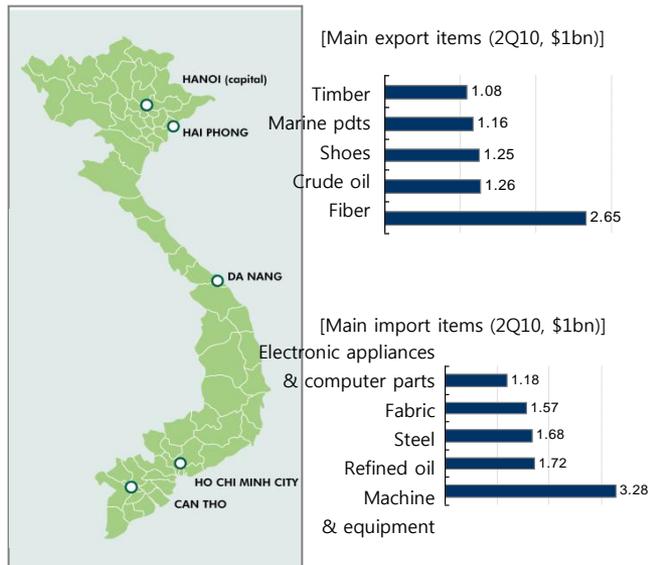
Zero Energy House Consideration

Vietnam Summary

**Population is approximately 88 million.
Its capital is Hanoi, and its main cities include Ho Chi Minh City and Da Nang.**

Vietnam summary

- Name: Vietnam (Socialist Republic of Vietnam)
- Population: 88mn persons (as of 2009)
- Area: 331, 211 km²
- Climate: Subtropical (north), tropical (south)
- Race: Kinh (89%), Tay (2%), Thai (1.6%), etc.
- Religion: Buddhism (80%), Catholic (10%), etc.
- Trade: trade deficit of US\$12.9bn for 2009



▪ [Geographical location]

Bordered by China to the north, Laos and Cambodia to the west, South China Sea to the south, and the Pacific to the southeast.

To the southeast	To the west	To the south	To the north
The Pacific	Laos and Cambodia	South China Sea	China

- **[Geographical merit]** Vietnam lies at the point of contact between Northeast Asia and Southeast Asia and can play a role as the bridgehead for ASEAN countries, China, and the Indochina's interior.
- **[Administrative division]** 5 central cities > 59 provinces > approximately 500 districts > approximately 10,000 quarters

Ho Chi Minh	Hanoi	Hai Phong	Da Nang
7.1mn	6.3mn	1.9mn	0.9mn

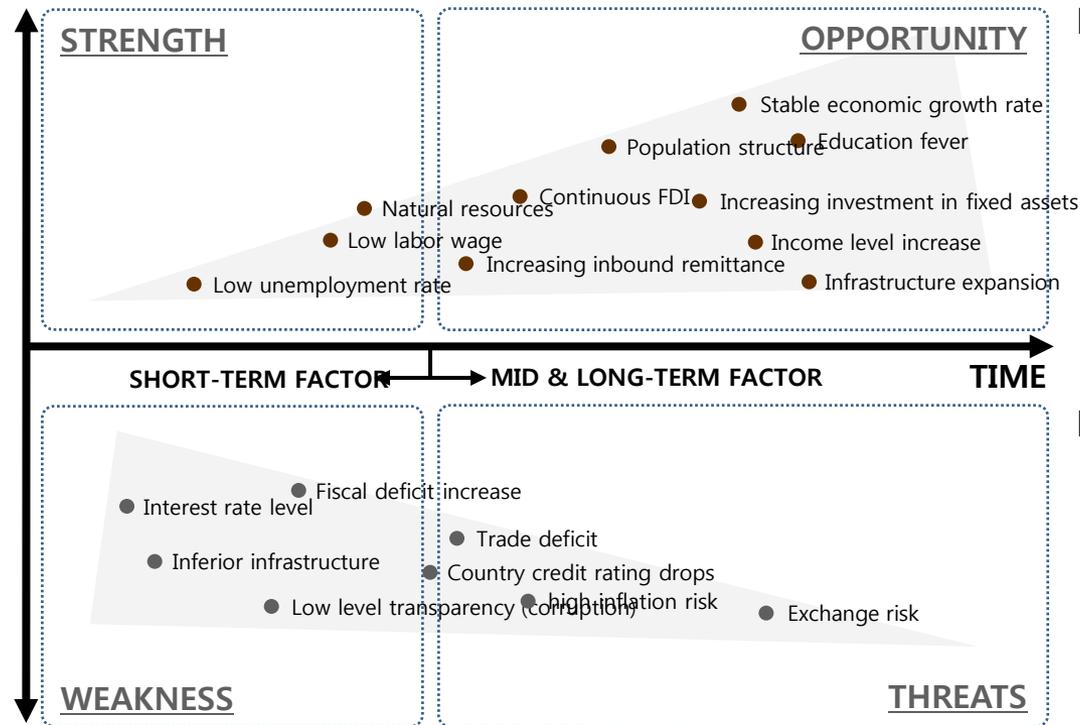
- **[Population]** Approximately 88mn persons as of 2009 (mean growth rate of 1.2% over last 10 years)
- **[International relations]** Vietnam joined WTO in 2007, and at the moment is a member of UN, ASEAN, ARF, ASEM, and APEC.
- **[Relationship with Korea]** In 1992, Vietnam established diplomatic relations with Korea. In 2009, they developed from comprehensive partnership to strategic partnership. Korea was the number 1 FDI country in Vietnam in 2006 and 2007 with its accumulated investment was \$20.5bn in 2009. Korea's trade volume increased to approximately \$9.5bn for 2009.

