Study of cost optimised standard for social housing retrofit in Mexico: EnerPHit

Technical design for NAMA of existing buildings

by the **consortium PHI-GOPA-IzN**

for

the technical cooperation between Mexico and Germany,
Mexican-German NAMA Programme

May - November 2014

Speakers: Susanne Theumer, MariCarmen Rivero, Passivhaus Institut

Background: Mexico

Up until the 1960's more than 50% of the Mexican population lived in rural areas

Today:
Almost 80% of the Mexican population lives in cities (INEGI 2010)

Current building practices:
- Ignore climatic considerations
- Turn to high energy demanding solutions

[Morillón 2006].

Important barriers:
- Lack of knowledge and experience about energy efficiency
- Highly subsidised energy prices
- High costs for the necessary building materials and technical equipment

[CONAVI, SEMARNAT 2012].

Mexico: Efforts to improve housing

- Many successful initiatives to enhance building practices

Sisevive Ecocasa
¡Ahorras y vives bien!

By 2030 Mexico nearly 11 million new houses to be built. 9 million existing houses to be refurbished [CONAVI, SEMARNAT 2012].

- Labelling system for all new social dwellings, rating water savings and energy efficiency.
- Use of DEEVi tool (Diseño Energéticamente Eficiente de la Vivienda), energy evaluation tool based on Passive House Planning Package

INFONAVIT Hogares con valor

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

GOPA WORLDWIDE CONSULTANTS

NAMAs for the housing sector in Mexico

Mexico: ambitious goals & first actions

GHG emission reduction: 30% by 2020, 50% by 2050

NAMA Vivienda Nueva:

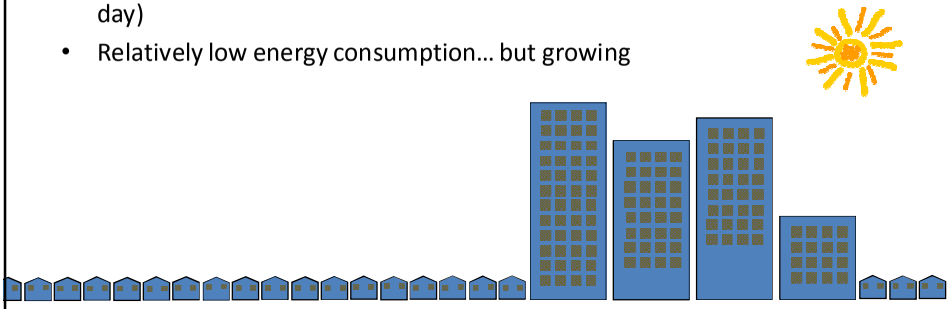
- COP 16 (2010), COP 17 (2011) and COP 18 (2012)
- Operated by CONAVI
- Commitments from international financial institutions
- Resulting programes: Sisevive-Ecocasa (Infonavit), CONOCER
- Technical design by the consortium GOPA-IzN-PHI

NAMA Vivienda Existente:

- Need for focus on existing housing
- By 2030, one third of existing housing will require retrofitting [CONAVI 2010]
- First concept presented at COP18
- Technical design by the consortium PHI-GOPA-IzN

Current living conditions in social housing

- Urban centres with large urban sprawls
- Very high room temperatures in summer (up to 30°C in extreme climates) and low room temperatures in winter (down to 16°C in colder climates)
- Main energy consumption of social houses: gas for cooking and DHW and electricity for electrical appliances (TV, fridge…)
- Minimal or no use for energy for temperature control: In hot climates: electricity ceiling fans or A/C (only at certain times of day)
- Relatively low energy consumption… but growing



NAMA for existing buildings: The tasks

- ✓Energy balance calculations of diverse social housing typologies in the four main climate zones in Mexico for diverse energy standards (from baseline to EnerPHit)
- ✓Consideration of (low) current energy use
- ✓Estimation of CO_2 emission mitigation potential
- ✓Calculation of cost-efficiency
- ✓Consideration of existing labelling system

Climate zones, social housing typologies

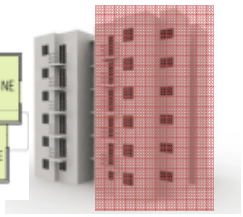
Adosada
(based on Polígono 108 Mérida)

