




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









Technical design for NAMMA of existing buildings
by the **consortium PHI-GOPA-IzN**

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



May - November 2014

Speakers: Susanne Theumer, Maricarmen Rivero, Passivhaus Institut

19th International Passive House Conference, Leipzig 2015

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 [Morillon 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].

Theumer, Rivero 2015

NAMMA Vivienda Existente

2

Mexico: Efforts to improve housing



- Many successful initiatives to enhance building practices



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



Theuner, Rievro 2015

NAMA Vivienda Existente

3

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 programmes: 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

Theuner, Rievro 2015

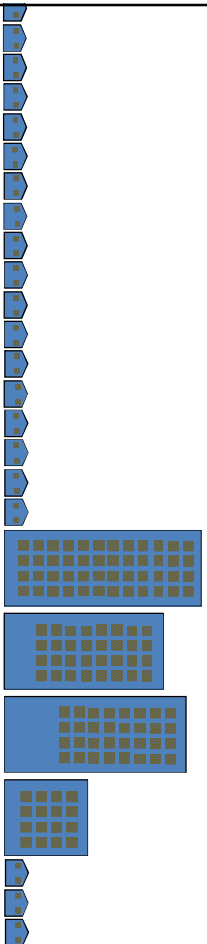
NAMA Vivienda Existente

4

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



Theuner, Riveiro 2015

NAMA, Vivienda Existente

5

NAMA for existing buildings: The tasks



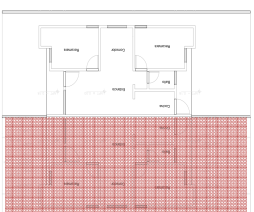
- ✓ Energy balance calculations of diverse social housing typologies in the four main climate zones in Mexico for diverse energy standards (from baseline to EnerPHit)
- ✓ Consideration of (low) current energy use
- ✓ Estimation of CO₂ emission mitigation potential
- ✓ Calculation of cost-efficiency
- ✓ Consideration of existing labelling system

Theuner, Riveiro 2015

NAMA, Vivienda Existente

6

Climate zones, social housing typologies



Adosada
(based on
Polígono 108
Mérida)

