

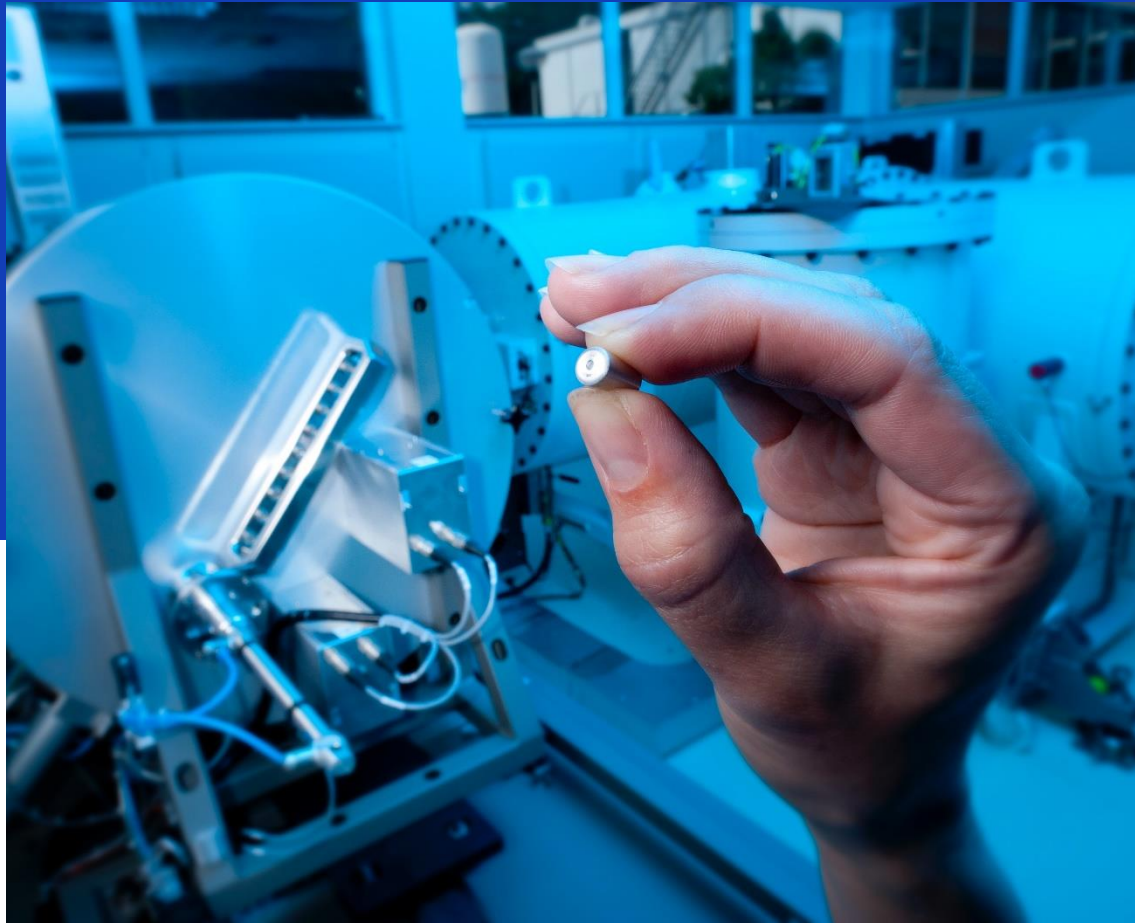
The road to sustainability

And some stops along the way

Adam Bufacchi and Menno Hinkema |



Agenda



1. TNO Healthcare built estate team
2. Navigating the Dutch healthcare landscape
3. Your travel itinerary
4. Sustainability
5. Age-resilient housing and care
6. Pandemic preparedness
7. In conclusion

TNO Healthcare built estate team

Who we are



Bufacchi, A.A. (Adam)



Lange, A.A.J. (Anneloes) de



Kompatscher, K. (Karin)



Rueb, C.E. (Lisette)



Hinkema, M.J. (Menno)



Lejeune, N. (Niels)



