

On behalf of



Federal Ministry  
for Economic Cooperation  
and Development

On behalf of:



Federal Ministry  
for the Environment, Nature Conservation,  
Building and Nuclear Safety



of the Federal Republic of Germany

**giz** Deutsche Gesellschaft  
für Internationale  
Zusammenarbeit (GIZ) GmbH

# Integrating the HFC phase down in ongoing national mitigation actions

## *Applied tools to support a HFC phase down*

**Franziska Frölich, GIZ Proklima  
Side Event at MOP 28  
Kigali, 10 October 2016**



# Introduction

- National governments and policy makers are in the position to **enable sector transformation and wider market penetration of low-GWP systems.**
- Preconditions for projects in the RAC&F sectors: **sound data basis** (inventory) and the examination of existing national policies as well as a Technology Needs Assessment (TNA)
- Need for **integration** into climate policy ((I)NDCs)
- Need for **appropriate tools and methodological approaches** for project preparation (Building national HFC inventories, technology selection, Monitoring, Reporting, Verification)



## The GIZ Proklima approach...

... addresses the entire RAC&F sector from data collection to implementation...



- *F-gas inventory*
- *Energy consumption data*
- *Cooling needs assessment*
- *Emission calculation & projection*

- *Policy framework*
- *Financing options*
- *Economic assessment*
- *Technical options*
- *Co-benefits*

- *Technology road map*
- *Implementation plan*
- *Measurement, reporting, verification*

... and provides the required guidelines and tools.



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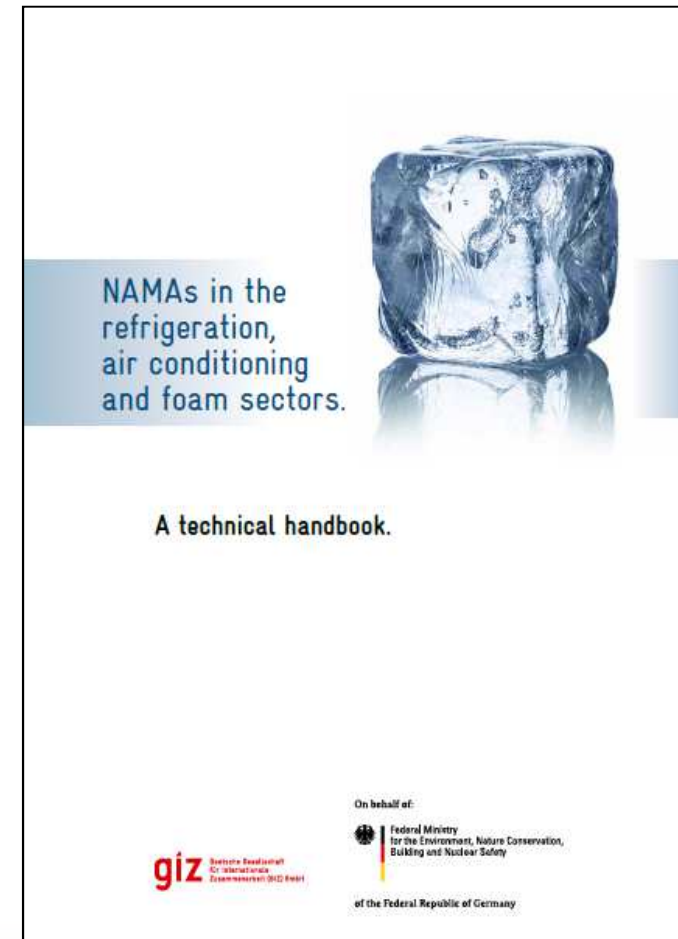
of the Federal Republic of Germany

# NAMA handbook for RAC&F sectors

*'NAMAs in the refrigeration, air conditioning and foam sectors (RAC&F):  
A technical handbook' is available [online](#).*

## 10 Modules

- Inventory
- Cooling needs assessment
- Technical options
- Economic assessment
- Mitigation scenarios
- Technology roadmap
- Measuring, reporting and verifying (MRV)
- Policy and financial options framework
- Implementation plan
- Co-benefits for the NAMA country