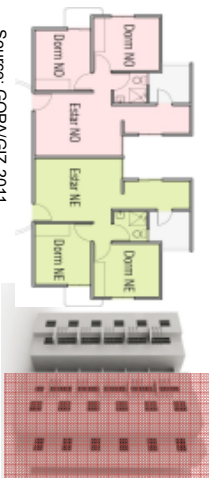


© Passivhaus Institut

Source: CMM / NHAB



Aislada
NAMA
Vivienda
Nueva



Vertical
NAMA
Vivienda
Nueva

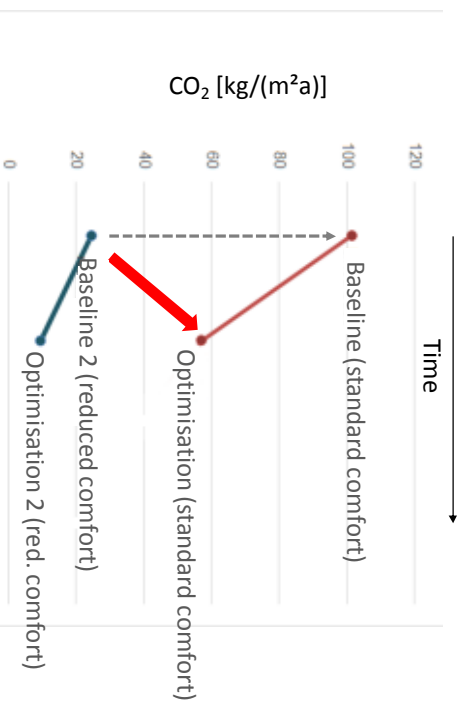
Source: GOPA/GIZ 2011

Theuner, Rivero 2015

Source: GOPA/GIZ 2011

NAMA, Vivienda Existente

Comparison of two comfort scenarios



© Passive House Institute

**Energy performance assessment:
Standard comfort versus reduced comfort baseline**

Theuner, Rivero 2015

NAMA, Vivienda Existente

Methodological approach



Theuner, Rievro 2015

NAMA Vivienda Existente

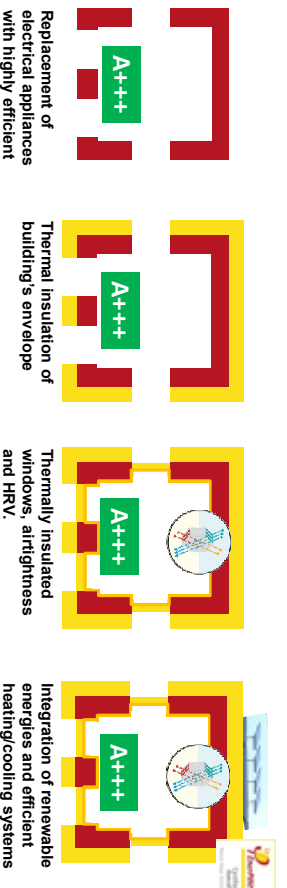
© Passive House Institute

9

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:

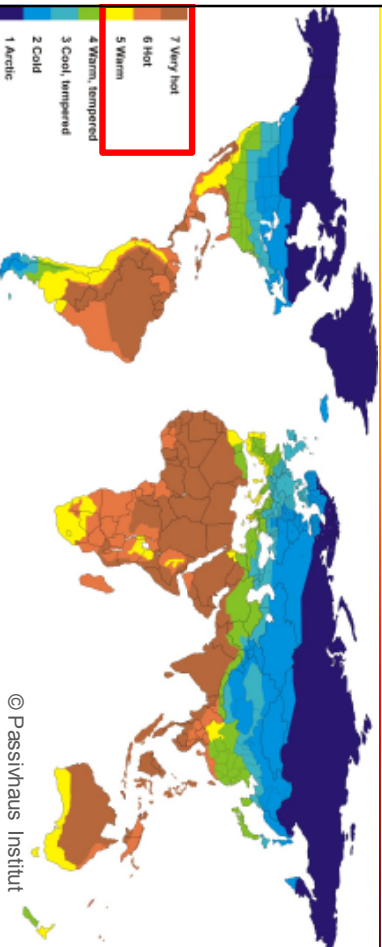
- ✓ To have an overall goal since the very beginning
- ✓ To consider all possible interactions between measures and their collateral effects

Theuner, Rievro 2015

NAMA Vivienda Existente

10

International EnerPHit requirements (by components)



© Passivhaus Institut

- High thermal comfort
- No humidity/mold problems
- Reduction of CO₂ emissions
- **Very low life cycle costs**

Theuner, Rievro 2015

NAMA, Vivienda Existente

11

International EnerPHit requirements (by components)



Climate Zone according to PHPP	Opaque envelope ¹ against... ...ground ¹ ...ambient air			Windows (including exterior doors)		Solar loads ⁵ [kWh/m ² a]	Ventilation	
	Insulation [W/(m ² K)]	Exterior insulation ² (U-value)	Interior insulation ² [W/(m ² K)]	Overall ⁴ [W/(m ² K)]	Glazing Solar heat gain coefficient (g-value), only if active heating present		Min. heat reco-very rate ⁶ %	Min. humidity re-covery rate ⁷ %
Arctic	0.09	0.25	0.25	0.45 0.50 0.60	U _g - g*0.7 ≤ 0		80%	-
Cold	0.12	0.30	0.30	0.65 0.70 0.80	U _g - g*1.0 ≤ 0		80%	-
Cool-temperate	0.15	0.35	0.35	0.85 1.00 1.10	U _g - g*1.6 ≤ 0		75%	-
Warm-temperate	0.30	0.50	0.50	1.05 1.10 1.20	U _g - g*2.8 ≤ -1		75%	-
Warm	heating and cooling degree days against ground	0.50	0.75	1.25 1.30 1.40	-	100	-	60 % (humid climate)
Hot	0.50	0.75	0.75	1.25 1.30 1.40	-	-	-	60 % (humid climate)
Very hot	0.25	0.45	0.45	1.05 1.10 1.20	-	-	-	60 % (humid climate)