Macroeconomic Trends

It is expected that merits and opportunities in the long term would expand with its stable economic growth, FDI increase, consumption level (domestic market) consolidation, and infrastructure expansion, while long and short term risks, such as inflation, foreign exchange instability and fiscal deficit, would decrease.

SWOT: Vietnam's macroeconomic indicators

MOMENTUM



[Opportunity expansion factors]

- [Economy] Maintained stable high economic growth rate
- [Investment] Increase of FDI and inbound remittance
- [Population] Labor-efficient growth model population structure
- [Consumption level] Expansion and consolidation of the domestic market
- [Infrastructure] Growth acceleration after long-term infrastructure expansion

[Threats reduction factors]

- [Inflation] Expectation about the stabilization of inflation through the flexibilization of loan and export policies (after 2009)
- [FX] Stabilization of FX market through the mid and long-term improvement of goods trade account
- [Trade deficit] Possible to improve trade deficit after long-term infrastructure expansion.
- [Infrastructure] Currently the infrastructure is poor, but infrastructure expansion and trade deficit improvement are expected through BT projects and others.
- [Interest rate] Stability of interest rate through the interest rate policies of Vietnamese government which responds flexibly to market situations.

RISK

*Note 1: Short-term growth momentum factor: Vietnam's current competitiveness factors, which are strong points in the short term and can develop into mid and long-term opportunity factors

*Note 2: Mid and long-term growth momentum factors: factors which are current strong points and also much likely to develop into mid and long-term opportunity factors.

*Note 3: Short-term weakness risk factors: factors which are current weak points in Vietnam's economy and which, if not resolved in the short term, are likely to develop into mid and long-term risk factors.

*Note 4: Mid and long-term threat risk factors: factors which are current weak points and which area much likely to develop into mid and long-term threat factors.

Foreign Institutes' Viewpoints on Vietnamese Market

Evaluations on Vietnam market for 2011 by foreign institutes



Forecast before the fall of Vietnam's credit rating

IFC included Vietnam in the top 10 most-improved in doing business 2011. "The top 10 most-improved in Doing Business 2011"

Reason to select Vietnam

Starting a business

Dealing with Construction Permits

Getting Credit

*Note: IFC (International Finance Corporation, under World Bank)



Forecast after the fall of Vietnam's credit rating

AFIRE ranked Vietnam as the #4 among the emerging markets likely to be most preferred by investors for 2011

1. Brazil (Co-#2 with India in 2010)
2. China (#1 in 2010)
3. India (Co-#2 with Brazil in 2010)

4. **Vietnam** (unranked in 2010)
5. Mexico (4th in 2010)

*Note: AFIRE (Association for Foreign Investors in Real Estate)



Forecast after the fall of Vietnam's credit rating

Franklin Franklin Templeton Investments chose Vietnam as one of the Three Frontier Markets in choosing countries of promising investments in 2011. (announced after the fall of Vietnam's credit rating)

1. Nigeria
2. **Vietnam**
3. Kazakhstan

Undervalued assets (including stocks)



Reason why Moody's lowered Vietnam's credit rating in Dec 2010

Construction Market

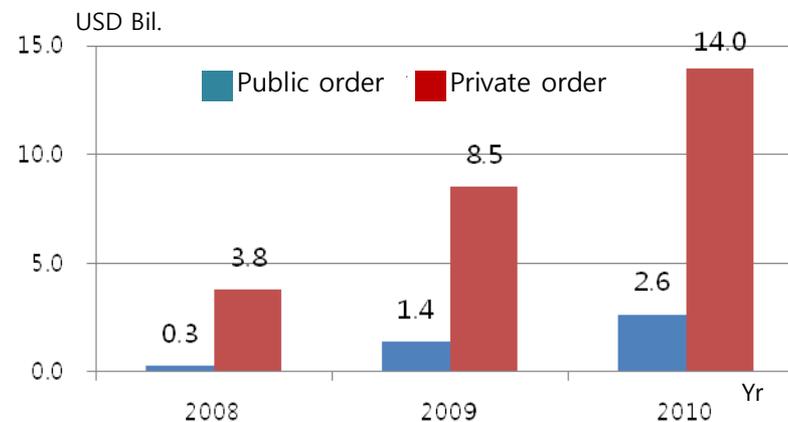
**Vietnam's investment in construction ratio is approximately 20% of its GDP.
Investment in infrastructure is expected to increase.**

The trend of the proportion of new investment in Vietnam by industry

(Unit: USD 1 billion)

	2000	2004	2005	2006	2007	2008	2009
GDP (USD)	23	37	43	50	59	76	84
Total investment (USD)	8	15	18	21	27	31	36
Investment in construction (USD)	3	7	8	9	12	14	16
Construction investment over GDP (%)	15%	18%	18%	18%	21%	18%	19%
Construction investment growth rate (%)	n/a	92%	18%	18%	31%	15%	15%

