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MITIGATION MEASURES: DOMESTIC HEATING, (AGRICULTURAL) WASTE BURNING, ELECTRICITY GENERATORS, TRAFFIC

Christian Nagl, Siegmund Böhmer

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CONTENT

- General principles for successfully implementing measures
- Waste burning and agricultural waste burning
- Domestic heating
- Transport / mobility
- Electricity generators

GUIDING PRINCIPLES

- Consider and tackle different pollutants together
- Cooperate with different authorities, levels and neighbouring communities
- Measures should be taken at level where most efficient
- Coherent approaches between different policies (climate change, transport, energy, noise, quality of life,…) are needed
- “Leading by example” ➔ green procurement, clean vehicles administration, clean public transport
- Cost-benefit-analysis, health data important for political support
- Public support important for implementation
- Indicators are important for monitoring and evaluation
- Main goal: to improve public health (i.e. not only compliance with limit values at station)

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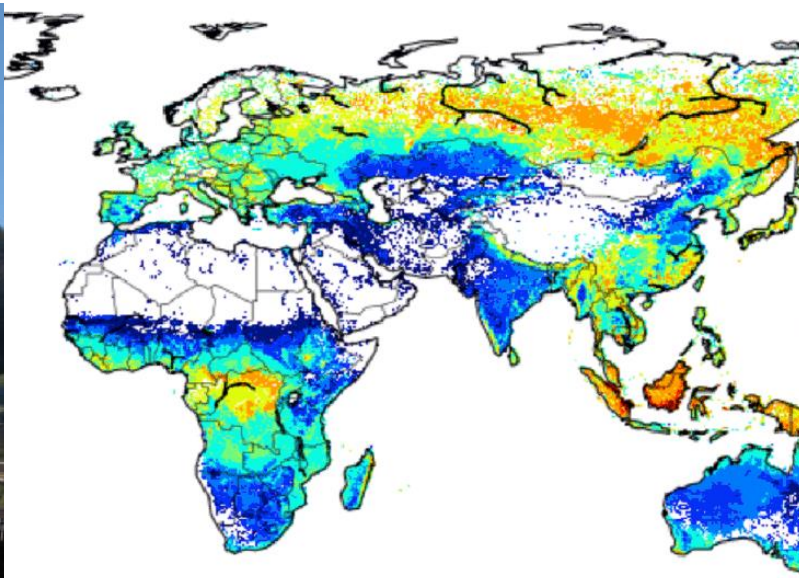
OPEN BURNING OF WASTE