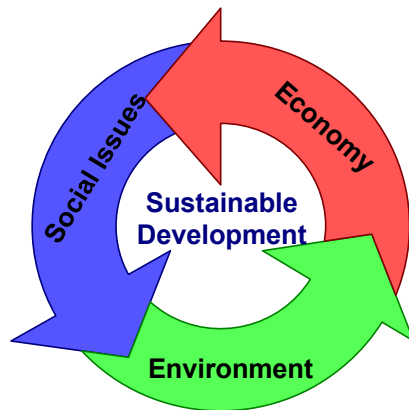


## Examples of Tools & Graphs Used in the Training

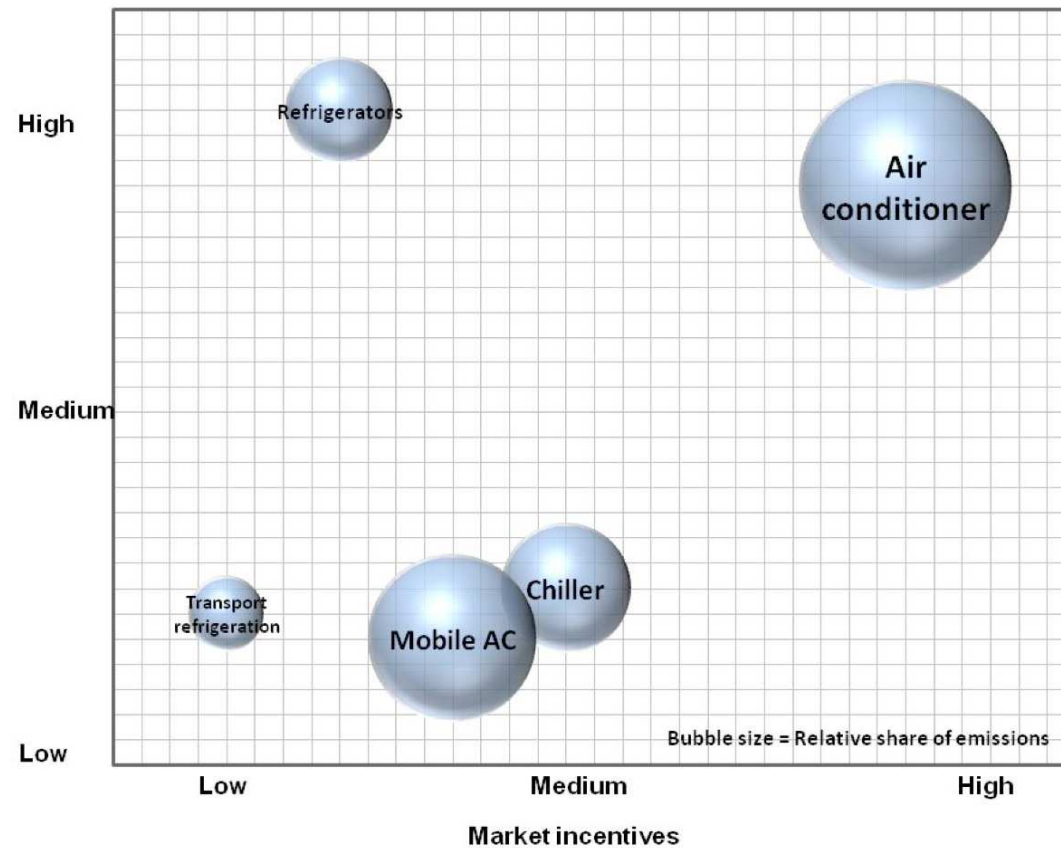
List of Tools
DIS-Tool
Emission savings & Scenarios
HFC Inventory & Projection Tool
Sales to Stock tool
Stock to sales tool
Stock Model
Co-benefit-tool
Mitigation & Cost Tool
<a href="#">Policy Tool</a>
<a href="#">Benchmarking Tool</a>



## Example: Ranking Tool for the Evaluation of Co-benefits



Policy incentives





# Co-benefits – Market and Policy Incentive Analysis Tools

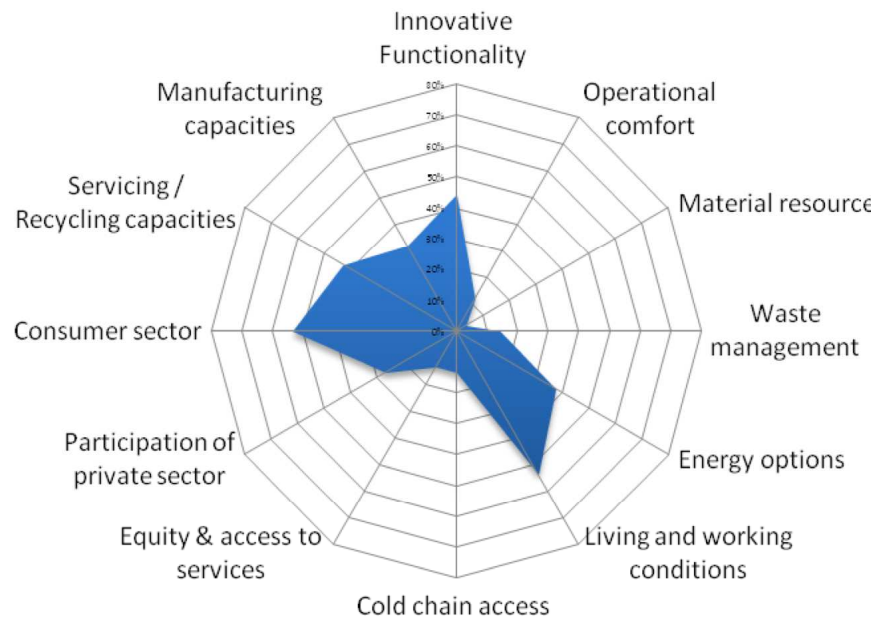


Figure 1: Direct co-benefits of refrigerator replacement - market incentive



Figure 1: External co-benefit of refrigerator replacement - policy incentives



## Level of data

### Tier 1 Data

- **National level**
- **Top Down Approach using F-gas production/import/export data at national level**