■ Trend of construction EPC market size (based on ordering sector)



Construction Market

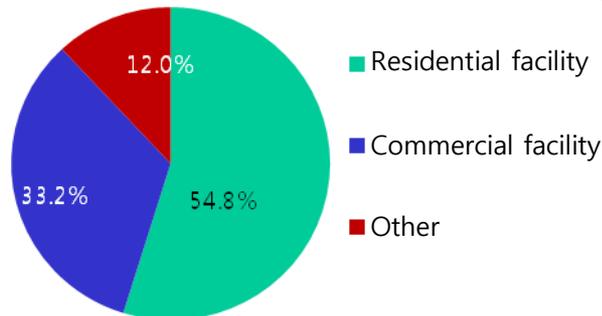
■ The status of construction EPC market for 2010 (Jan – Oct) (based on amounts)

Construction market size		Public/Private ratio		Size by PDT	
전체 건축 EPC시장	100%	Public	15.9%	Residential facility	3.2%
				Commercial facility	4.2%
			Other (Education/medical service/welfare/research)	8.5%	
	16,600.3 USD mil.	Private	84.1%	Residential facility	51.7%
				Commercial facility	29.0%
			Other (Education/medical service/welfare/research)	3.5%	
			2,639.1 USD mil.	USD 524.2 mil.	USD 1,412.9 mil.
			13,961.2 USD mil.	USD 702.0 mil.	USD 573.6 mil.

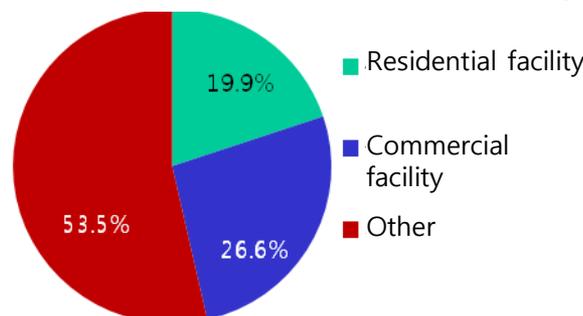
- As of Oct. 2010, the public : private ratio of the entire construction EPC volume is 15.9% : 84.1%.
- Residential facilities account for 54.8%, commercial facilities (offices, shops, and accommodations) 33.2%, and other facilities (education/clothes/welfare/research) 12.0%.
- As to residential facilities, which are the main part of the construction EPC market, the public sector order accounts for 3.2%, and the private sector order 51.7%..