Source: Government of Styria, Umweltinstitut Vorarlberg, van der Werf 2017

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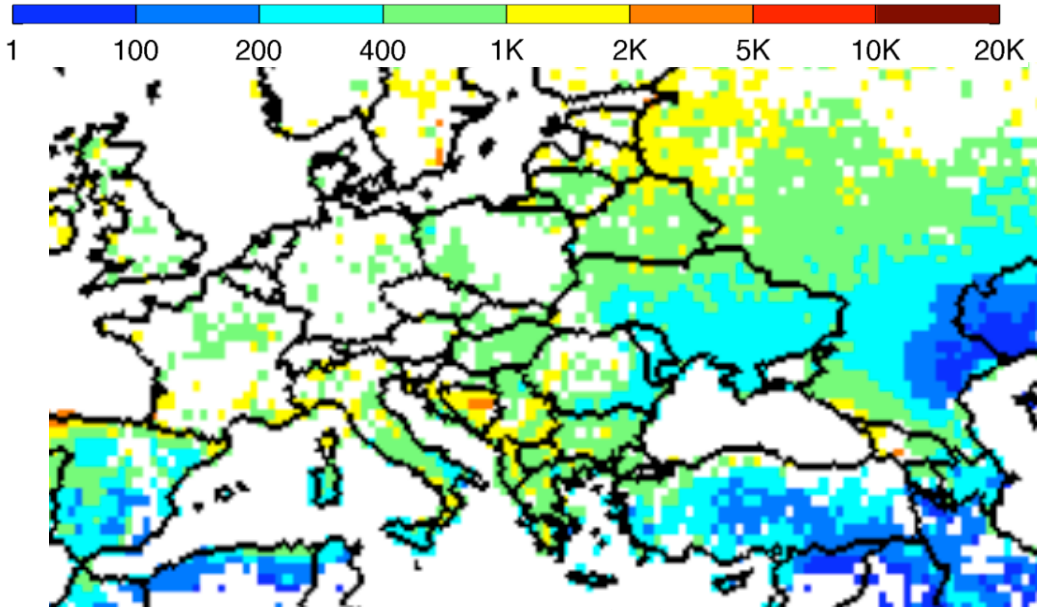
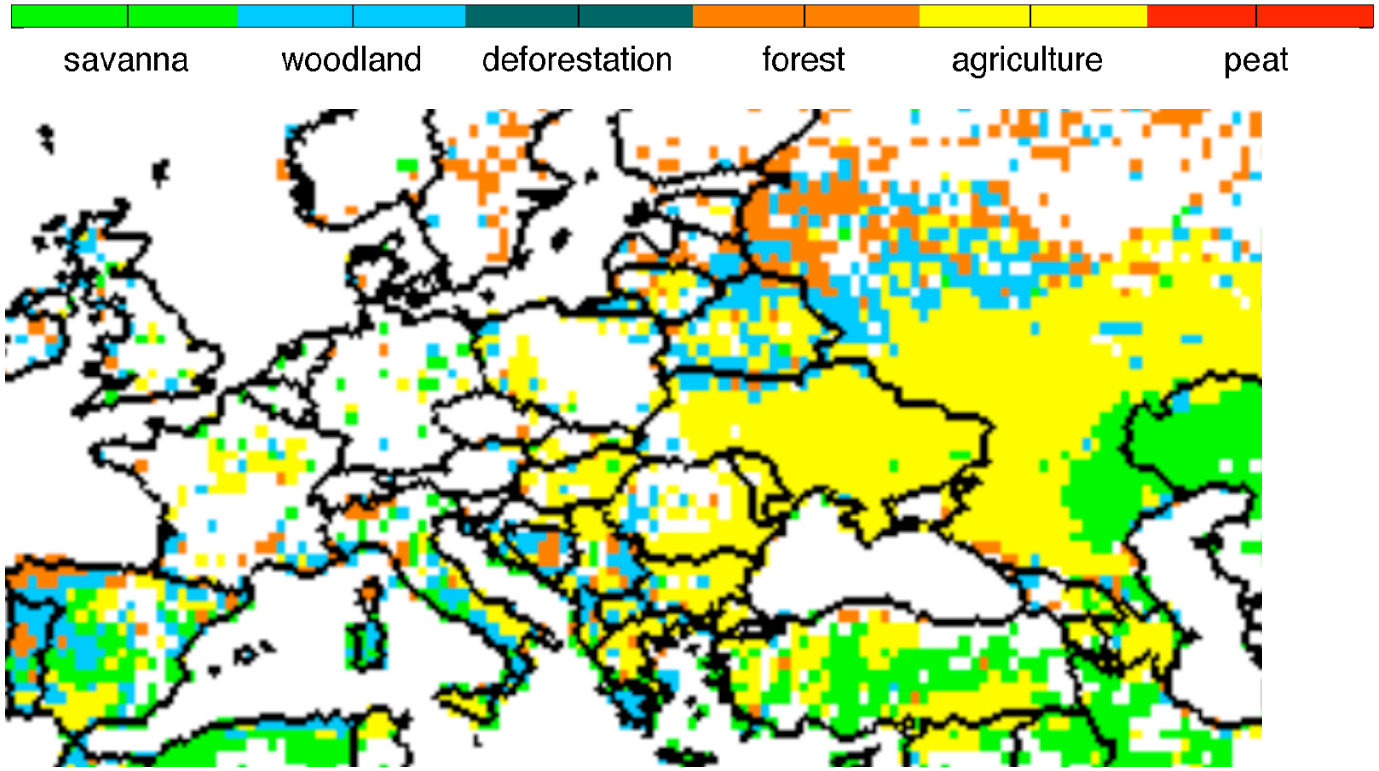
RELEVANCE OF OPEN BURNING