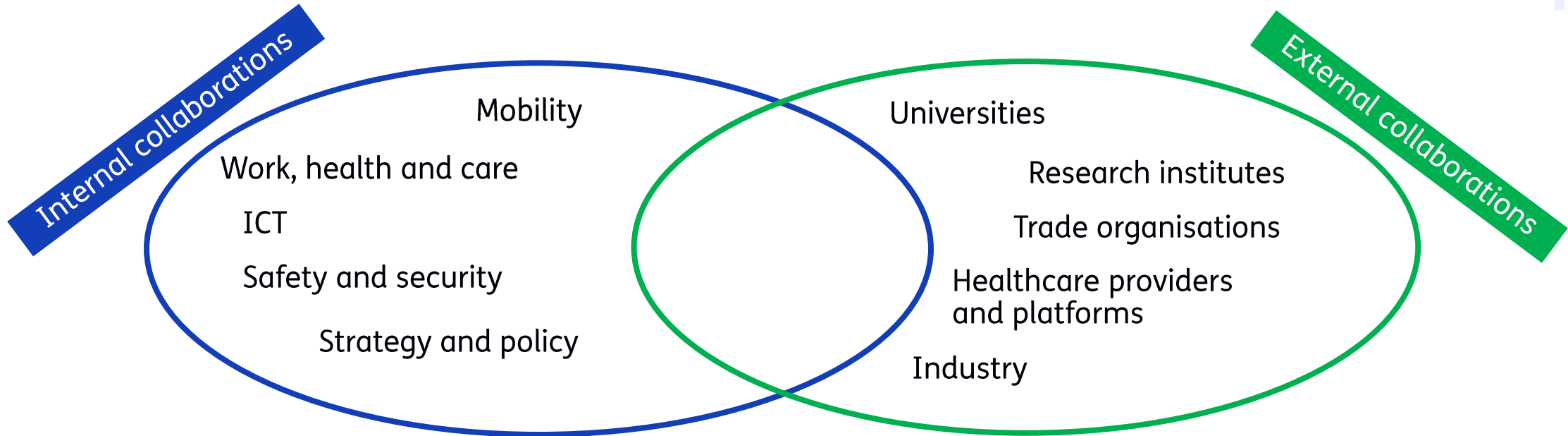
gter van Wissekerke, N.G. (Norman)



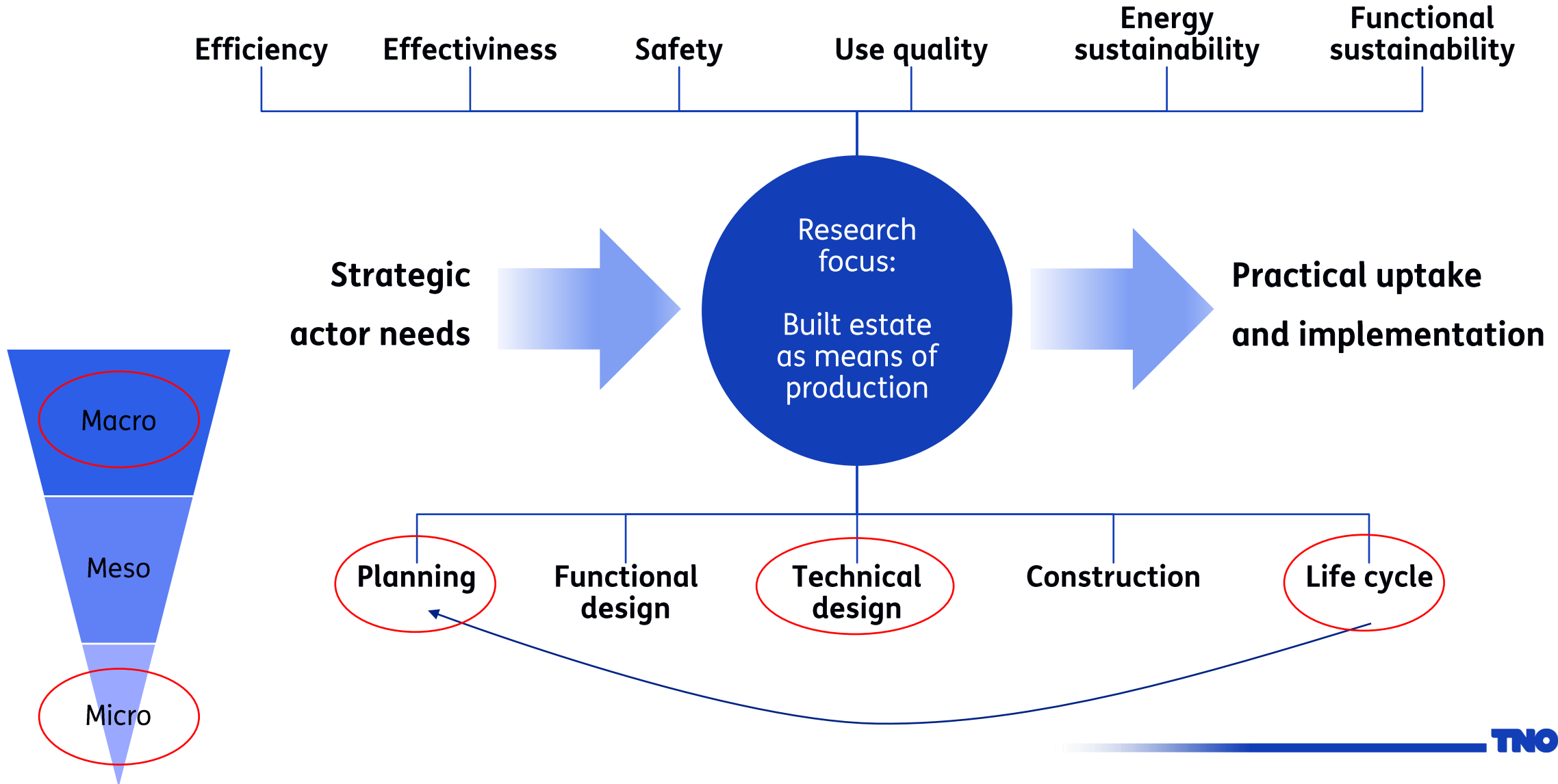
Traversari, A.A.L. (Roberto)