© Passive House Institute

Theuner, Rievro 2015

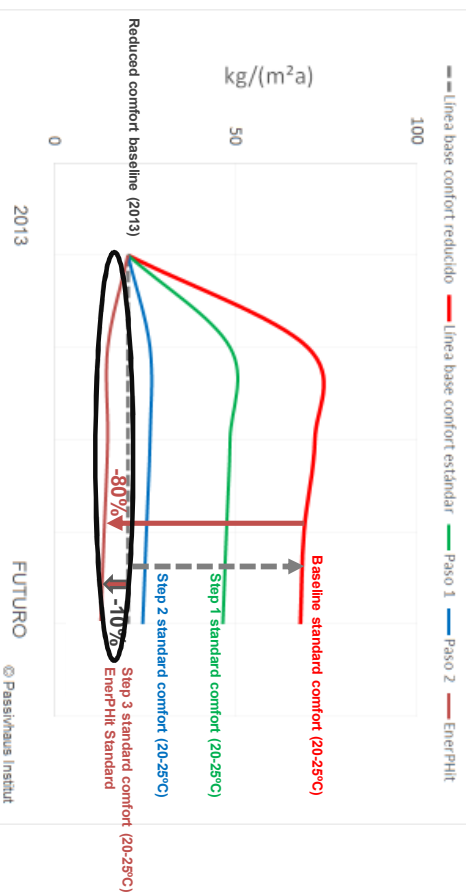
NAMA, Vivienda Existente

12

Baseline definition



Mitigation potential Example NAMMA VE (Adosada Monterrey)



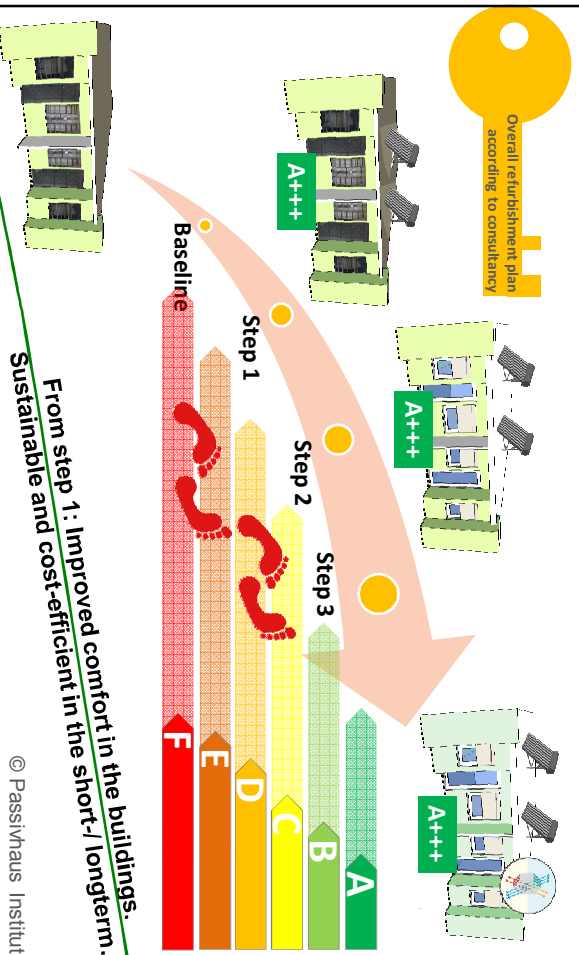
Consideration of “static” as well as “dynamic” baseline

Theuner, Rivero 2015

NAMMA Vivienda Existente

13

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



Theuner, Rivero 2015

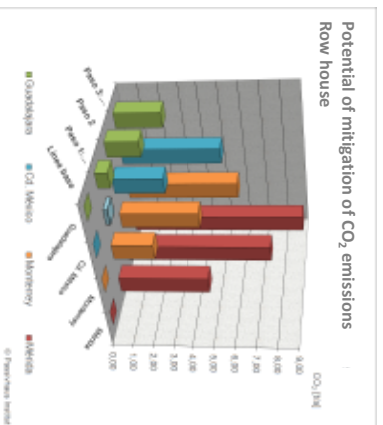
NAMMA Vivienda Existente

14

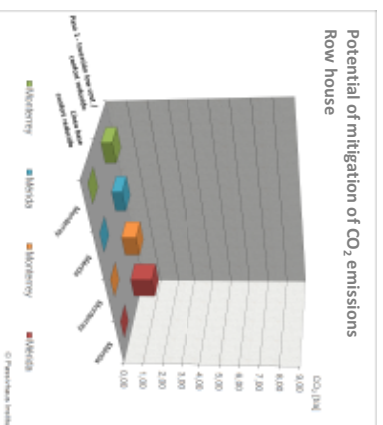
Results: Potential of mitigation and of reduction