Fuel consumption (g C per m² of area burned), averaged over 1997–2009



Dominant types of fires



(c) Van der Werf et al. 2010

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(AGRICULTURAL) WASTE BURNING

- Open burning of agricultural waste often underestimated source of large-scale air pollution
- Smouldering and improper fuel (e.g. waste) cause extremely high emissions (PM, VOC, BC,…)
- Burning of waste (treated wood, plastics) release further harmful substances (dioxins, polycyclic aromatic hydrocarbons)
- Regulation (EU) 1306/2013: good agricultural practice: ban on burning arable stubble
- Banned in many countries as part of good agricultural practice (and to avoid wildfire,…)
- Nevertheless: around 3.3% of PM emissions in EU-28 due to open burning (IIASA 2017), much higher in Southern EU and Eastern countries

Source: Umweltinstitut Vorarlberg

PM: Particulate Matter
BC: Black Carbon
VOC: Volatile Organic Compound

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MEASURES TO REDUCE (AGRICULTURAL) WASTE BURNING

- Ban of open burning of agricultural waste / residue (farms)
  - Requirement:
    - Training, information of farmers
    - Monitoring, inspection and enforcement
  - Lot of experience in EU countries
  - Net costs for farmers negligible, no-burn methods proven to be more cost effective
  - Derogations for agronomic or sanitary reasons possible
  - UNECE guidance available
- Alternatives
  - Conservation agriculture
    a) No or minimum mechanical soil disturbance
    b) Maintenance of soil mulch cover
    c) Diversified cropping
  - Low-till practices
  - Alternative use practices
  - Use as animal feed and bedding
  - Use as bioenergy

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MEASURES TO REDUCE (AGRICULTURAL) WASTE BURNING

- Forest/Orchard/Fallow land
  - Chopping and spreading the excess biomass
  - Conversion to pellets, use in wood mills (paper, mulch)

- However: managed use of fire can be necessary

- Ban of open burning of waste, residues (private)
  - Composting of garden residues in own garden or in municipality
  - Collection of waste
  - Requirement:
    - Collection, recycling system installed
    - Information
    - Monitoring, inspection and enforcement

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DOMESTIC HEATING

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CHALLENGES

- High investment costs ⇔ relatively cheap fossil / solid fuels (including waste)
- There can be high social, psychological barriers to improve energy efficiency of buildings & replace heating systems
- Fostering of biomass ➔ can result in increase of air pollutant emissions
- Long lifetime of appliances
- No incentives for landlord to improve heating system, energy efficiency ⇔ no incentive / possibility for tenants
- Inspection, correct operation, regular maintenance
- Availability / uncertainty of data
  - Amount and type of fuel (activity)
  - Appliances
  - Emission factors

