



IEA Bioenergy
Technology Collaboration Programme

IEA Bioenergy

Task 32

Strategies for reducing the impact on air quality from residential and commercial wood combustion



Hans Hartmann

TFZ Straubing, Germany

IEA Bioenergy Triannual Online Conference:
“Bioenergy - A critical part of the path to
carbon neutrality”

The IEA Bioenergy Technology Collaboration Programme (TCP) is organised under the auspices of the International Energy Agency (IEA) but is functionally and legally autonomous. Views, findings and publications of the IEA Bioenergy TCP do not necessarily represent the views or policies of the IEA Secretariat or its individual member countries.

Technology Collaboration Programme

by IEA

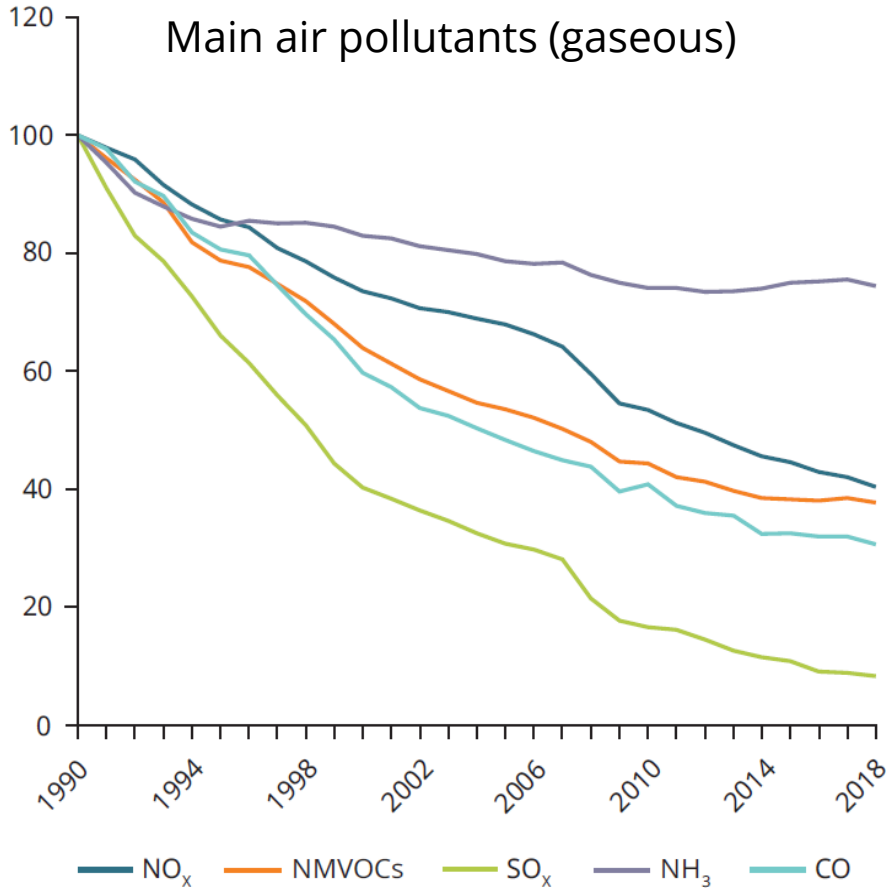
TFZ - Technology and Support Centre of Renewable Raw Materials (TFZ)