### Tier 2 Data

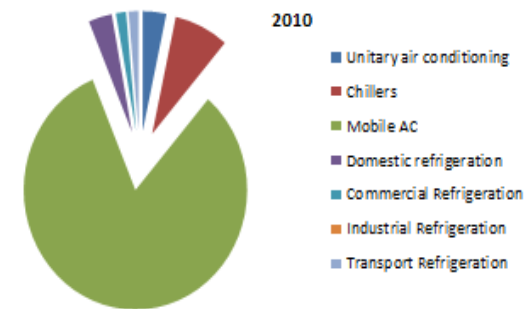
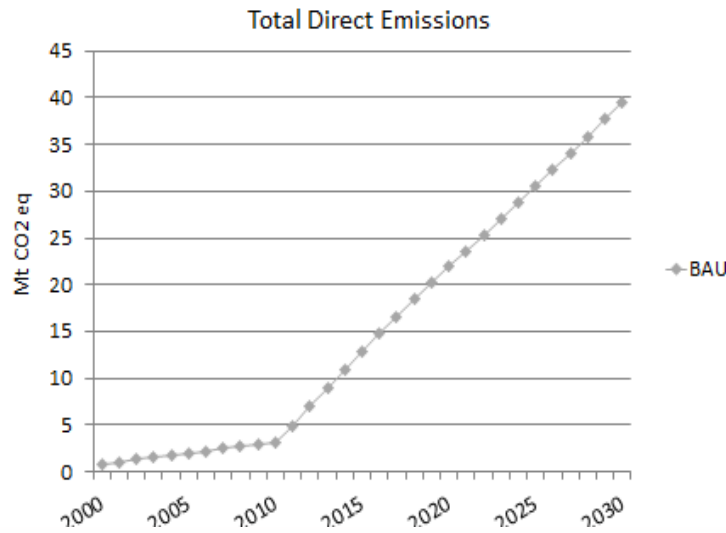
- **Company level**
- **Bottom Up Approach using production data of F-gas and equipment based on them**



# Inventory & Projection Tool

Air conditioning chillers	0	17.304	43.260	69.216	95.172	121.128	147.084	173.040	198.996	224.952	250.908	258.981	258.553	258.752	259.529	260.840	262.737
Process chillers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Car air conditioning	263.900	327.600	391.300	455.000	518.700	582.400	646.100	709.800	773.500	837.200	900.900	914.160	920.296	927.843	936.707	946.800	960.224
Large vehicle air conditioning	507.867	629.200	750.533	871.867	993.200	1.114.533	1.235.867	1.357.200	1.478.533	1.599.867	1.721.200	2.752.533	3.848.231	4.905.549	5.927.046	6.915.109	7.855.745
Refrigeration Domestic refrigeration	80.080	82.810	85.540	88.270	91.000	93.730	96.460	99.190	101.920	104.650	107.380	110.623	114.878	119.088	123.249	127.359	131.503
Refrigeration Stand-alone equipment	0	780	2.947	5.113	7.280	9.447	11.613	13.780	15.947	18.113	20.280	26.139	38.575	51.048	63.557	76.099	88.889
Refrigeration Condensing units	0	1.098	2.393	3.607	4.862	6.117	7.371	8.626	9.881	11.136	12.390	23.526	36.073	48.620	61.168	73.715	86.125
Refrigeration Centralized systems for supermarkets	0	1.263	2.705	4.148	5.591	7.034	8.477	9.920	11.363	12.806	14.249	392.567	837.381	1.296.027	1.767.815	2.252.086	2.724.228
Refrigeration Integral	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refrigeration Integral Condensing units	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refrigeration Centralized systems	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refrigeration Refrigerated truck/trailers	0	4.060	8.662	13.263	17.864	22.466	27.067	31.669	36.270	40.872	45.473	48.255	51.171	54.516	58.288	62.489	67.492
xxxx																	
	851846,6667	1071050,732	1305428,677	1539806,622	1774184,566	2008562,511	2242940,456	2477318,401	2711696,346	2946074,29	3180452,235	4914722,653	6947718,58	8952304,933	10931168,3	12886776,6	14785835,8

Refrigeration	0	6.936	18.129	29.322	40.515	51.708	62.900	74.093	85.286	96.479	107.671,8972	387.938	842.560	1.290.862	1.733.810	2.172.280	2.608.894
Refrigeration	0	17.304	43.260	69.216	95.172	121.128	147.084	173.040	198.996	224.952	250.908	258.981	258.553	258.752	259.529	260.840	262.737
Refrigeration	771.767	956.800	1.141.833	1.326.867	1.511.900	1.696.933	1.881.967	2.067.000	2.252.033	2.437.067	2.622.100	3.666.693	4.768.527	5.833.392	6.863.753	7.861.909	8.815.968
Refrigeration	80.080	82.810	85.540	88.270	91.000	93.730	96.460	99.190	101.920	104.650	107.380	110.623	114.878	119.088	123.249	127.359	131.503
Refrigeration	0	3.140	8.005	12.869	17.733	22.598	27.462	32.326	37.191	42.055	46.919,274	442.231	912.029	1.395.696	1.892.540	2.401.900	2.899.242
Refrigeration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refrigeration	0	4.060	8.662	13.263	17.864	22.466	27.067	31.669	36.270	40.872	45.473,064	48.255	51.171	54.516	58.288	62.489	67.492