Heumen, S.P.M. (Stefan) van



What we do and how we do it



Dutch healthcare landscape Basic satnav info

- 'Private not-for-profit' paradigm
- Highly segmented funding system
- Good overall performance in international comparisons
- Fairly lean acute care sector
- Relatively large long-term care sector
- Highly decentralised approach to planning and delivery

Locaties ziekenhuizen 2023

Academische en algemene ziekenhuizen inclusief buitenpoliklinieken en kindziekenhuizen

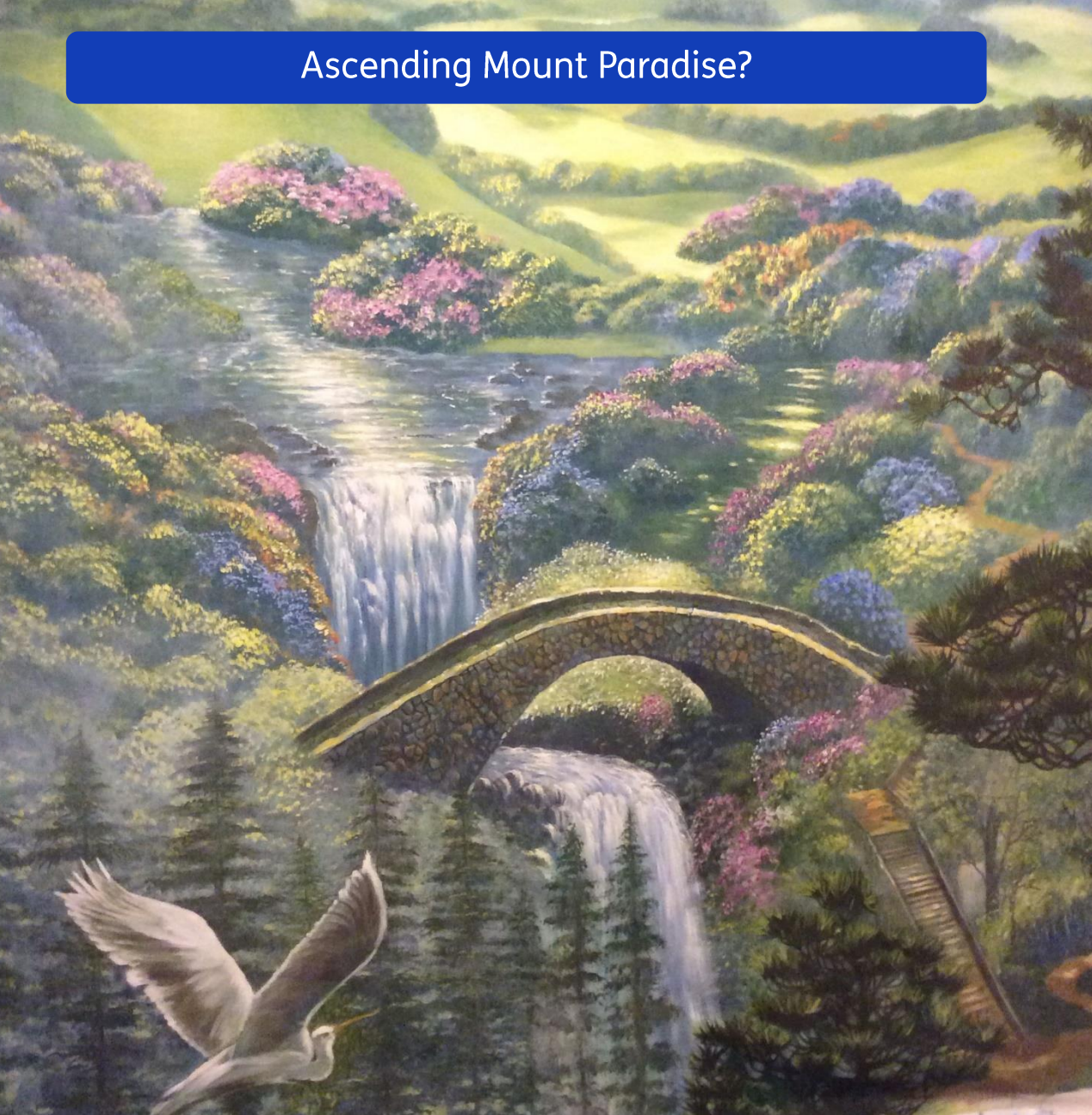
Soort ziekenhuis

- Academisch ziekenhuis (8)
- Algemeen ziekenhuis (98)
- Buitenpolikliniek (147)