■ Analysis on product proportion by ordering sector in 2010

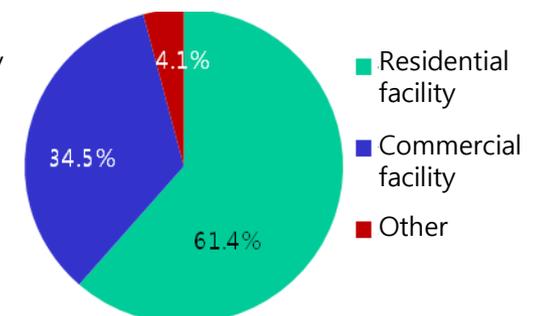
◆ All



◆ Public sector



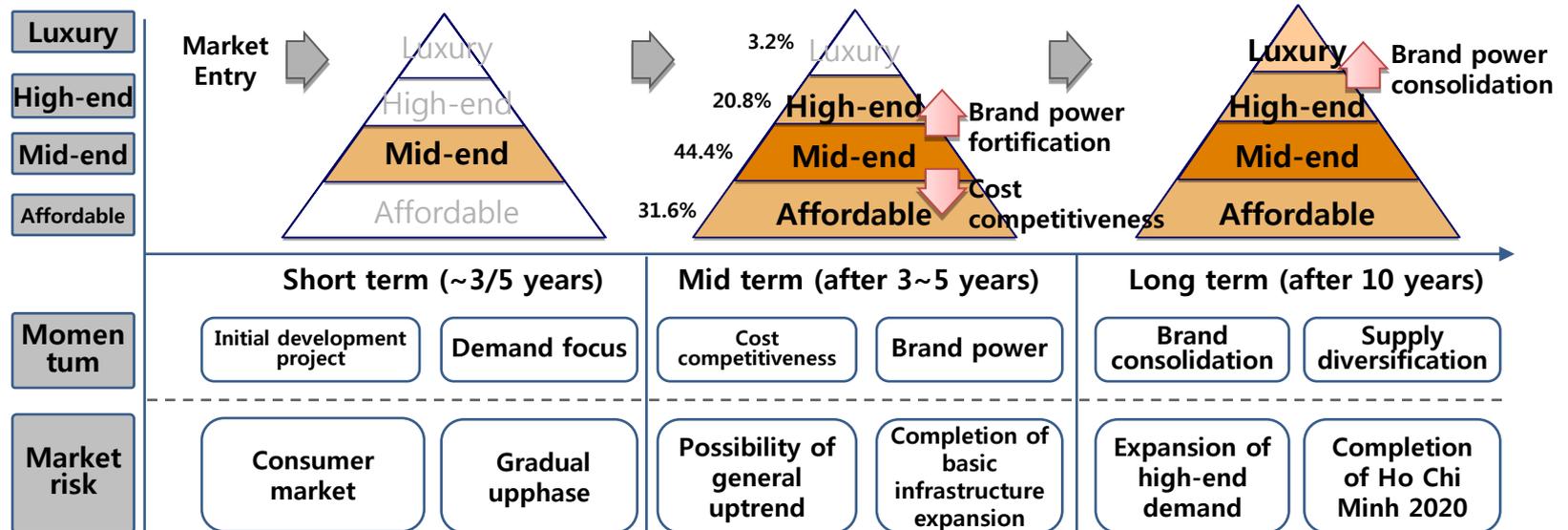
◆ Private sector



Characteristics of Housing Market (Ho Chi Minh)

Characteristics of housing market in Ho Chi Minh

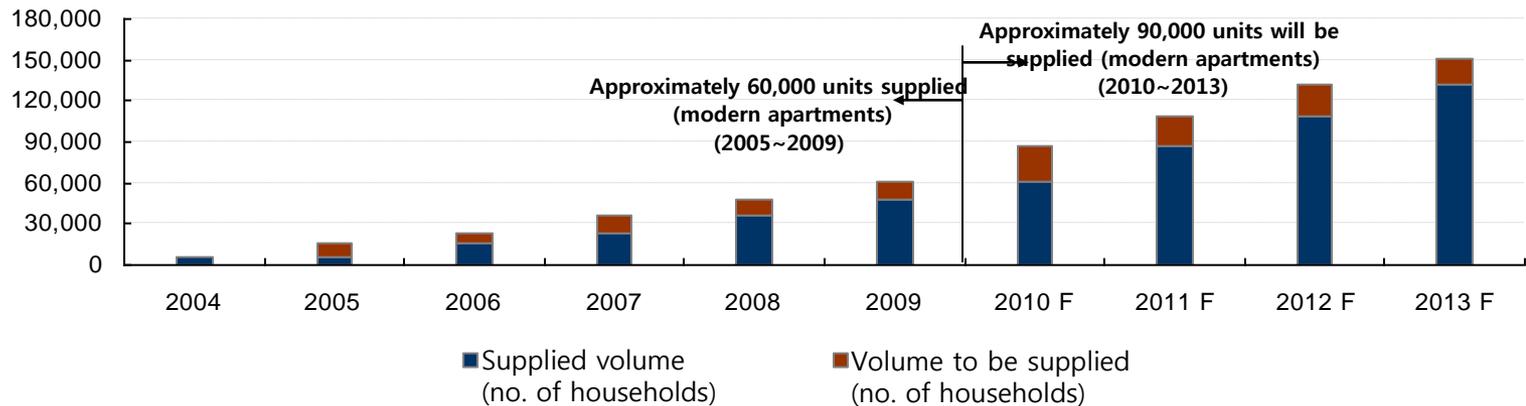
Housing market potential	Advice on the region	Advice on housing rating	Advice on entrance timing (Changes in market environment)
<ul style="list-style-type: none"> - Expansion of housing market size - Balance between consumer and provider markets and expansion of pie (according to diversification of demands in the future) - Housing cluster expansion and new town development acceleration 	<ul style="list-style-type: none"> - Ho Chi Minh master plan (region benefitting from policies) - Axes of Ho Chi Minh housing development (East axis and south axis) <p>➔ The 2nd region: Saigon South</p>	<ul style="list-style-type: none"> - Mid-end and affordable demand increase - Government-driven development of affordable housing - Subdivision of mid-end housing demand is expected <p>➔ Mid-end (short term), Mid and high-end (long term)</p>	<ul style="list-style-type: none"> - 4Q09: trend change - ~ 3/5 years: gradual up-phase (after 3/5 years: possibility of general uptrend) <p>➔ Entering before general uptrend phase</p>



Ratio of housing products (Ho Chi Minh)

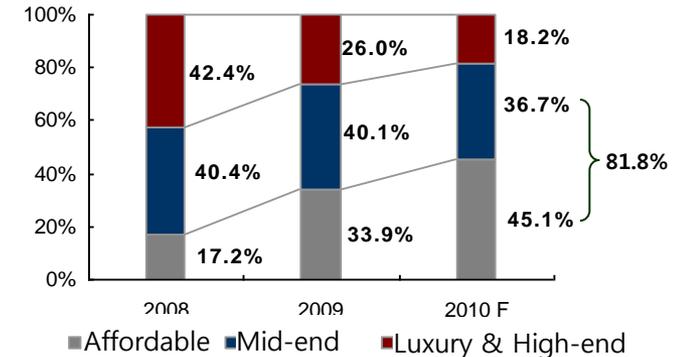
The ratio of high-end housing supply is decreasing. The ratio of mid-end and affordable housing volume is increasing and currently account for over 60% of the entire volume.