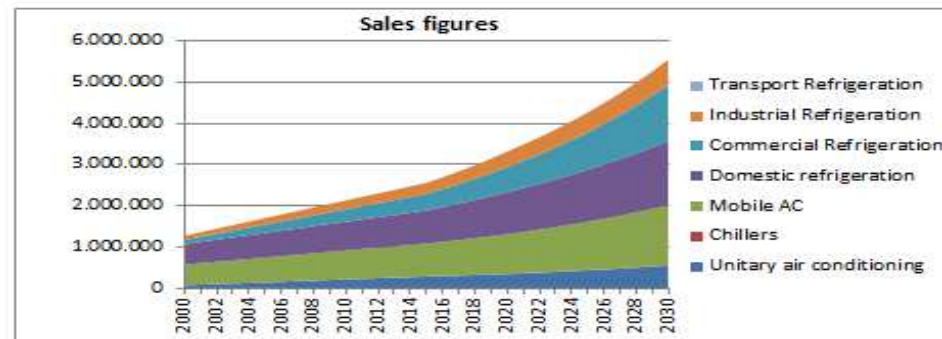




# Inventory & Projection Tool – Sales figures

Unitary ai	Multi-splits	10.000	12.000	14.000	16.000	18.000	20.000	22.000	24.000	26.000	28.000	30.000	32.000
Chillers	Air conditioning chillers	500	600	700	800	900	1.000	1.100	1.200	1.300	1.400	1.500	1.600
Chillers	Process chillers	500	600	700	800	900	1.000	1.100	1.200	1.300	1.400	1.500	1.600
Mobile AC	Car air conditioning	250.000	260.000	270.000	280.000	290.000	300.000	310.000	320.000	330.000	340.000	350.000	360.000
Mobile AC	Large vehicle air conditioning	250.000	260.000	270.000	280.000	290.000	300.000	310.000	320.000	330.000	340.000	350.000	360.000
Domestic	Domestic refrigeration	500.000	520.000	540.000	560.000	580.000	600.000	620.000	640.000	660.000	680.000	700.000	720.000
Commerc	Stand-alone equipment	100.000	120.000	140.000	160.000	180.000	200.000	220.000	240.000	260.000	280.000	300.000	320.000
Commerc	Condensing units	1.000	1.100	1.200	1.300	1.400	1.500	1.600	1.700	1.800	1.900	2.000	2.100
Commerc	Centralised systems for supermarkets	100	200	300	400	500	600	700	800	900	1.000	1.100	1.200
Industrial	Integral	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000
Industrial	ICondensing units	1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.000	12.000
Industrial	Centralised systems	100	200	300	400	500	600	700	800	900	1.000	1.100	1.200
Transport	Refrigerated trucks/trailers	500	600	700	800	900	1.000	1.100	1.200	1.300	1.400	1.500	1.600
XXX	XXX												

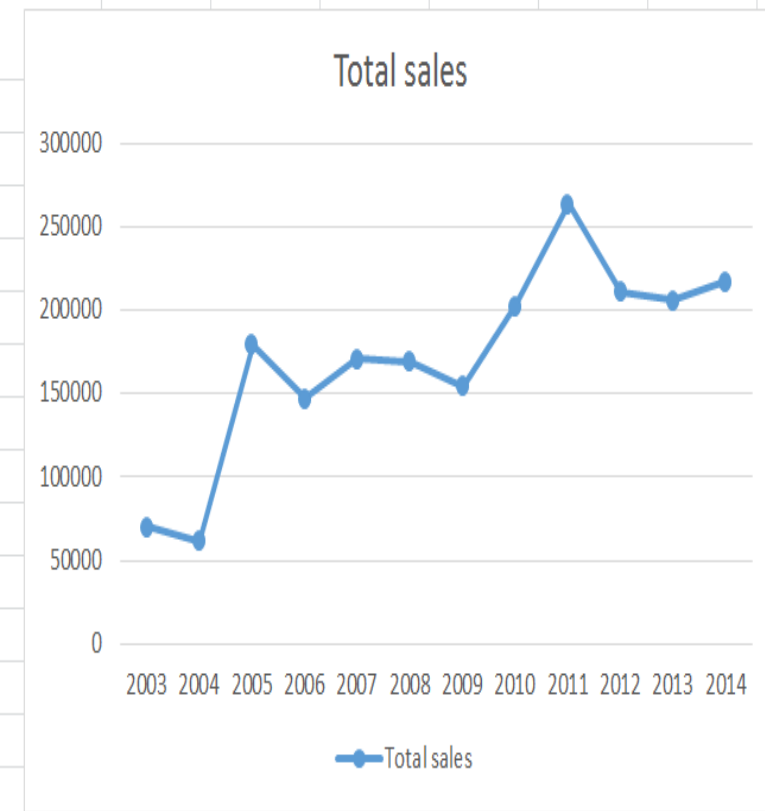
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Unitary air conditioning	70.000	84.000	98.000	112.000	126.000	140.000	154.000	168.000	182.000	196.000	210.000	224.000
Chillers	1.000	1.200	1.400	1.600	1.800	2.000	2.200	2.400	2.600	2.800	3.000	3.200
Mobile AC	500.000	520.000	540.000	560.000	580.000	600.000	620.000	640.000	660.000	680.000	700.000	720.000
Domestic refrigeration	500.000	520.000	540.000	560.000	580.000	600.000	620.000	640.000	660.000	680.000	700.000	720.000
Commercial Refrigeration	101.100	121.300	141.500	161.700	181.900	202.100	222.300	242.500	262.700	282.900	303.100	323.300
Industrial Refrigeration	101.100	112.200	123.300	134.400	145.500	156.600	167.700	178.800	189.900	201.000	212.100	223.200
Transport Refrigeration	500	600	700	800	900	1.000	1.100	1.200	1.300	1.400	1.500	1.600