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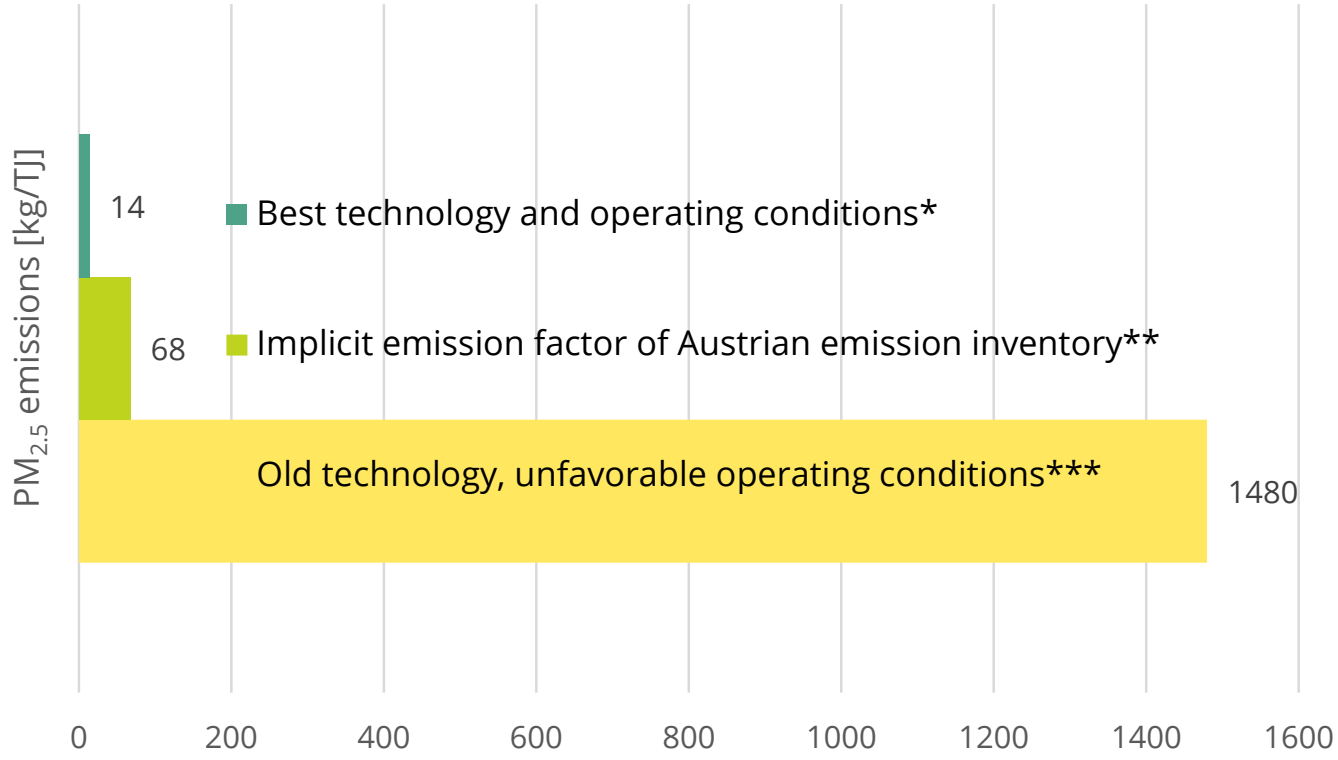
RANGE OF $PM_{2.5}$ EMISSION FACTORS FOR BIOMASS HEATING SYSTEMS

- Large influence of operating conditions
- Automatic appliances should be preferred



*) Factsheet Staubemissionen: BIOENERGY 2020+, Wieselburg/Graz, 2019: emission factor for pellet heating
**) Energy-weighted emission factor across all biomass technologies based on the Austrian emission inventory 2021
***) EMEP EEA Guidebook 2019 Small combustion: emission factor "Conventional Stoves and Boilers, upper 95% confidence interval"