Entire supply and planned volume (based on modern apartments)



Ratio of Ho Chi Minh housing products (ratio of volume to be supplied)

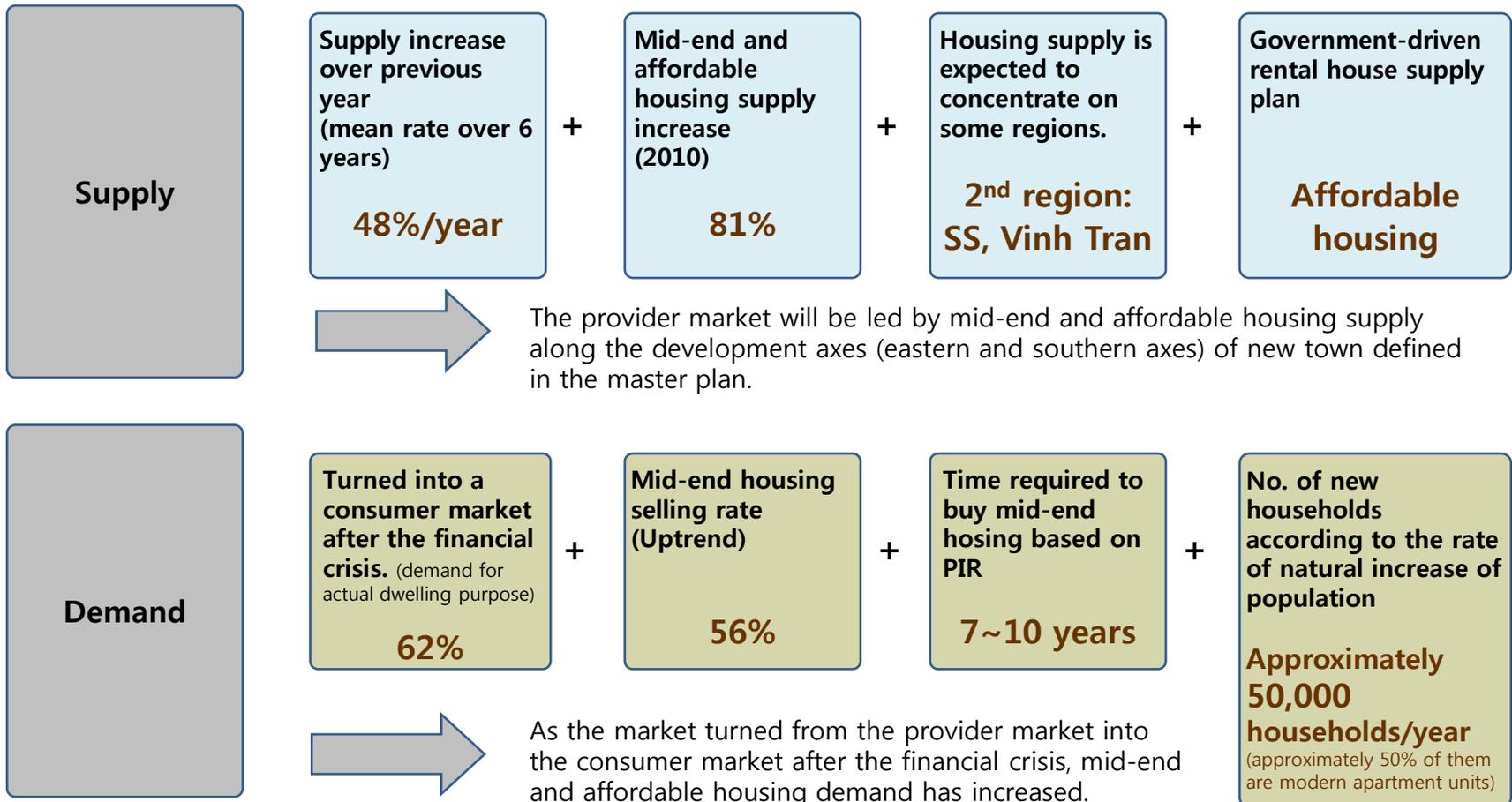
Volume to be supplied	2008		2009		2010 F	
	No. of households	Ratio	No. of households	Ratio	No. of households	Ratio
Luxury & high-end	4,005	42.4%	2,781	26.0%	4,791	18.2%
Mid-end	3,818	40.4%	4,276	40.1%	9,662	36.7%
Affordable	1,630	17.2%	3,619	33.9%	11,873	45.1%
Total	9,453	100.0%	10,676	100.0%	26,326	100.0%



Comparison between Demand and Supply of Housing (Ho Chi Minh)