- Potential of mitigation of CO₂ emissions
- Potential of reduction of CO₂ emissions



Standard comfort



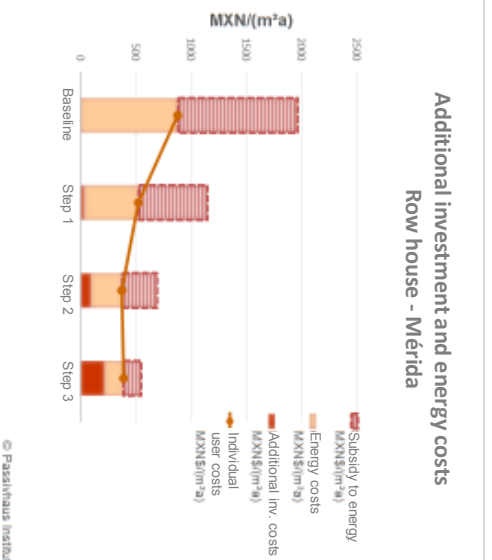
Reduced comfort

Theuner, Rievro 2015

NAMA Vivienda Existente

15

Results: Row house, Merida (hot humid climate)



Boundary conditions for calculation

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

Source: Passive House Institute based on data of SENER

As of: 22 October 2014

Theuner, Rievro 2015

NAMA Vivienda Existente

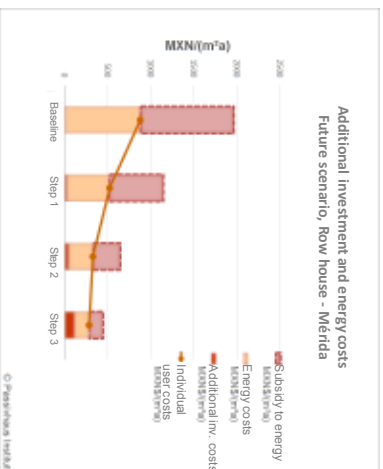
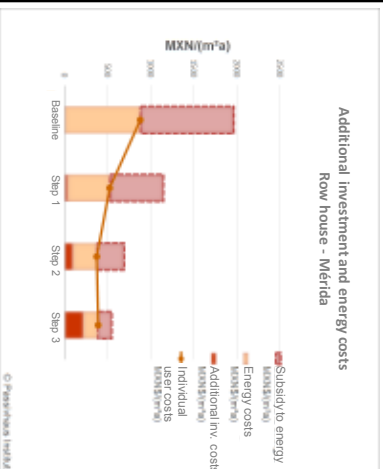
16

Results: Row house, Merida (hot humid climate)



Current costs scenario

Future costs scenario



As of: 22 October 2014

Theuner, Rivero 2015

NAMA, Vivienda Existente

17

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)

Theuner, Rivero 2015

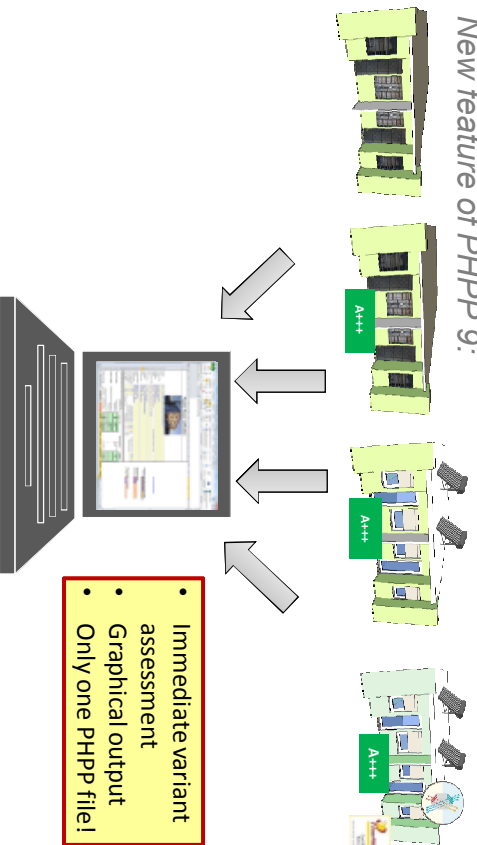
NAMA, Vivienda Existente

18

Calculation of variants in PHPP



New feature of PHPP 9:



Available in English soon!