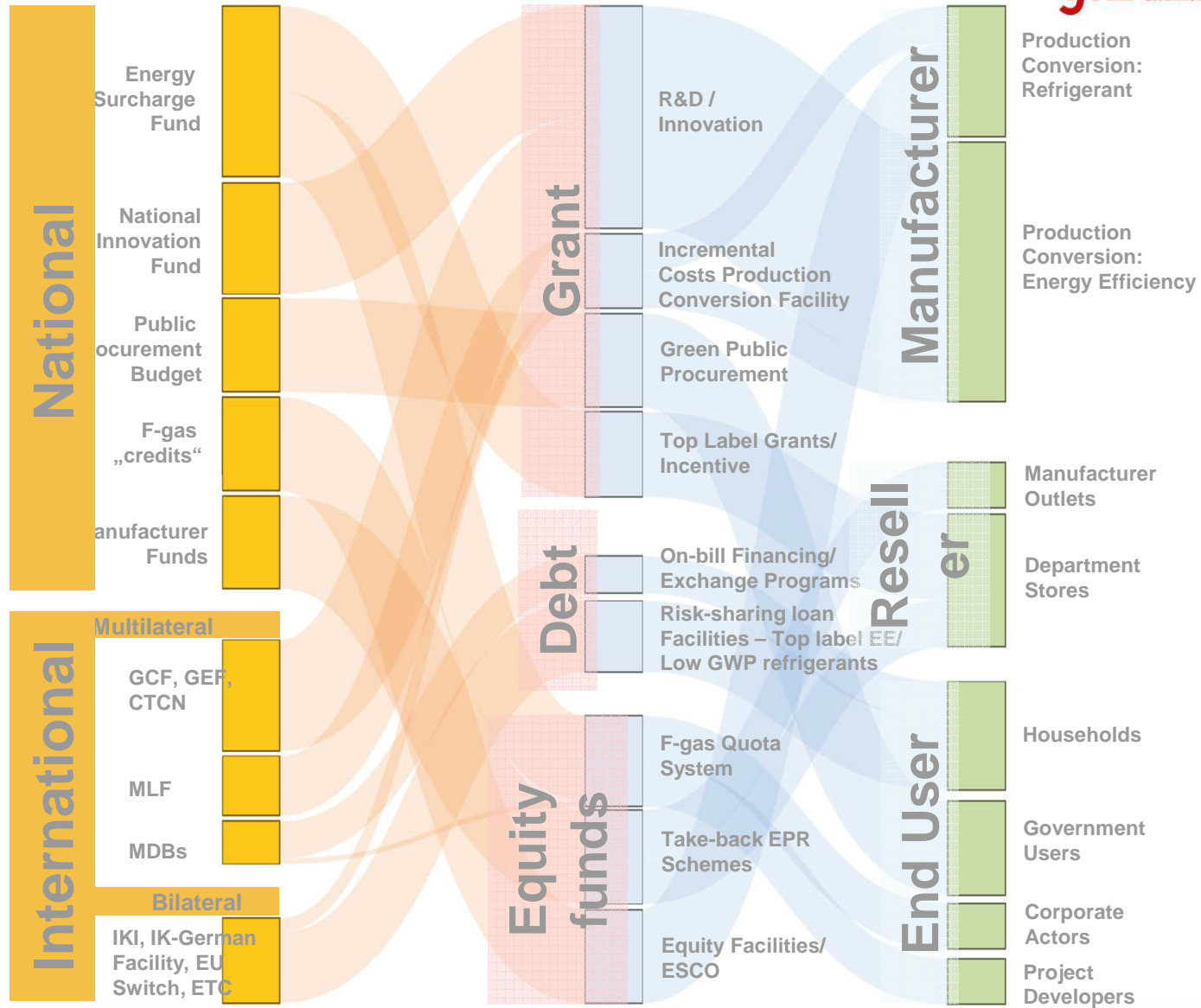


## Stock Tool (Excel)

Period	Trade Quantity					Total sales	Period
2003	405	56.981	8.678	3.539	525	70128	2003
2004	556	53.662	4.825	2.130	750	61923	2004
2005	897	170.474	3.402	4.395	462	179630	2005
2006	628	133.772	2.438	7.895	2.650	147383	2006
2007	31.238	120.924	6.836	11.940	N/A	170938	2007
2008	25.971	118.663	6.553	10.031	8.201	169419	2008
2009	21.289	106.921	8.198	18.274	N/A	154682	2009
2010	24.682	130.903	6.257	37.982	2.900	202724	2010
2011	36.946	160.012	11.297	46.743	8.751	263749	2011
2012	46.584	128.014	6.604	29.660	N/A	210862	2012
2013	66.475	89.635	9.129	40.530	N/A	205769	2013
2014	74.779	90.665	7.608	42.579	1.756	217387	2014



# FUNDING SOURCE INSTRUMENT RECIPIENT





## The RAC&F NAMA Training

- **PACKAGE 1 “Cool NAMA Training for Policy Makers”**: step-by-step guidance on NAMA planning and development processes in the RAC&F sector. Tools to plan and manage a NAMA taking into account policy, finance, technology and MRV.
- **PACKAGE 2 “Inventory and Mitigation Potentials in the RAC&F Sector”**: inventory preparation and assessment of mitigation potentials; development of HFC-gas inventories, calculation of emissions (both direct and indirect) using data input sheets and the proposal of mitigation scenarios.
- **PACKAGE 3 “The Economic Rationale for NAMA Projects in the Cooling Sector”** tools on how life cycle cost concepts and theoretical basics on dynamic investment grade calculation can be developed and up-scaled on a sectoral level.