- Kinderziekenhuis (7)

— Provincies



Ascending Mount Paradise?



Or hurtling towards Mount Doom?



Navigating the future Dutch healthcare landscape

Our itinerary

Trip 1



The green lanes of sustainability

Trip 2



Old but not decrepit: age-resilient housing

Trip 3



The airy vistas of pandemic preparedness

The green lanes of sustainability



Green Deal 3.0

Covenant around five holistic goals

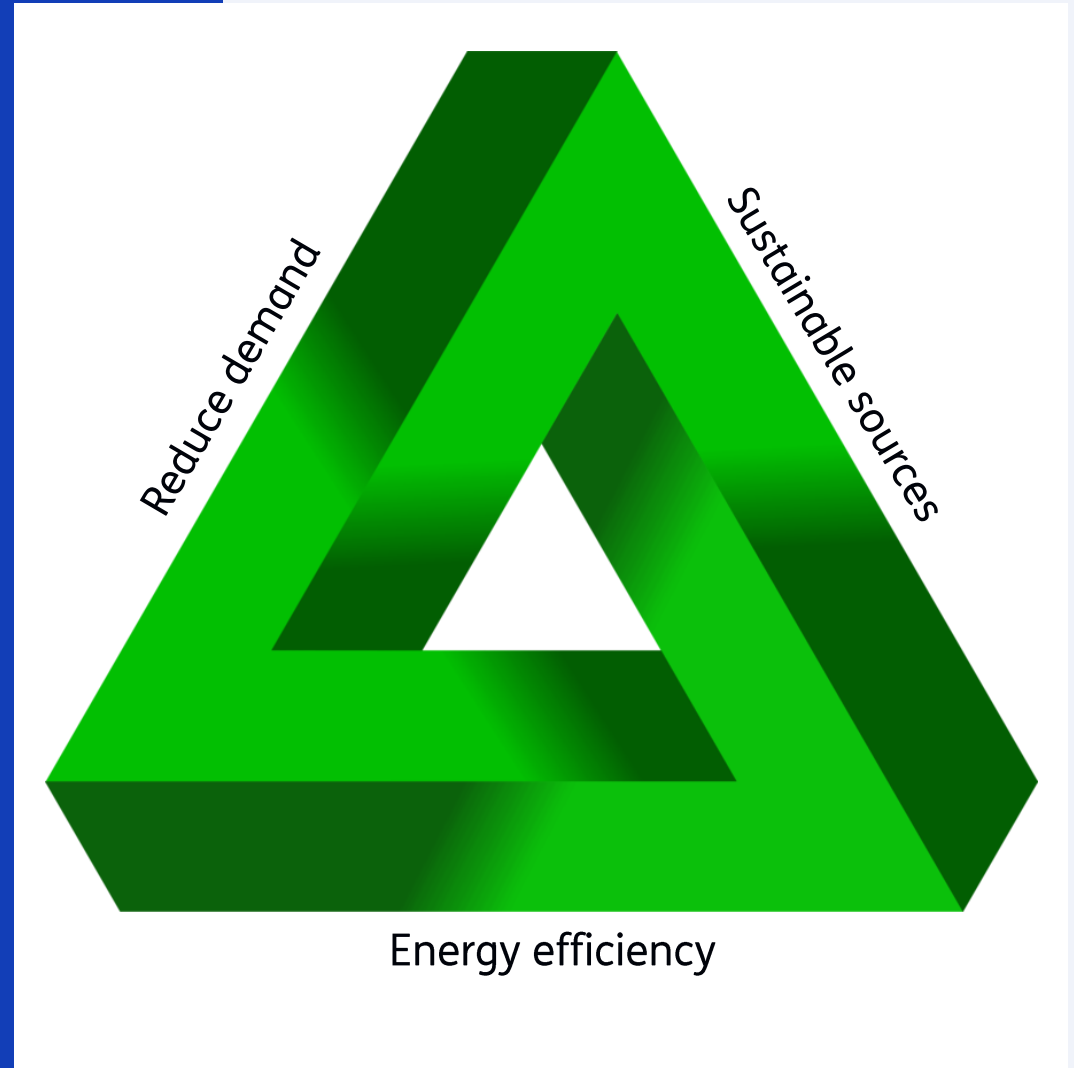
- Promoting health
- Awareness and attitudes
- Reducing CO₂ emissions
- Circularity and efficient use of raw materials
- Managing medical waste streams