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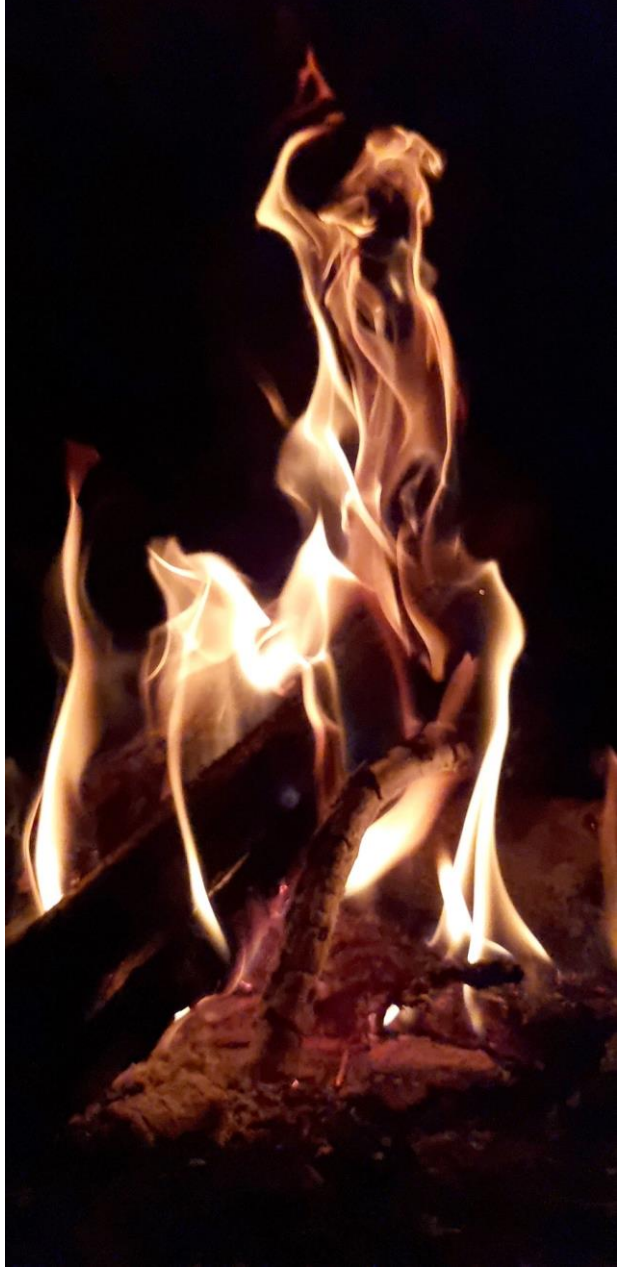
POSSIBLE ACTION POINTS – BIOMASS

- Use of biomass mainly in well-insulated buildings
- Correct dimensioning in new buildings
- Low-emission technologies only
- Surveillance, control, replacing of old technologies
- Proper operation, regular maintenance, high quality fuels
- Awareness raising, consulting service
- In cities: district heating, integrated air quality plan
- Spatial energy planning
- Addressing poorer households, improving data
- Stoves, comfort heating: fostering of ecolabels
- Platforms to exchange information and data due to interdisciplinary questions



(c) Umweltbundesamt / Kitzler

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CONCLUSIONS, RECOMMENDATIONS DOMESTIC HEATING

Conclusions ➔ Recommendations

- Strategic approach necessary (air quality, climate, energy efficiency & security, biodiversity)
- Timeframe for bans ➔ planning security
- Subsidies for replacing should also cover old biomass appliances
- Subsidies for biomass district heating including strict emission limit values / criteria lead to substantial air quality improvements
- Improving user behavior can greatly reduce emissions, important for old appliances and for stoves, when there is no foreseeable replacement
- Social, psychological barriers for replacing old stoves / boilers can be high ➔ social and energy consultants need to provide low-threshold support together

Further recommendations

- Technology should be improved to reduce influence of users
- User-friendly operating instructions with best practice operation
- Results of the current type test do not reflect real world emissions ➔ improvement needed
- Data quality improvement constant process ➔ support by citizen science?