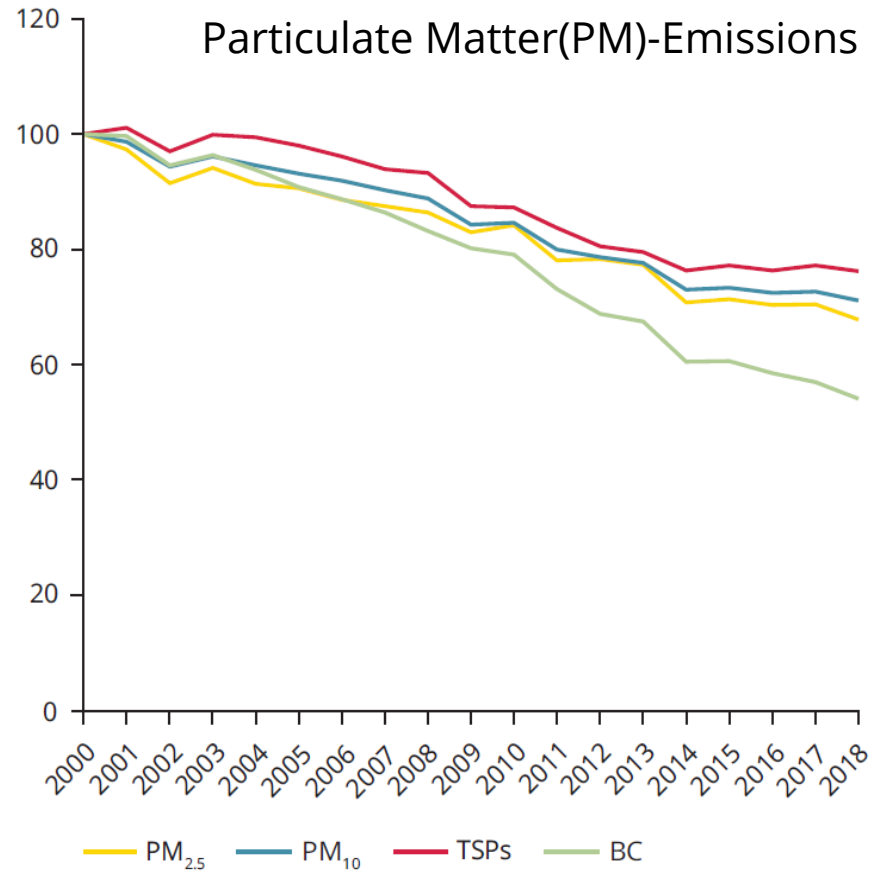
TFZ: Applied research and knowledge transfer for renewable resources (under the Bavarian Ministry of Agriculture)

Background: Emission trends (in Europe)

Index (1990 = 100)



Index (2000 = 100)