© Passivhaus Institut

Source: CMM / INHAB

Aislada
NAMA Vivienda Nueva

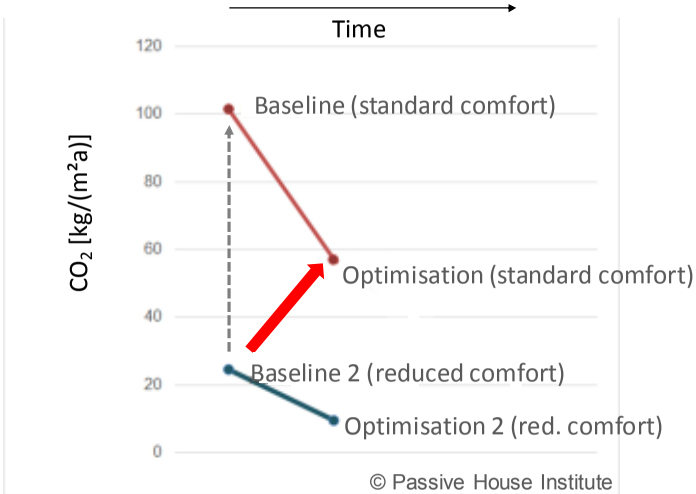
Source: GOPA/GIZ 2011



Vertical
NAMA Vivienda Nueva

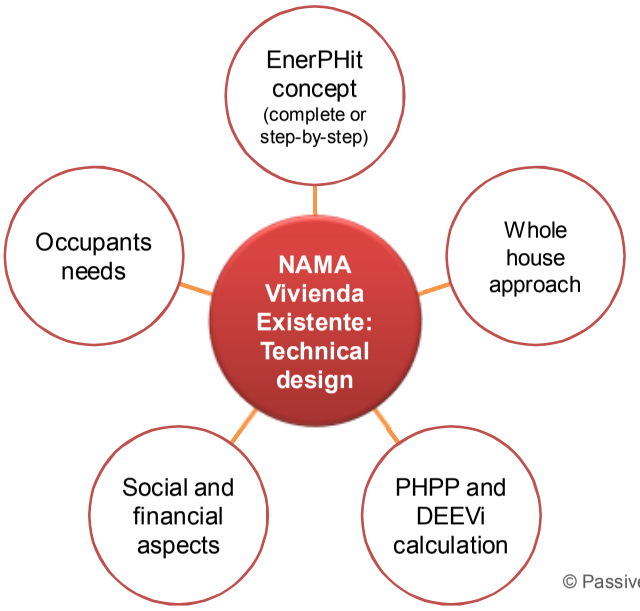
Source: GOPA/GIZ 2011

Comparison of two comfort scenarios



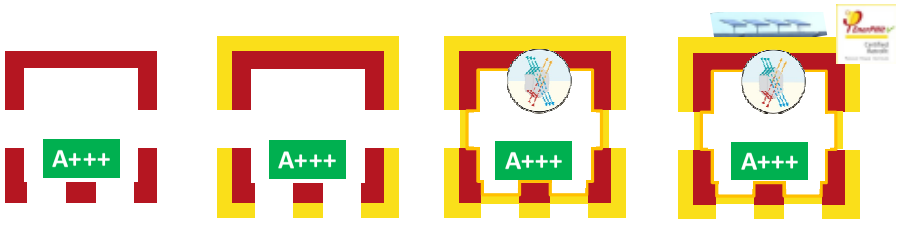
Energy performance assessment:
Standard comfort versus reduced comfort baseline

Methodological approach



The concept of step by step retrofitting

Example: Component by component retrofit



Replacement of electrical appliances with highly efficient ones.