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TRANSPORT / MOBILITY

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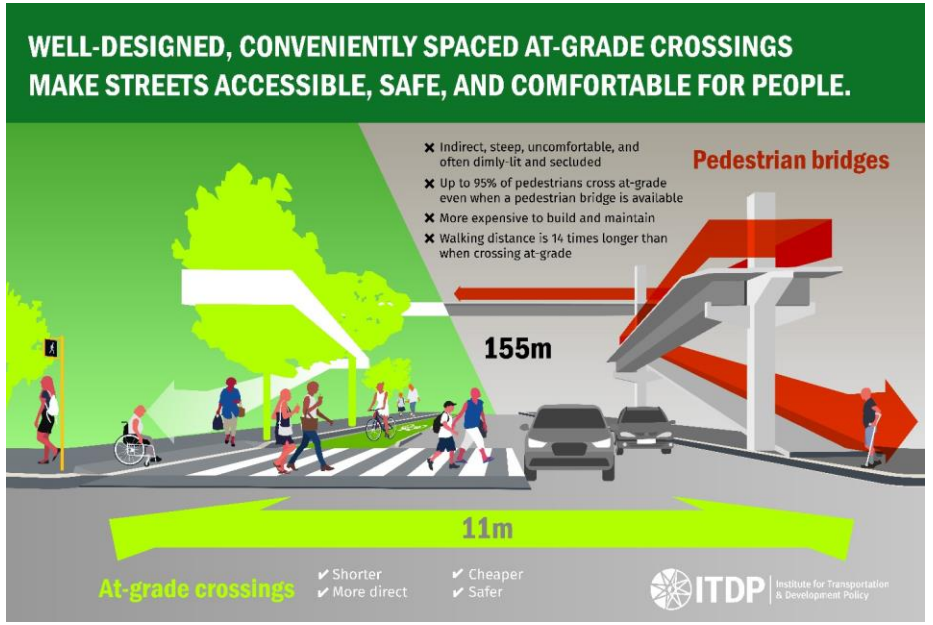
GOOD PRACTICE EXAMPLES – TRANSPORT / MOBILITY

- Shift of focus from improving car infrastructure to **improving mobility needs** of all different group of people (children, elderly, handicapped, parents with little children,…)
- Integrated transport policies needed to address mobility needs including:
  - Public transport
  - Pedestrian infrastructure, walkable cities
  - Bicycle strategies
  - Land use planning
  - Vehicle technologies
  - Fuel technologies



1. Avoid traffic
2. Shift to clean modes
3. Improve traffic

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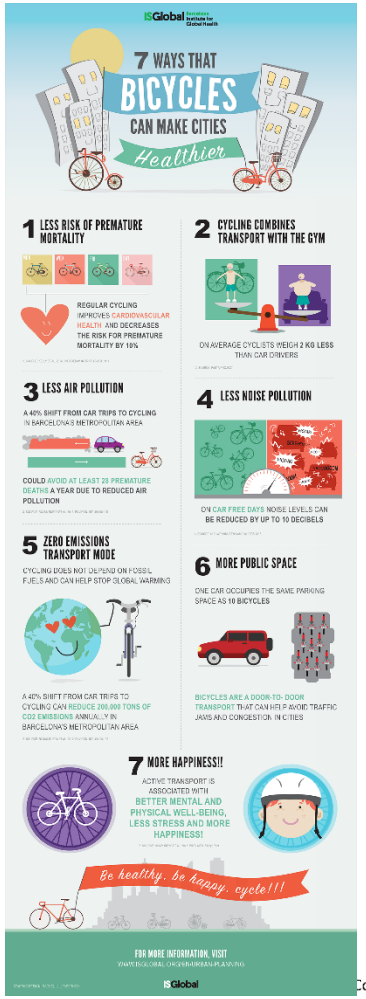
GOOD PRACTICE EXAMPLES: REVIEW URBAN, TRANSPORT PLANNING FOR CARBON NEUTRAL, HEALTHY CITIES