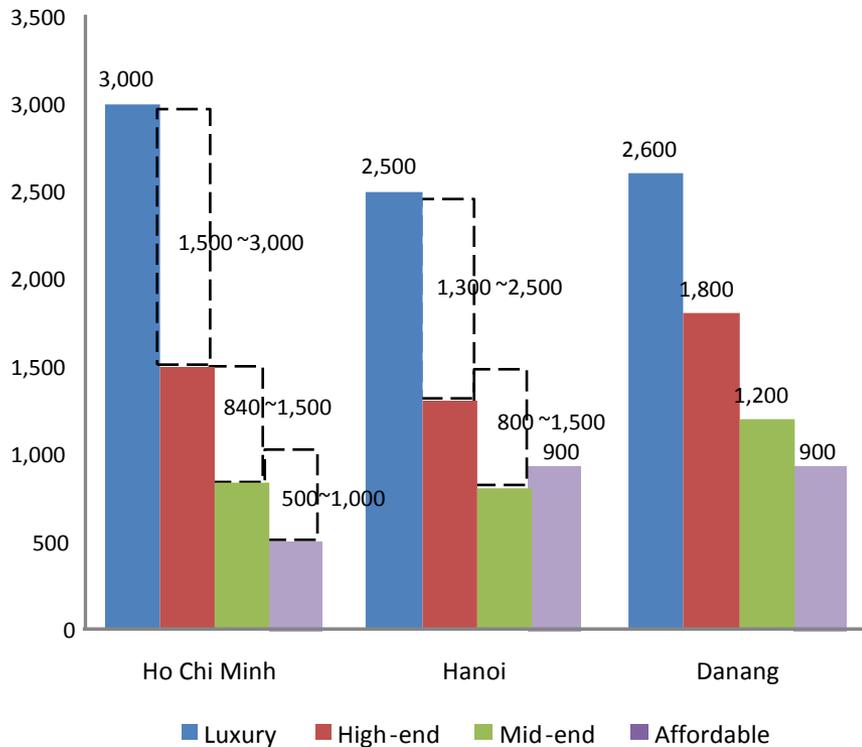
As the market turned into a consumer market after the financial crisis, demand for mid-end and affordable housing demand is expanding, and to meet such demand, mid-end and affordable housing products are being supplied along the main development axes.

Supply and demand of housing market in Ho Chi Minh City

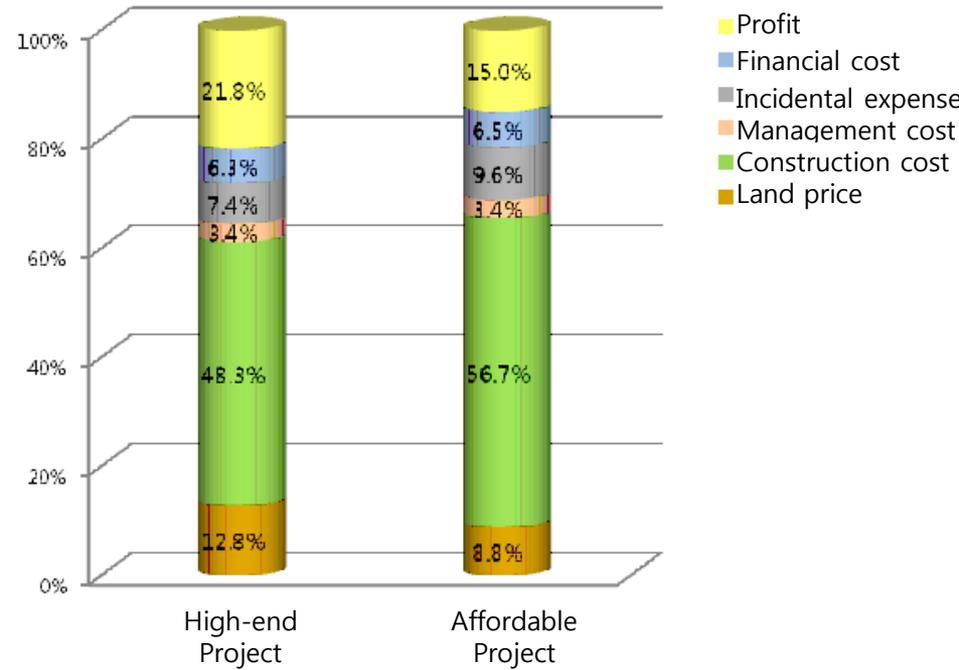


Ratio of price composition for major city housing

■ Apartment price by region and rating (USD/m²)



■ Ratio of apartment price composition (Ho chi Minh)