Theuner, Rievro 2015

NAMA, Vivienda Existente

19

Examples



© Moritz Bernouilly / INHAB www.passivhouse-database.org ID 2959

Theuner, Rievro 2015

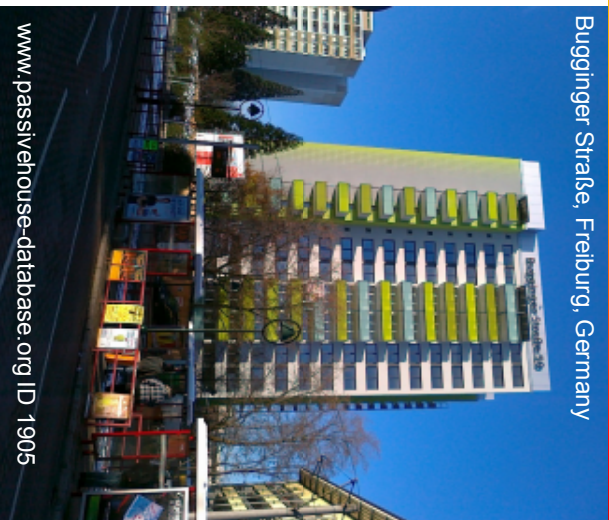
NAMA, Vivienda Existente

20

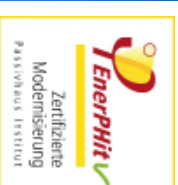
Examples



Bugginger Straße, Freiburg, Germany



[www.passivhouse-database.org/ID 1905](http://www.passivhouse-database.org/ID_1905)



Theuner, Rivero 2015

NAMA, Vivienda Existente

21



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

Consortium PHI-GOPA-IZN

Passivhaus Institut

GOPA Consultants

IZN Friedrichsdorf

Susanne Theuner
Susanne.Theuner@passiv.de

Albert Beele
Albert.Beele@gopa.de

Georg Kraft
gah.kraft@t-online.de

Maria del Carmen Rivero
Maria.Rivero@passiv.de

Angelika Stöcklein
Angelika.Stoeklein@gopa.de

Werner Neuhauf
wernerhomburg@arcor.de

Javier Flórez
Javier.Florez@passiv.de

Theuner, Rivero 2015

NAMA, Vivienda Existente

22

www.passiv.de
Passive House Institute



Bitte beachten Sie folgenden Hinweis zum Urheberrecht:

Die vorliegende Foliensammlung wurde zusammengestellt für die Teilnehmer der 19. Internationalen Passivhausstagung am 18.04.2015 in Leipzig, durchgeführt vom Passivhaus Institut. Diese Datei bzw. ein Papierausdruck ist nur zur Informationszwecken und zum persönlichen Gebrauch für die Teilnehmer dieser Veranstaltung bestimmt. Die Überlassung der Datei begründet kein Recht zur Weitergabe an Dritte oder ein Recht zur Veröffentlichung in jedweder Form. Die Inhalte bleiben geistiges Eigentum des Passivhaus Instituts. Insbesondere ist eine weitergehende Verwendung einzelner Inhalte (Folien) ohne ausdrückliche Zustimmung seitens des Passivhaus Instituts nicht gestattet.

Please note the following copyright notice:

The present collection of slides was assembled for the participants of the 19th International Passive House Conference on 18th April 2015 in Leipzig, Germany, which was organised by the Passive House Institute. This file or any printed copy of this file is for information purposes only and intended only for the personal use of the participants of this event. The transferal of this file to a third party or the right to publish it in any form is excluded. The contents are the intellectual property of the Passive House Institute. In particular, further use of individual contents (slides) is not permitted without the express permission of the Passive House Institute.