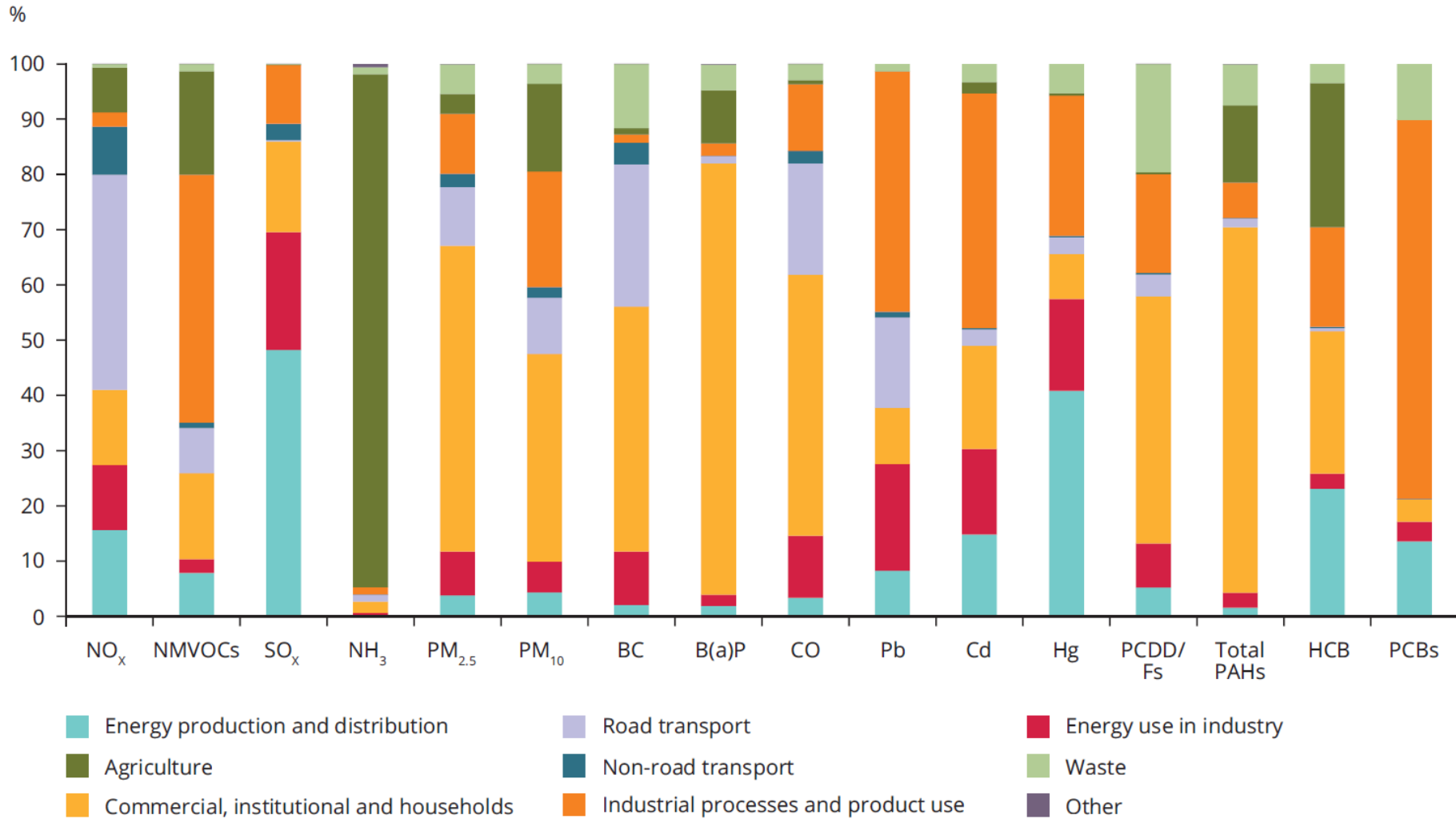


Background: Main sources of emission

Each air pollutant has one major source category:

- For NO_x, the major source category is 'road transport'.
- For SO_x, the major source category is 'energy production and distribution'.
- For NH₃, the major source category is 'agriculture'.
- For NMVOCs, the major source category is 'industrial processes and product use'.
- For CO und PM, the major source category is **'commercial, institutional and households'**.