	High-end	Affordable
Apartment price	\$2,300/m ²	\$1,000/m ²

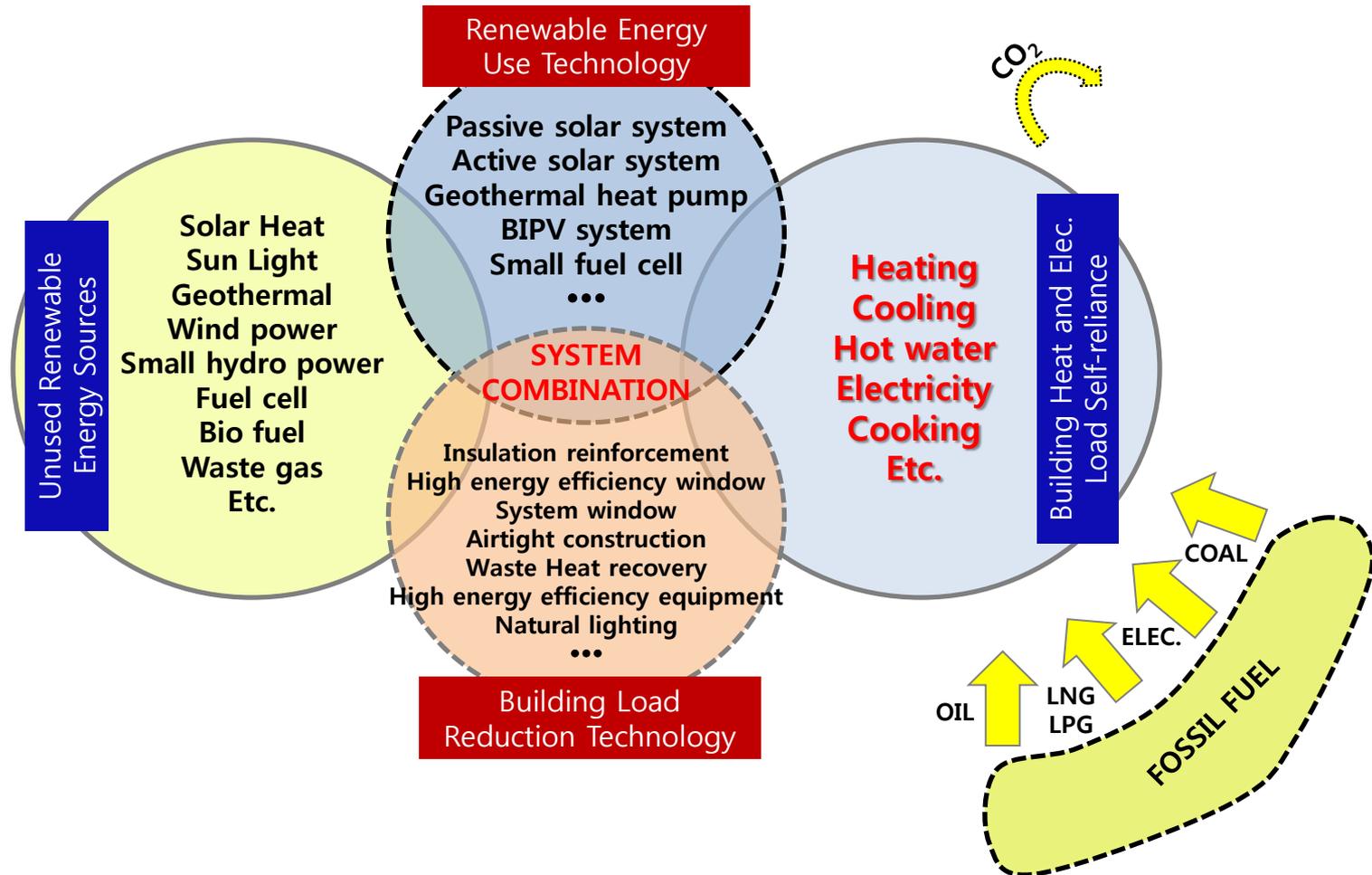
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Basic Design Elements for Zero Energy Building



Source : Jongho Yoon, How to achieve zero self-sufficiency for Korean high-rise apartment building, 5th symposium of KSTBF* , 2005

*KSTBF : Korea Super Tall Building Forum

Local Climate Characteristics(Ho chi Minh)

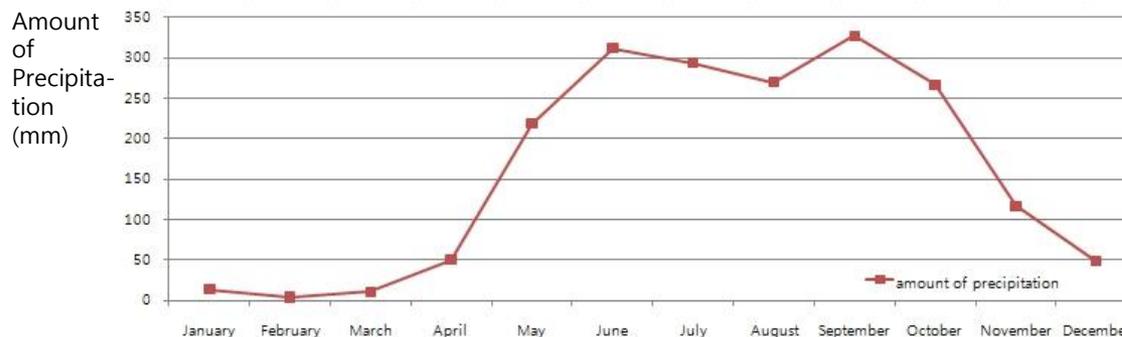
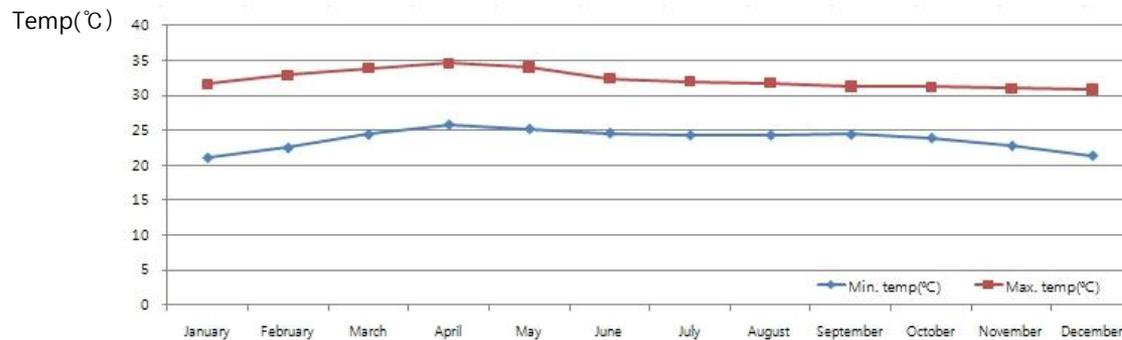
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min. temp (°C)	21.1	22.5	24.4	25.8	25.2	24.6	24.3	24.3	24.4	23.9	22.8	21.4
Max. temp (°C)	31.6	32.9	33.9	34.6	34	32.4	32	31.8	31.3	31.2	31	30.8
amount of precipitation (mm)	13.8	4.1	10.5	50.4	218.4	311.7	293.7	269.8	327.1	266.7	116.5	48.3