Thermal insulation of building's envelope

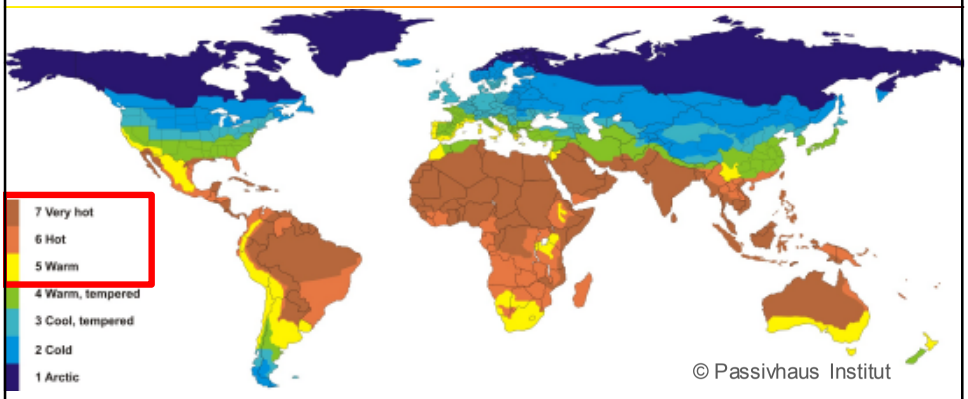
Thermally insulated windows, airtightness and HRV.

Integration of renewable energies and efficient heating/cooling systems

Important:

- ✓ To have an overall goal since the very beginning
- ✓ To consider all possible interactions between measures and their collateral effects

International EnerPHit requirements (by components)



- High thermal comfort
- No humidity/mold problems
- Reduction of CO_2 emissions
- **Very low <u>life cycle costs</u>**

International EnerPHit requirements (by components)

Climate Zone according to PHPP	Opaque envelope[1] against...				Windows (including exterior doors)					Ventilation	
	...ground	...ambient air			Overall[4]			Glazing	Solar load[5]		
	Insu-lation	Exterior insulation	Interior in-sulation[2]	Exterior paint[3]	Max. heat transfer coefficient ($U_{D/W,installed}$)			Solar heat gain coefficient (g-value), only if active heating present	Max. specific solar load during cooling period	Min. heat reco-very rate[6]	Min. hu-midity re-covery rate[7]
	Max. heat transfer coefficient (U-value)			Cool colours							
	[W/(m²K)]			-	[W/(m²K)]			-	[kWh/m²a]	%	
											
Arctic	Deter-mined in PHPP from project specific heating and cooling degree days against ground.	0.09	0.25	-	0.45	0.50	0.60	U_g - g*0.7 ≤ 0		80%	-
Cold		0.12	0.30	-	0.65	0.70	0.80	U_g - g*1.0 ≤ 0		80%	-
Cool-temperate		0.15	0.35	-	0.85	1.00	1.10	U_g - g*1.6 ≤ 0		75%	-
Warm-temperate		0.30	0.50	-	1.05	1.10	1.20	U_g - g*2.8 ≤ -1		75%	-
Warm		0.50	0.75	-	1.25	1.30	1.40	-	100	-	-
Hot		0.50	0.75	Yes	1.25	1.30	1.40	-		-	60 % (humid climate)
Very hot		0.25	0.45	Yes	1.05	1.10	1.20	-		-	60 % (humid climate)