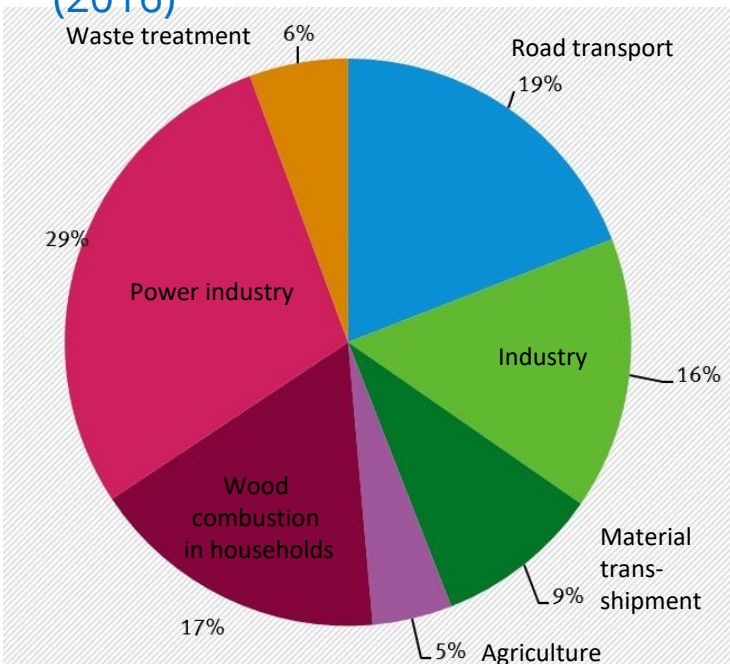
Main sources of emission



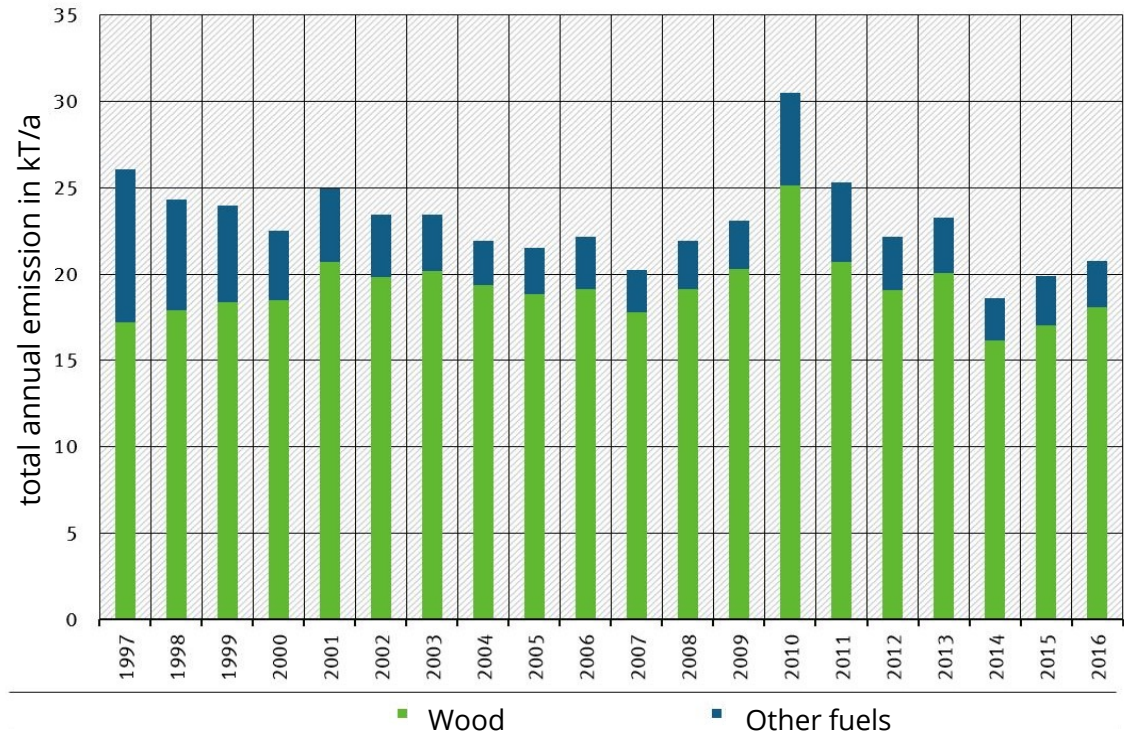
Source: European Union emission inventory report 1990-2018
Report No 05/2020

PM-emission contribution from households via wood combustion - Example: Germany

Sources of PM_{2.5}-Emissions (2016)



PM₁₀-Emissions in private households



Sources: Umweltbundesamt, 2018

Goals and scope of the activity

- To learn from approaches (and failures) concerning emission reduction strategies in the field of wood combustion in IEA-member countries
- Provide an inventory of possible measures
- To compile an IEA Task-32-report on national approaches concerning emission reduction from wood fuels
- *Main focus:* PM-emissions
- *Scope:* Mainly residential heating
- *Target group:* All decision makers and experts involved in emission abatement from wood combustion

Approach

- Design of a comprehensive questionnaire and a data collection file to allow a systematic search for relevant information from each country
- Questionnaires were reviewed and finally sent out (March 2021).
- The 9 receiving/participating partners are:
Austria, Canada, Switzerland, Germany, Denmark, Italy,
The Netherlands, Norway, Sweden
- 6 of 9 replies were already submitted and are now being evaluated.
- Finalisation of draft strategy report by March 2022

Collecting the information

Focus areas of questionnaire:

- **PART A – STATUS QUO OF AIR POLLUTION FROM WOOD COMBUSTION**
 - Number of appliances in the Country
 - Amount of wood fuel used
 - Current emission limits in the Country

- **PART B – MEASURES AND ACTIONS**

Collecting the information (2)

Areas looked at in "PART B "MEASURES AND ACTIONS"

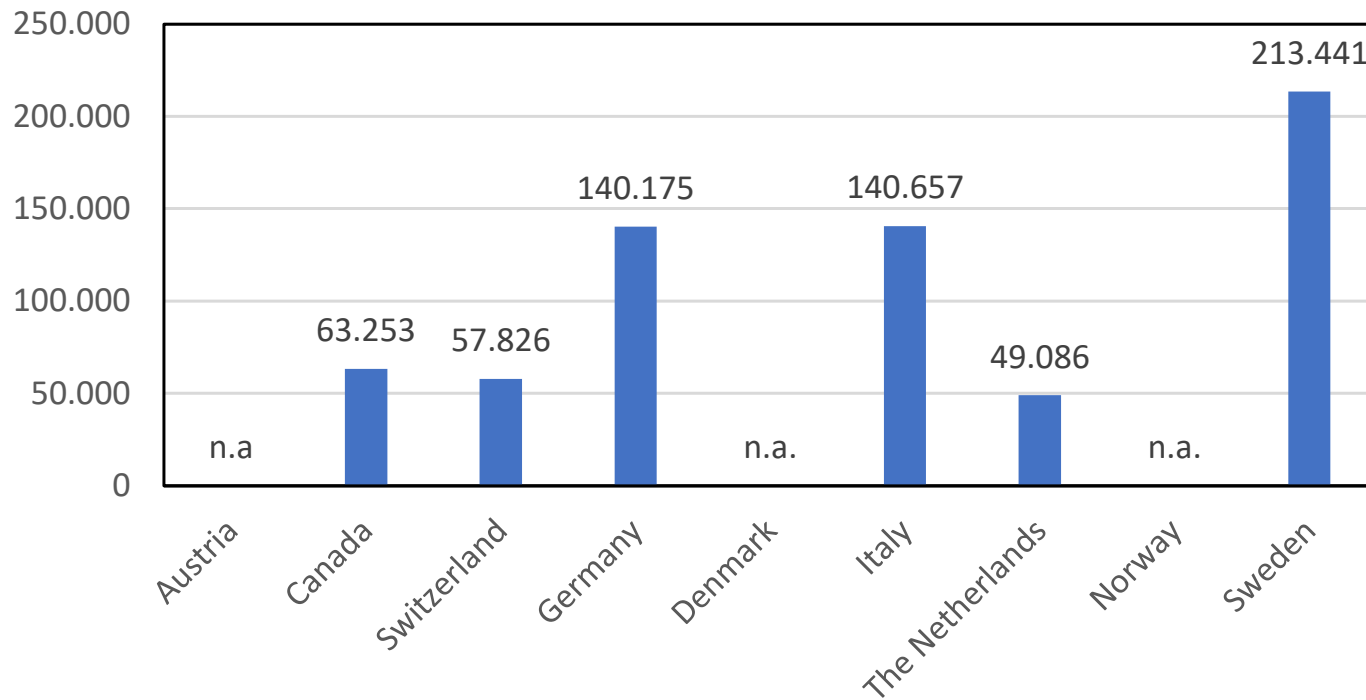
- Replacement strategies and expiration dates for appliances
- Regional bans for biomass fuels or fuel qualities
- Tightening of general emission limits for biomass combustion and further requirements
- Public financial support schemes
- Other indirect regulatory measures
- Inspections of boilers, stoves, fuel or ash
- Possible forced shutdown of appliances
- Impact through regulations for chimneys
- Particle precipitation devices in residential sector
- Catalyst application in residential sectors
- Fuel certificates or labels
- Stove or boiler certificates or labels
- Specific information campaigns on clean use of wood fuels
- Activities of fuel-, stove- and boiler industry towards lower emissions
- R&D activities
- Other actions