A grand scheme... With problems

- It's so complex – where do I start?
- It's so costly – where's the money coming from?
- I can't do this alone – how can I collaborate?
- This is not my core business – I have other problems
- I'll just do the legal minimum – will that be alright?

**How can we turn sustainability from
“can't avoid” into “can't afford to
miss”?**



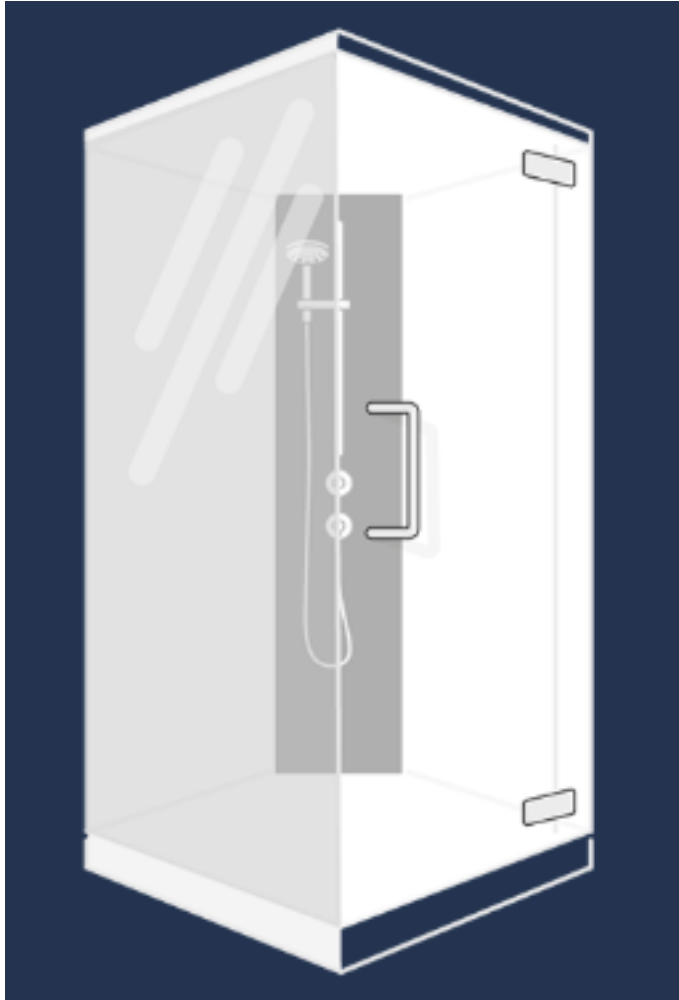
Hot water distribution networks: pilots MEED



Problem statement

- Energy intensive
- Energy demand beyond all-electric solutions
- Heat loss and little or no waste heat reclamation
- System level alternatives are costly, complicated and run into grid congestion issues
- Do localised easy adoption alternatives exist?