**Contact:** [Nika.Greger@giz.de](mailto:Nika.Greger@giz.de) / [Nicole.Mueller@giz.de](mailto:Nicole.Mueller@giz.de)

→ [Training Flyer](#)



### Training Workshops on the Rationale for Energy Efficiency in the Cooling Sector

St. Kitts Marriott Resort and Royal Beach Casino  
Frigate Bay, St. Kitts and Nevis  
12-15 September 2016





## The GIZ NAMA Tool (general)

- has been prepared by GIZ
- The NAMA-Tool:
  - provides brief step-by-step instructions on how to develop a NAMA
  - navigates users to the relevant information, knowledge, and instruments
  - does not give sector-specific instructions, but includes links to sector-specific expertise and handbooks
  - is available at [www.mitigationpartnership.net](http://www.mitigationpartnership.net) in Spanish, English, French and Vietnamese

### Also available:

- self-paced [e-learning course](#) on NAMA development (based on NAMA Tool)



## Cool Training

- Training consists of 30 % theory and 70 % practical work
- Main subject is the application of natural refrigerants for commercial refrigeration systems
- 1 week training for NOUs
- 2 weeks training for technicians and trainers



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On behalf of

BUNDESFACHSCHULE  
Kälte | Klima | Technik



Federal Ministry  
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COUNTRY DATA

## The refrigeration and air conditioning sectors around the world

Our world map allows you to explore a wide variety of data: refrigeration and air conditioning appliances in use, unit sales, emissions and emission mitigation potentials in the cooling sectors both today and in the future.

[explore data >](#)

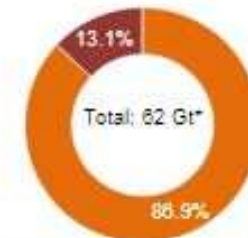


COOLING SECTORS

## Global greenhouse gas emissions in 2030

Global greenhouse gas emissions and percentage contributed by the cooling sector (projections for 2030)

[switch to Table](#)



■ cooling sector ■ others

\*in CO<sub>2</sub> eq



NETWORK

## Our network and best practice examples

Do you want to contribute to making green cooling a worldwide success story? The Green Cooling Initiative is looking for network members and best practice examples.



TECHNOLOGY

## Green cooling - markets and technologies



Natural refrigerants and high energy efficiency are



ABOUT

## Green Cooling Initiative

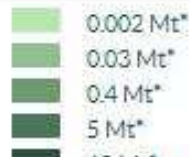
Refrigeration and air conditioning are responsible for a significant share of the global greenhouse gas emissions. Especially in developing and emerging countries, the demand for cooling equipment is rising. Low levels of efficiency and high leakage rates of refrigerant gases with high global warming

### Total emissions of cooling sector

All sectors

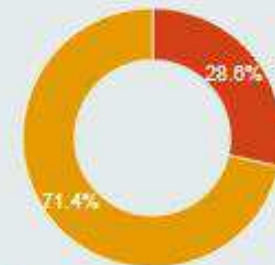
Absolute

+ | -

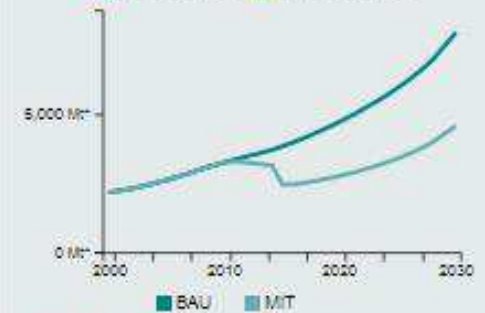


### World

Total emissions  
3,740 Mt\*



■ direct emissions ■ indirect emissions



\* in CO<sub>2</sub> equivalents  
BAU = Business as usual  
MIT = Mitigation scenario

### Subsectors shown





# Country data sheets

green cooling initiative

Print Close

Choose subsector:

all sectors

## Thailand

Population 67,201,200

GDP per capita 3,709 US\$

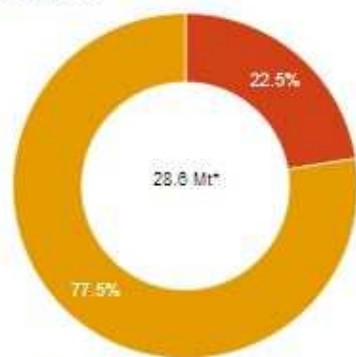
Urbanisation 35.6%

Electrification 99%

all sectors

Emissions

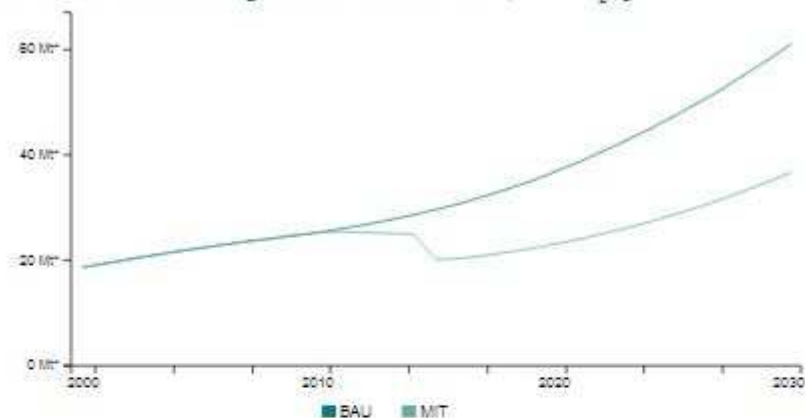
Indirect and direct emissions 2014



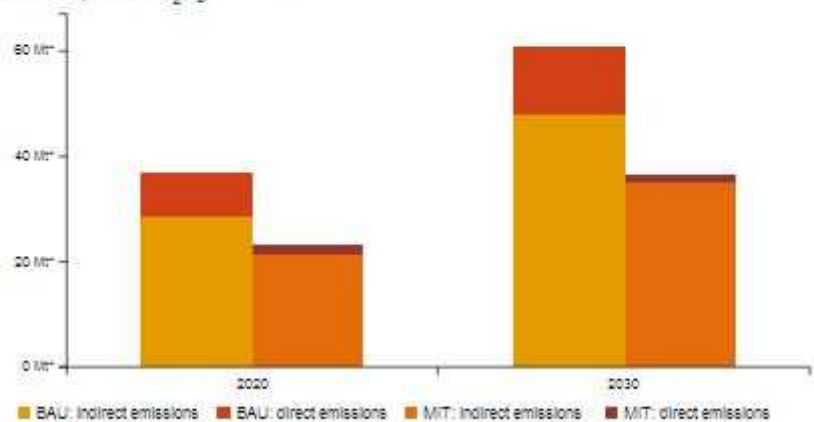
direct emissions indirect emissions

## Emissions in the business-as-usual and mitigation scenario

Business-as-usual and mitigation scenario until 2030 (in Mt CO<sub>2</sub>eq)



Indirect and direct emissions in business-as-usual and mitigation scenario in 2020 and 2030 (in Mt CO<sub>2</sub>eq)