Questionnaire

<p>• PART-B—MEASURES AND ACTIONS</p> <p>• B1- Replacement strategies or expiration dates</p> <p>• Is there any regional or national replacement schedule of older wood stoves, boilers, or does their permission expire at a fixed date or age? <input type="checkbox"/></p> <p>If yes: <input type="checkbox"/> Via which regulation is this replacement enforced? (please insert applicable and the source, in English language). <input type="checkbox"/></p> <p><input type="checkbox"/> For which wood-heating appliances does this replacement apply? (slow heat-releasing appliances, pellet stoves, open chimneys, saun boilers, etc.) <input type="checkbox"/></p> <p><input type="checkbox"/> Which are the expiration dates for such old appliances? (please diff of appliances, ages, etc.) <input type="checkbox"/></p> <p><input type="checkbox"/> Are there any exceptions or measures through which the replacement can be avoided? (e.g. stove is the only heating source, an ESP or etc.) <input type="checkbox"/></p> <p>Other useful information: <input type="checkbox"/></p>	
<p>• B2- Regional bans for biomass fuels</p> <p>• Are or were there any regional bans for the use of wood stoves? <input type="checkbox"/></p> <p>If yes: <input type="checkbox"/> In which regions? (urban district/municipality/state, if too many: give examples) <input type="checkbox"/></p> <p><input type="checkbox"/> Please explain the background and how this is executed (e.g. which how is it enforced, is there any compensation, does the regulation apply for existing planned appliances, for new houses, etc.) <input type="checkbox"/></p> <p><input type="checkbox"/> Are there any exceptions or measures through which the ban be avoided (technology or performance data for stoves) <input type="checkbox"/></p> <p>Are or were there any regional bans for the use of wood boilers or heating plants? <input type="checkbox"/></p> <p>If yes: <input type="checkbox"/> In which regions? (urban district/municipality/state, if too many: give examples) <input type="checkbox"/></p> <p><input type="checkbox"/> Please explain the background and how this is executed (e.g. which how is it enforced, is there any compensation, does the regulation apply for existing planned appliances, for new houses, etc.) <input type="checkbox"/></p> <p><input type="checkbox"/> Are there any exceptions or measures through which the ban be avoided (technology or performance data for the boiler/heating plant) <input type="checkbox"/></p>	
<p>• B3-Tightening of general emission limits for biomass combustion</p> <p>• Was there a tightening of emission limits for biomass burning appliances since 2010? <input type="checkbox"/></p> <p>If yes: <input type="checkbox"/> Countrywide? <input type="checkbox"/></p> <p><input type="checkbox"/> Or in (which?) regions? <input type="checkbox"/></p> <p><input type="checkbox"/> Which were the main changes for stoves? (give at least the changes for PM- and limits, if they are not already covered in Part A3). <input type="checkbox"/></p> <p><input type="checkbox"/> Do these changes apply for type tests or for field performance? <input type="checkbox"/></p> <p><input type="checkbox"/> Which were the main changes for residential boilers? (give at least the changes for CO-emission limits if they are not already covered in Part A3). <input type="checkbox"/></p> <p><input type="checkbox"/> Do these changes apply for type tests or for field performance? <input type="checkbox"/></p> <p><input type="checkbox"/> Which were the main changes for large combustion plants? (give at least the PM- and CO-emission limits if they are not already covered in Part A3) <input type="checkbox"/></p> <p>Other useful information: <input type="checkbox"/></p>	