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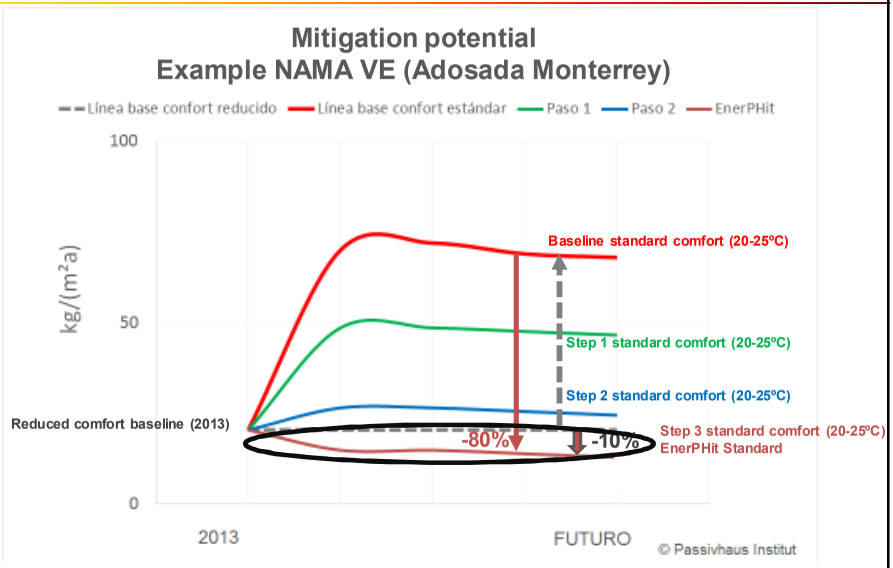
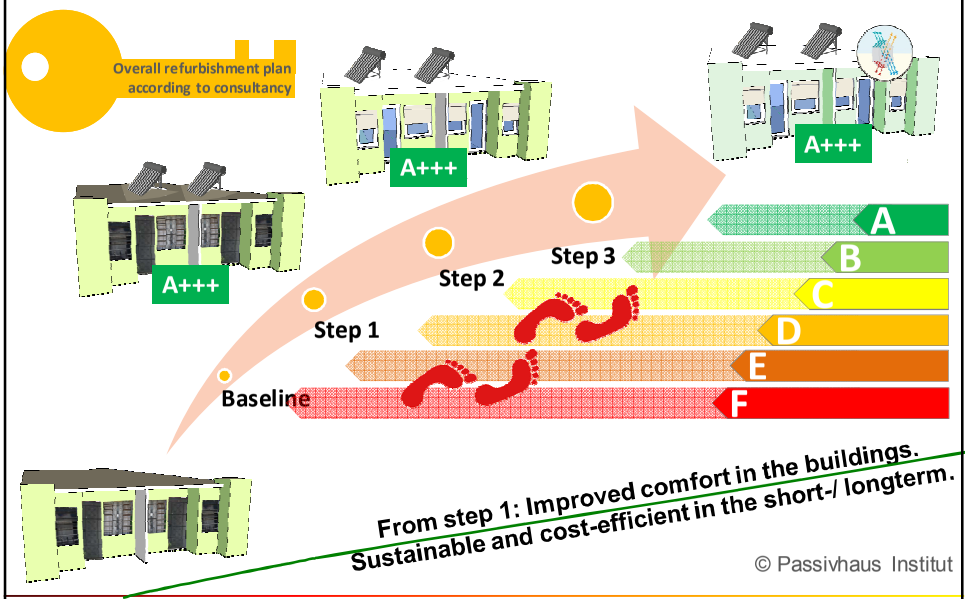
Baseline definition



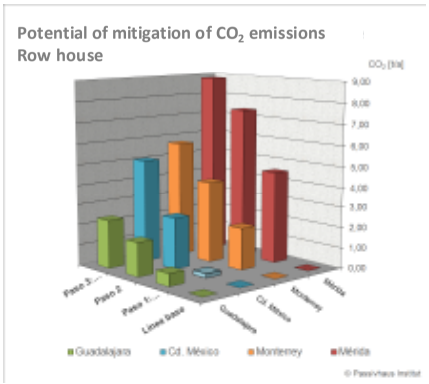
Consideration of "static" as well as "dynamic" baseline

Step-by-step retrofit: Example Adosada (row house)

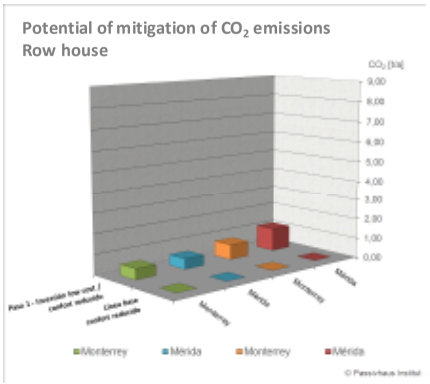


Results: Potential of mitigation and of reduction

- Potential of mitigation of CO_2 emissions
- Potential of reduction of CO_2 emissions

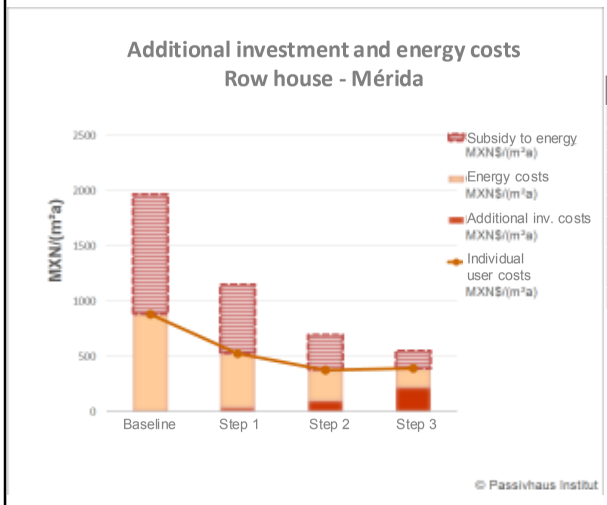


Standard comfort



Reduced comfort

Results: Row house, Merida (hot humid climate)