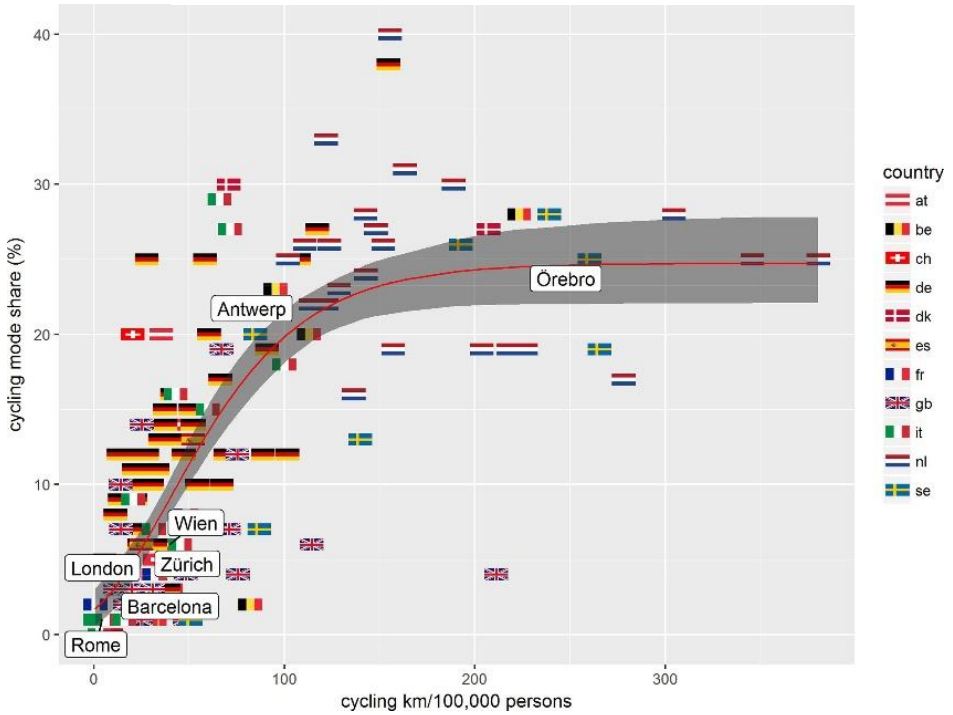
- Land use (five Ds): density, diversity, design, destination accessibility, and distance to transit
- Greening of cities, e.g. replacing parking spaces with green infrastructure
- Visioning
- Citizen involvement (e.g. ClairCity project)

- See also sustainable urban mobility in Europe (Eltis platform)



Source: ISGlobal

example: cycling needs infrastructure



Source: Mark J.Nieuwenhuijsen, 2020

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GOOD PRACTICE EXAMPLES – TRAFFIC / MOBILITY – "CLIMATE TICKET" AUSTRIA

- One annual ticket for ALL public transport in Austria
- Affordable price (55% of monthly net median income in Austria for annual ticket)
- Option for family ticket (only slightly more expensive)
- Discount for seniors, youth
- Option for (cheaper) regional tickets

Source: https://www.klimaticket.at/en/

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ELECTRICITY GENERATORS

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ELECTRICITY GENERATORS

- Short-term solution to recurring power failures
- Can contribute to PM (and NO_2) concentrations, noise problems
- Possible short-term measures to reduce impacts on air quality
  - Power adequate for needs
  - Exhaust in well ventilated areas away from residential buildings, schools, kindergartens,…
  - Clean fuels
  - No idling
  - Proper maintenance according to manufacturer
  - Few large generators better than many small ones
  - Retrofit of secondary exhaust treatment (particle filter, selective catalytic reduction)
- Possible medium to long-term measures
  - Small-scale, resilient electricity generation from renewable energy sources
  - Resilient electricity grids
- In addition: registration of generators (including type, power etc.)
- Legal requirements in EU
  - Regulation (EU) 2016/1628 non-road (mobile) machinery
  - Above 1 MW thermal input: medium combustion plant Directive (EU) 2015/2193