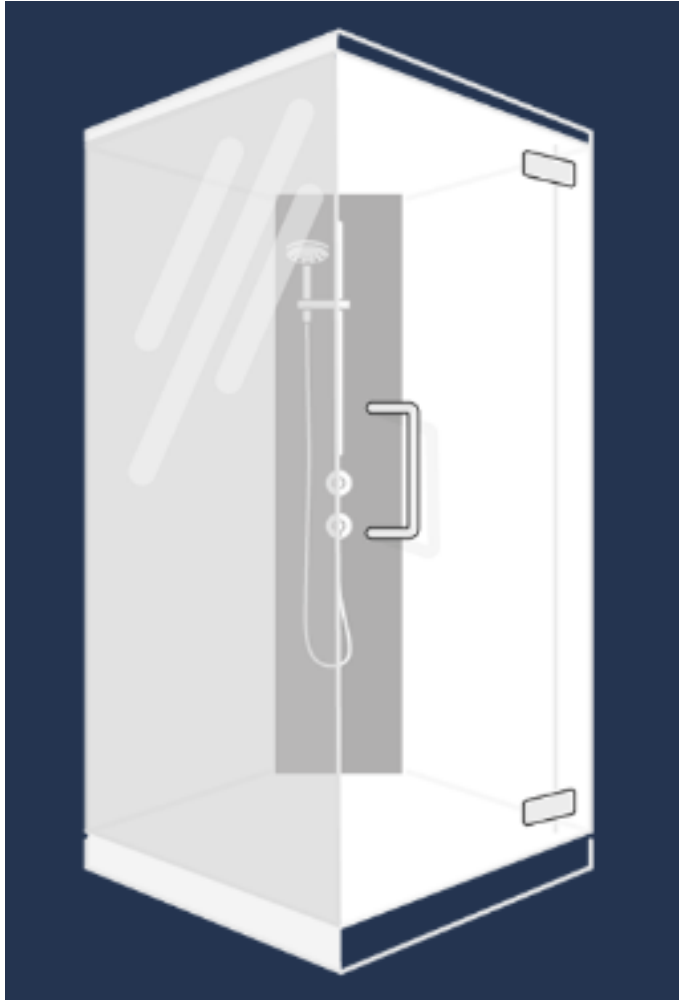
Hot water distribution networks: pilots MEED



Technology concept

- Prefab sanitary unit
- Electrical heat exchanger + boiler, 3 variants
- 80% waste heat reclamation
- Developed by TNO in collaboration with SME's
- Already deployed in residential and hospitality sectors

Hot water distribution networks: pilots MEED



Pilot project: research questions

- Applicability in healthcare?
- Energy savings and added value?
- Compatibility with healthcare specific functional requirements?
- User experiences? Appreciation and reservations

Pilot project: set-up

- Test sites in long-term care, youth care and acute care settings. Two MEED-units per site
- Energetical performance monitoring using temperature sensors, water meters, electrical capacity monitoring
- Utilisation monitoring and questionnaires

Maintaining sustainability – sustainable maintenance

Ambition

- Support healthcare organisations in implementing integrated approach to sustainable maintenance.
- Capitalising on potential life cycle sustainability gains.

Basis:
six step method
(Halmos and TNO)



Maintaining sustainability – sustainable maintenance

Innovation agenda

- Inventory to blueprint, blueprint to tool
- Testing tooling in healthcare
- Adaptation for use in other public real estate sectors

0. Why sustainability?

1. Establishing goals

2. Starting position

3. Action agenda

4. Getting organised

5. Monitoring progress



Old but not decrepit Age-resilient housing



Twin problems – one challenge



Rethinking the continuum of housing and care

Getting to grips with the challenge

Housing and Care for Older Citizens national programme

- Ambitious, long-term programme
- Interdepartmental collaboration
- One of a series of sweeping covenants and programmes designed to futureproof the Dutch health and care landscape



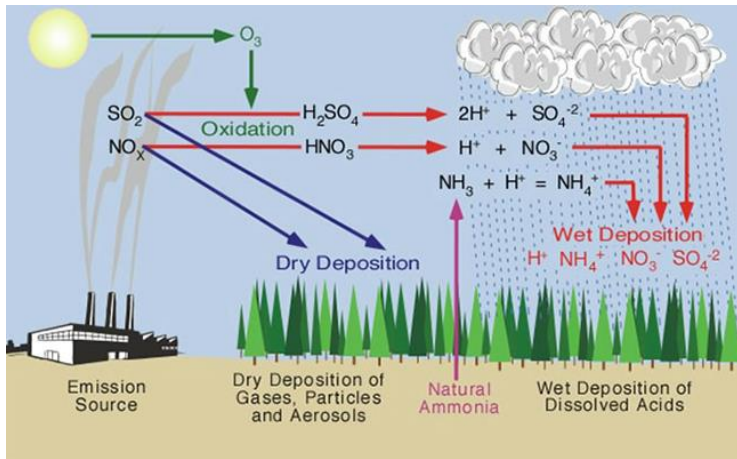
Ministerie van Volksgezondheid,
Welzijn en Sport