<p>• B4-Public financial support schemes</p> <p>• Is or was there any subsidy or financial incentive for installing a wood stove? <input type="checkbox"/> (can be municipal, regional, or national subsidy) <input type="checkbox"/></p> <p>If yes: <input type="checkbox"/> Please give name(s) of program(s) and area(s) of validity and year. <input type="checkbox"/></p> <p><input type="checkbox"/> Which is (or was) the amount of funding? if applicable: please differentiate for stove technology, eligibility of costs, bonuses, etc. <input type="checkbox"/></p> <p><input type="checkbox"/> (How) Was the funding designed to stimulate use of advanced and clean stoves? Please explain whether the funding was linked to any requirements or conditions which are prove the state of the art in stove combustion. This could for example be achieved by strict efficiency limits, by requiring certain stove features (e.g. automatic stove control, air-tightness, air supply), by the need for any certificates or labels, by on-site tests at the stove, fuel restriction, etc. <input type="checkbox"/></p> <p>Is or was there any subsidy or financial incentive during the last 10 years for installing a wood boiler or heating plant? (can be municipal, regional, or national subsidy) <input type="checkbox"/></p> <p>If yes: <input type="checkbox"/> Please give name(s) of program(s) and area(s) of validity and year. <input type="checkbox"/></p> <p><input type="checkbox"/> Which is (or was) the amount of funding? if applicable: please differentiate for boiler technology, eligibility of costs, bonuses, etc. <input type="checkbox"/></p> <p><input type="checkbox"/> How was the funding designed to stimulate the use of advanced and clean boilers? <input type="checkbox"/></p>	
<p>• B6-Boiler-/stove-/fuel-/ash-inspections</p> <p>• Does a system of regular on-site inspections for wood combustion appliances exist? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p>If yes: <input type="checkbox"/> Does it apply for stoves? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p><input type="checkbox"/> Who performs the inspections? <input type="checkbox"/></p> <p><input type="checkbox"/> When (how often) does this happen? <input type="checkbox"/></p> <p><input type="checkbox"/> Which parameters or aspects are looked after? (e.g. safety, air tightness, flue gas parameters, efficiency, correct fuel use, ash quality) <input type="checkbox"/></p> <p><input type="checkbox"/> How are the inspections performed (which testing aids)? <input type="checkbox"/></p> <p><input type="checkbox"/> Can inspections be triggered by occasional complaints, and which are possible consequences? <input type="checkbox"/></p> <p><input type="checkbox"/> Can you give reference to any standards or technical guidelines which need to be followed? <input type="checkbox"/></p> <p>If yes: <input type="checkbox"/> Does it apply for residential heating boilers? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p><input type="checkbox"/> Who performs the inspections? <input type="checkbox"/></p> <p><input type="checkbox"/> When (how often) does this happen? <input type="checkbox"/></p> <p><input type="checkbox"/> Which parameters or aspects are looked after? (e.g. safety issues, air tightness, flue gas parameters, efficiency, correct fuel use, ash quality) <input type="checkbox"/></p> <p><input type="checkbox"/> How are the inspections performed (which testing aids)? <input type="checkbox"/></p> <p><input type="checkbox"/> Can inspections be triggered by occasional complaints, and which are possible consequences? <input type="checkbox"/></p> <p><input type="checkbox"/> Can you give reference to any standards or technical guidelines which need to be followed? <input type="checkbox"/></p> <p>If yes: <input type="checkbox"/> Does it apply for large-scale biomass boilers or CHP's? <input type="checkbox"/></p> <p><input type="checkbox"/> Who performs the inspections? <input type="checkbox"/></p> <p><input type="checkbox"/> When (how often) does this happen? <input type="checkbox"/></p> <p><input type="checkbox"/> Which parameters or aspects are looked after? (e.g. safety, air-tightness, flue gas parameters, efficiency, correct fuel use, ash quality) <input type="checkbox"/></p> <p><input type="checkbox"/> How are the inspections performed (which testing aids)? <input type="checkbox"/></p> <p><input type="checkbox"/> Can inspections be triggered by occasional complaints, and which are possible consequences? <input type="checkbox"/></p> <p><input type="checkbox"/> Can you give reference to any standards or technical guidelines which need to be followed? <input type="checkbox"/></p>	