Climate Characteristics

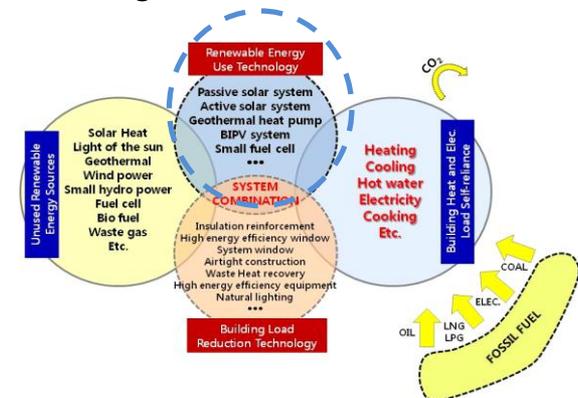
- Hot & humid
- High level of relative humidity mostly over the 80%
- Annual cooling operation is needed



Difficult climate condition for making the Zero Energy Building



Using the renewable energy technology for cooling is over the limitation



General New Housing Building(Ho Chi Minh)



Blooming Park(2011)



Sunrise City(2012)



Estella(2010)



Kenton Residences(2013)

- 60% of new construction housing is high-rise building
- Absent of national standard for insulation
- Building construction without insulation

Introduction to SK Sky View(KOREA)

- Mega Residential Development Project over 3,600 units up to 47 Stories High-end Condo in Suwon City (Southern area from Seoul)
- Start Selling from June 2010
- SK View is SK E&C's Residential Brand



- Climate

- Continental climate
- Winter : cold anticyclone
- **Summer : high temperature and humidity**
- Annual temperature range : about 30°C over

Energy Saving Items(Sky View)

Energy Saving per flat

- Improvement of insulation for window / wall and Introduction of LED lighting inside
- Energy efficiency level 2nd Grade /Fulfill Green Home criteria from current government enforcement(34% energy saving compared to standard housing)



Estate Energy

- Solar electricity generator (20kW, for common electricity)
- Outdoor LED lighting
- Optimizing air flow with natural ventilation by airflow simulation



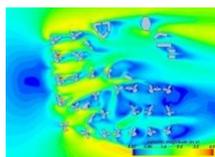
Solar electricity Generation



Solar LED lighting



LED Column Lighting



Airflow Simulation

Energy experiences for Residents

- Self generating fitness system / energy experience playground by collaboration with energy management authority
- Energy saving campaign for residents and training program for children



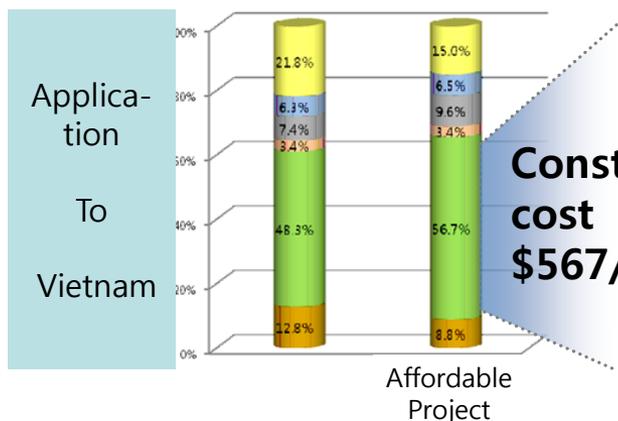
Self generating fitness system



Playground with energy experiences

Cost Impact

Items		Sky View		Cost Impact (USD)
Building Energy Efficiency Level		2nd Grade		
Energy Saving Amount		33%		
Building	Window	Type	- 22mm double layer double window (22mm+22mm)	\$33/m ²
		Heat transmission	2.0W/m ² °C	
	Insulation	Type	- Foam insulation Grade 2 No. 1 (Thermal conductivity : 0.031W/m°C)	\$4/m ²
		Outer Wall	80mm	
		Side Wall	110mm	
		Roof of highest story	120mm	
		Floor of lowest story	110mm	



Construction cost \$567/m²

Additional cost will 6.5% of construction cost

Additional cost \$37/m²

*BIPV will cost \$438/m², 6kWp is assumed to make ZEH in Ho chi Minh(based on floor area 100m², \$7,300/kWp)

Next step

1

Short term

- Energy consumption data investigation for Vietnamese households
- Affordable technology researching to make ZEH
- Cost impact analysis for ZEH

2

Long term

- Policy suggestion to Vietnamese government for insulation standard
- ZEH prototype development

The End