WOZO

Programma Wonen, Ondersteuning en Zorg
voor Ouderen

4 juli 2022

Potential barriers



Managing emissions and deposition



Gaining and maintaining momentum



Understanding social and psychological dynamics



A wicked problem

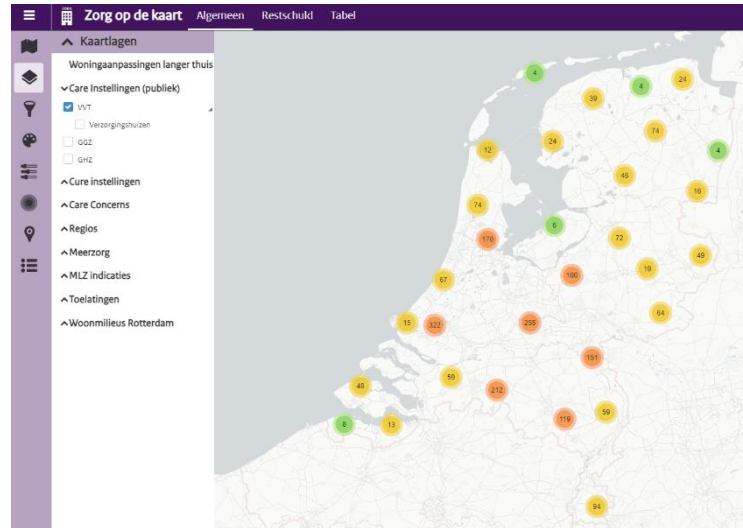
Research and innovation efforts

Technological



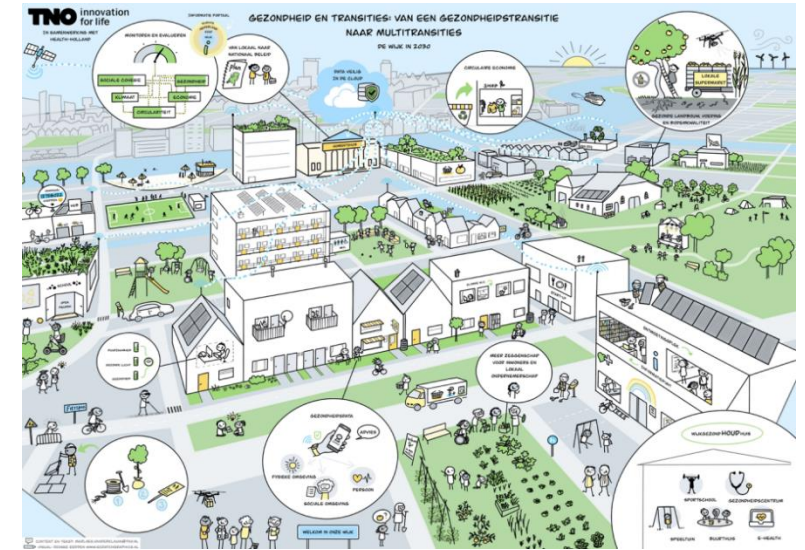
Bio-based building materials
Industrial scale pre-fab
Archotyping

Information management



Data integration
Map-based monitoring
Documenting good practices

Transdisciplinary



Local systems analysis and transitions
Facilitating self-organisation and autonomy
Crafting multi-domain local networks

HET BEGINT MET DE PLEK!

VERSCHILLEN & GELIJKWAARDIGHEID

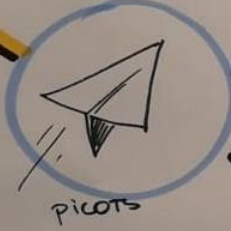
FYSIEK

DIGITAAL

DE-GROWTH



INITIATIEVEN



PILOTS

★ BEHOEFTES OPHALEN
"ECHT BEGRIJPEN V.D. ANDER"

★ SAMEN REDZAAM

"VORM VOLGT FUNCTIE, FUNCTIE VOLGT BEHOEFTE!"