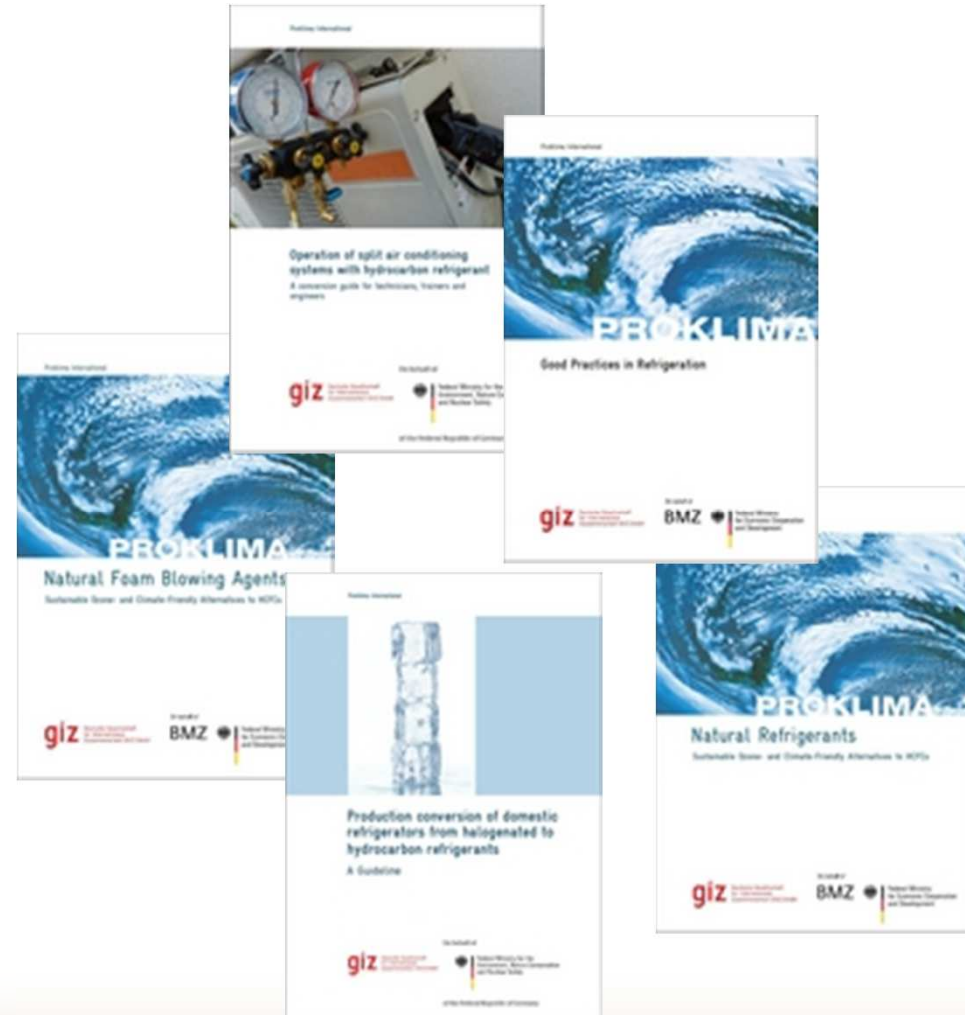
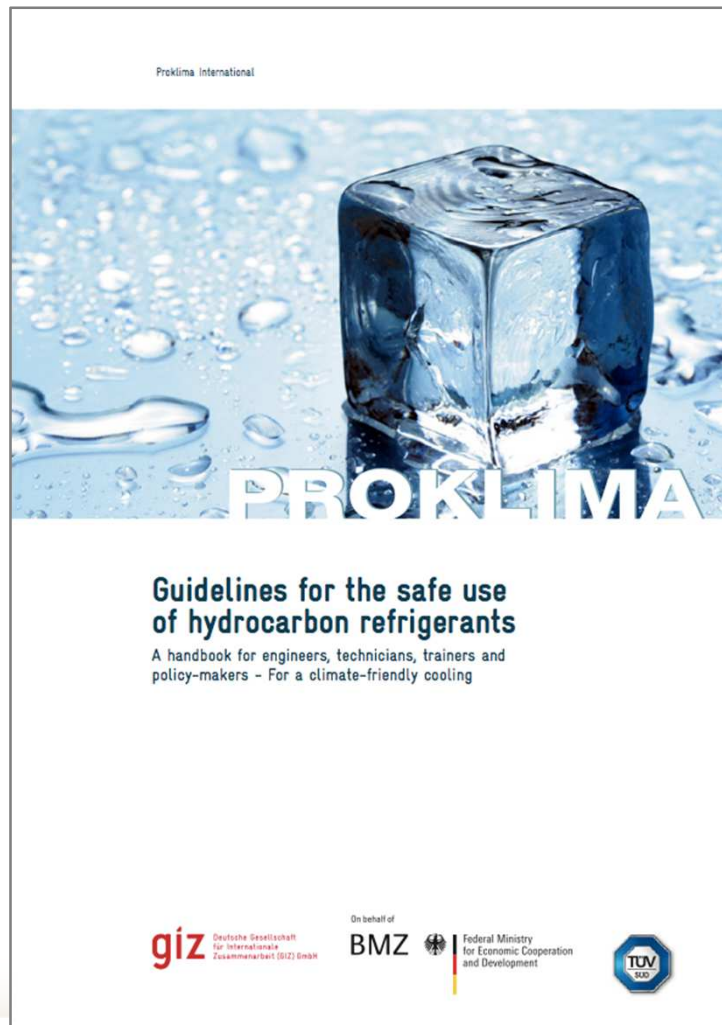
\* in CO<sub>2</sub> equivalents; BAU = Business-as-usual; MIT = Mitigation scenario

## Emission reduction potential

in Mt CO <sub>2</sub> eq	2020	2030
direct emissions	6.59	11.8



Guidance: [www.giz.de/proklima](http://www.giz.de/proklima)



# The GIZ Proklima NAMA Handbook

Brochure of the Handbook “NAMAs in the refrigeration, air conditioning and foam sectors”

[giz2013-en-NAMAs-E-Brochure.pdf \(pdf, 2.42 MB\)](#)

1) Inventory

[giz2013-en-NAMAs-Modul1-web.pdf \(pdf, 1.29 MB\)Annex Modul 1 \(pdf, 1.23 MB\)](#)

2) Cooling Needs Assessment

[giz2013-en-NAMAs-Modul2-web.pdf \(pdf, 1.84 MB\)](#)

3) Technical Options

[giz2013-en-NAMAs-Modul3-web.pdf \(pdf, 1.52 MB\)Annex Modul 3 \(pdf, 1.20 MB\)](#)

4) Economic Assessment

[giz2013-en-NAMAs-Modul4-web.pdf \(pdf, 1.60 MB\)Annex Modul 4 \(pdf, 1.36 MB\)](#)

5) Mitigation Scenarios

[giz2013-en-NAMAs-Modul5-web.pdf \(pdf, 1.39 MB\)](#)

6) Technology Roadmap

[giz2013-en-NAMAs-Modul6-web.pdf \(pdf, 1.44 MB\)](#)

7) MRV System

[giz2013-en-NAMAs-Modul7-web.pdf \(pdf, 1.32 MB\)Annex Modul 7 \(pdf, 1.12 MB\)](#)

8) Policy & Financial Framework

[giz2013-en-NAMAs-Modul8.1-web.pdf \(pdf, 1.28 MB\)giz2013-en-NAMAs-Modul8.2-web.pdf \(pdf, 1.35 MB\)](#)

9) Implementation Plan

[giz2013-en-NAMAs-Modul9-web.pdf \(pdf, 1.27 MB\)](#)

10) Co-benefits

[giz2013-en-NAMAs-Modul10-web.pdf \(pdf, 1.31 MB\)Annex Modul 10 \(pdf, 1.13 MB\)](#)



# Thank you for your attention!

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**GIZ Proklima International**

[www.giz.de/proklima](http://www.giz.de/proklima)

[www.green-cooling-initiative.org](http://www.green-cooling-initiative.org)