Boundary conditions for calculation

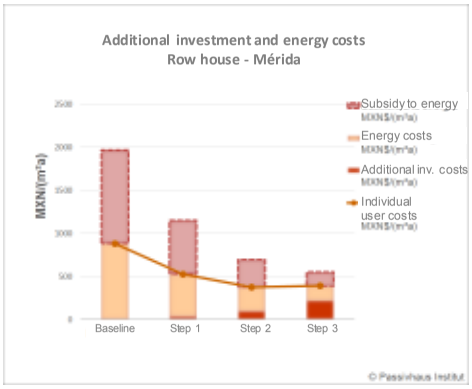
Indicator	Value	Unit
Real interest rate	3.00%	p.a.
Lifecycle	30	years
Gas Price	1.1	MXN/kWh
Gas Price increase	6.8%	p.a.
Electricity Price	1.2	MXN/kWh
Electricity Price increase	4.5%	p.a.
Electricity subsidy	1.7	MXN/kWh
Subsidy increase	4.5 %	p.a.

Source: Passive House Institute based on data of SENER

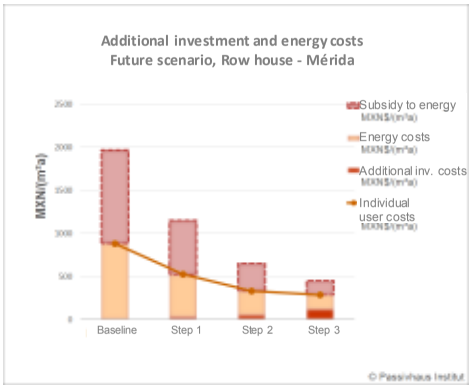
As of: 22 October 2014

Results: Row house, Merida (hot humid climate)

Current costs scenario



Future costs scenario



As of: 22 October 2014

Appropriate EnerPHit assessment

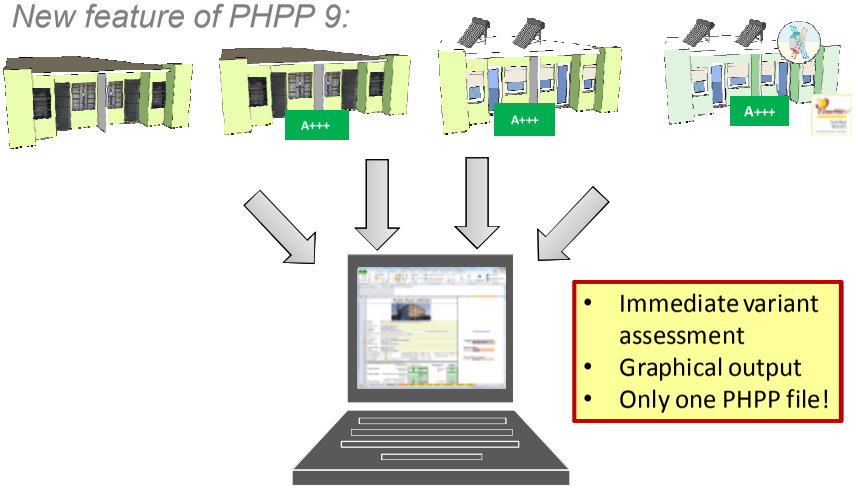
EnerPHit by heating/cooling demand → Milder climates (warm temperate)

Row house (adosada)				Detached house (aislada)				Multistorey building (vertical)			
	☑				☑				☑	☑	
☑		☑	☑	☑		☑	☑	☑			☑

EnerPHit by quality of building components → Extreme climates (hot/dry and very hot/humid)

Calculation of variants in PHPP

New feature of PHPP 9:



- Immediate variant assessment
- Graphical output
- Only one PHPP file!

Available in English soon!

Examples

Examples

EnerPHit Zertifizierte Modernisierung Passivhaus Institut

¡Gracias por su atención!
Thank you for your attention!

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