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GUIDING PRINCIPLES

1. • reduce emissions at the source
2. • reduce concentrations
3. • reduce exposure

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EUROPEAN LEGAL AND POLICY FRAMEWORK ADDRESSING DOMESTIC HEATING

- Ambient Air Quality Directives 2008/50/EC, 2004/107/EC,
- Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants
- Ecodesign
  - Commission Regulation (EU) 2015/1189EN requirements for solid fuel boilers
  - Commission Regulation (EU) 2015/1185EN requirements for solid fuel local space heaters

- European Green Deal
  - REPowerEU plan: „affordable, secure and sustainable energy for Europe"
  - Renovation wave (part of the recovery plan)
  - New European Bauhaus initiative
  - Zero pollution action plan
  - Forest strategy (builds on biodiversity strategy)

- Energy efficiency: targets, directive, rules, national action plans + progress reports
- Energy performance of buildings directive, proposal for revision

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EXAMPLES MEASURES AUSTRIA – HEATING STRATEGY

Goals

- Renewable heat supply through gradual phase-out of fossil energy
- Expansion of district heating systems in urban areas and overall decarbonization
- Key points to further reduce energy consumption
  - Thermal-energetic refurbishment
  - Efficient energy production for space heating and hot water
  - Installation of cooling systems without or low energy demand

Instruments

- Regulatory measures at federal and state level ➔ Renewable Heat Act
- EU funding programmes, specifically to alleviate case of social hardship
- Fiscal measures (Carbon tax, currently 35€/t ➔ climate bonus of 100€ for each person)
- Supporting spatial planning instruments (spatial energy planning)
- Supplementary programs
  - Information, raising awareness
  - Support measures labor market
  - Green gas strategy

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EXAMPLES MEASURES AUSTRIA – HEATING STRATEGY

- Participation process including all stakeholders to analyse consequences and necessary steps to achieve Austrian goal of climate neutrality until 2040
- 8 working groups
- Process led to largely improved data quality
  - How much biomass available and where
  - How to avoid increase in air pollutant emissions
  - How to make use of improved technologies
  - How to improve operation of appliances, behaviour changes

- Already achieved: ban of oil and coal heating since 2020 in new buildings
- No oil and coal heating appliances in all buildings from 2035 onwards
- Currently discussions for phase-out of all fossil fuel systems until 2040 in existing buildings, ban of gas heating for new buildings from 2023 onwards („renewable heating law“)
- Subsidies for replacing old appliances important, especially for poor households („clean heating for all“), subsidies for improving insulation

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DATA QUALITY IMPROVEMENTS (AUSTRIAN EXAMPLE)

- For informed decisions on most (cost-) effective measures data is necessary for:
  - Type, age of heating appliances
  - Type, amount of fuel used
  - Emission factors of different heating technologies
  - Structure of building ownership
  - Infrastructure (district heating, gas network, electricity)
- Data needs to be available in high spatial resolution, up-to-date and regularly updated

- Current status
  - Emission factors for 20 different technologies developed
  - Database for heating appliances on federal province level
  - Energy use (differentiated by fuel type)
  - Stakeholder “platform biomass and air quality” to exchange information, improve data
- Next steps
  - GIS open data layer on individual building level
  - Will be combined with use of different fuels

➔ Important information to identify and address PM hotspots

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"CLEAN HEATING FOR ALL" IN AUSTRIA

- Subsidies for private persons
- Owners of detached or semi-detached houses
- Proof of social need
  - Receipt of social / housing assistance or
  - Exemption of public broadcast fee
- For replacement of a fossil heating system (oil, gas, coal/coke all-purpose burner and electricity-powered night or direct storage heaters) with new climate-friendly heating system

- Connection to climate-friendly or highly efficient local/district heating is primarily funded
- If not available: wood-fired central heating system or a heat pump

➔ Focus on climate change

➔ However, overall air quality improvement due to local/district heating or switch to central heating (pellets) expected

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