Popularity of wood stoves (logs and pellets), in „plants per million“ (ppm)

Number of wood stoves per 1 Mill. Inhabitants



Example of outcome (1): Replacement strategies

Preceding chapter-question:

“Is there any regional or national replacement schedule of older wood stoves or wood boilers, or does their permission expire at a fixed date or age?”

Country	AT	CD	CH	DE	DK	IT	NL	NO	SE
Reply		yes*	no	yes		yes	no		no

* Frequently combined with incentives

Reply from Italy:

Expiration dates: In the 4 regions which have signed the “Po basin agreement”, two deadlines are effective:

from 15.10.2018:

- only appliances with more than “2 Stars” can continue to be in operation,
- only appliances with more than “3 Stars” can be installed,

from 01.01.2020:

- only appl. with more than “3 Stars” can continue to be in operation,
- only appl. with more than “4 Stars” can be installed.

Example of outcome (2): Tightening of emission limits

Preceding chapter-question:

“Was there a tightening of emission limits for biomass burning appliances since 2010?”

Country	AT	CD	CH	DE	DK	IT	NL	NO	SE
Reply		yes	yes	yes		yes	yes		no

Reply from Switzerland:

Emission limit values for placing space heaters on the Swiss market (at 13 % O₂)

	OAPC-Appendix 4 [14] (until Dec. 2021)		European Ecodesign Directive 2009/125/EG (from Jan. 2022)	
	CO [mg/m ³]	TPM [mg/m ³]	CO [mg/m ³]	TPM [mg/m ³]
Residential cookers	3,000	90	1,500	120
Central heating cookers	3,000	120	1,500	120
Fire places	1,500	75	1,500	40
Pellet space heaters	500	40	300	20
Storage heaters	1,500	75	1,500	40

Example of outcome (3): Regional bans

Preceding chapter-question:

“Are or were there any regional bans for the use of wood stoves/boilers”

Country	AT	CD	CH	DE	DK	IT	NL	NO	SE
for wood stoves		yes	yes	yes		yes	?		no
for wood boilers		no	yes	yes		yes	yes		no

Reply from Canada:

- Metro Vancouver (MV) region introduced seasonal restrictions for a use of wood heating appliances, it prohibits their use in the warmer months (May 15 to September 15), with some defined allowable uses.
- MV will also restrict the use of unregistered appliances in most urban areas of the region after 2025. Appliances need to meet emissions criteria (By-law 1303) to be eligible for registration.
Exemptions: if heaters are sole source of heat in a residence, if homes are off-grid, in case of emergency (e.g. power outage over more than 3 hours)

Example of outcome (4): Inspection of appliances

Preceding chapter-question:

“Does a system of regular on-site inspections for wood combustion appliances exist?”

Country	AT	CD	CH	DE	DK	IT	NL	NO	SE
for wood stoves		yes*	yes	yes		yes	no		yes**
for wood boilers		yes*	yes	yes		yes	no		yes**

*not on regular basis **only for safety issues

Reply from Germany:

- ✓ Regular stove inspections performed by the “authorized chimney sweep of the district”: 2 times in 7 years
- ✓ This includes: safety issues, technical stage of stove, conformity rules, fuel moisture measurements, etc.
- ✓ Boiler inspections include on-site CO- and TPM-measurements every 2 years
- ✓ Inspection rules and owner instructions follow purpose-created VDI-Standards
- ✓ There are 5 different approved flue gas inspection devices available for chimney sweepers.



Example:
Afriso STM 225

Outlook

- Detailed report to be released in first half of 2022, with
 - Detailed descriptions of all national measures and approaches
 - Chapter summaries and conclusions for each of 16 focus areas
 - Web-links to original sources of information, where possible
 - Expert judgement and prioritisation from each participant

- Report could serve as basis for involvement of further countries for possible future expansion of the activity

IEA Bioenergy

Task 32

Thanks for listening !

Contact:

Dr. Hans Hartmann

Technology and Support Centre of Renewable Raw
Materials (TFZ)

Schulgasse 18, 94315 Straubing / Germany

Email: hans.hartmann@tfz.bayern.de

Tel.: +49 (0) 9421 300-172

www.tfz.bayern.de



IEA Bioenergy

Technology Collaboration Programme

www.ieabioenergy.com

Technology Collaboration Programme

by **iea**