- + RUIMTE VOOR BURGERINITIATIEF
- + ERKENNEN & WAARDEREN
- + OVERHEID INTERVENEERT INDIEN NODIG

INDUSTRIE

OVERHEID

WETENSCHAP

The airy vistas of pandemic preparedness



Adverse effects of aerosol transmission precautions

- Impact on quality of care
- Impact on availability of care
- Impact on quality of life
- Impact on physical health
- Impact on mental health
- Impact on social health

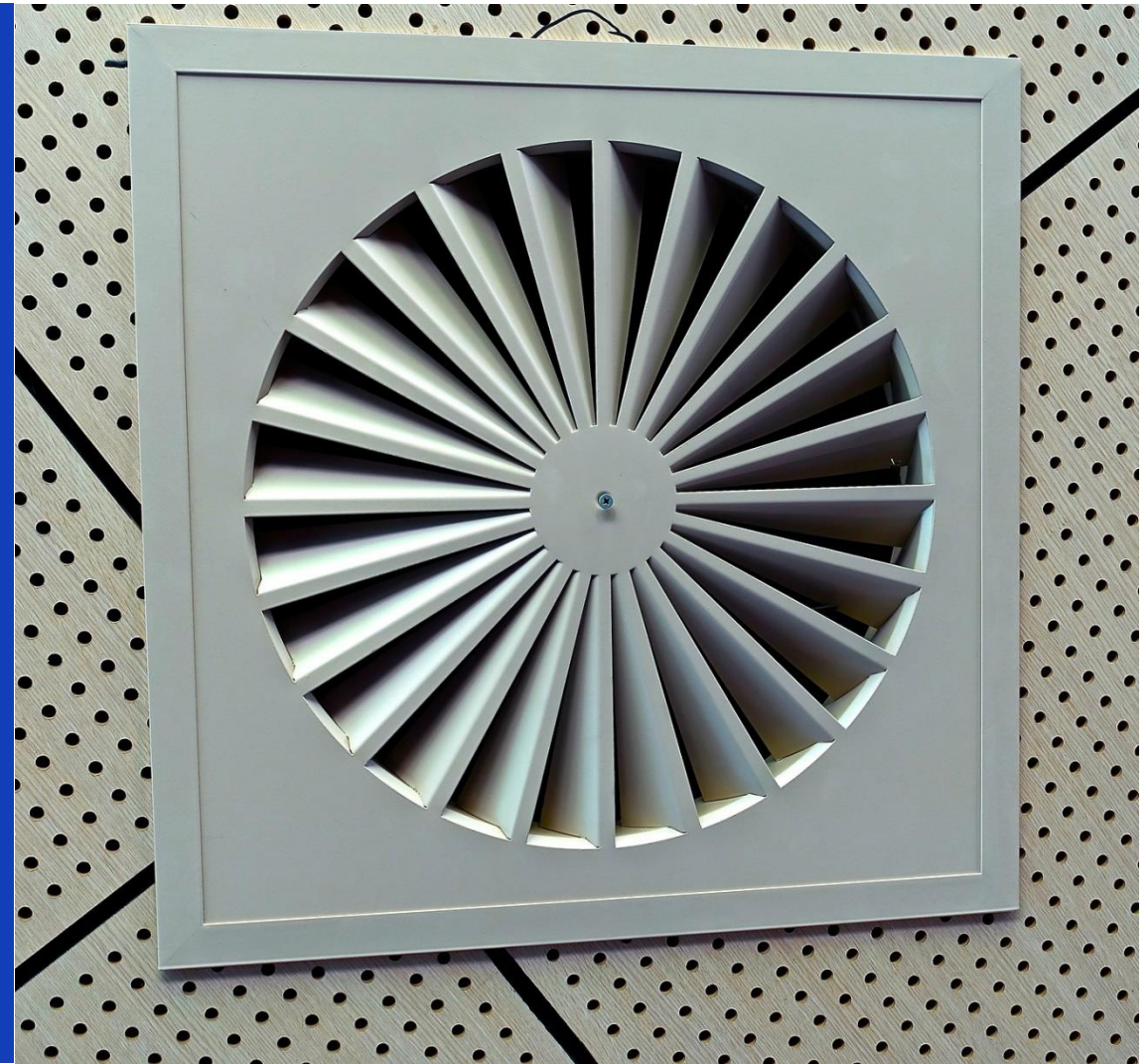
Can we do better in future pandemics?



Can ventilation help? We don't know enough

Knowledge gaps

- Existing conditions – behaviour & HVAC systems
- Particle dispersal patterns through space and over time
- Ventilation system performance
- Relative importance of aerosol transmission route
- Infectivity of airborne virus particles
- Impact and prioritisation of public sector investments
- Financial and social costs and benefits



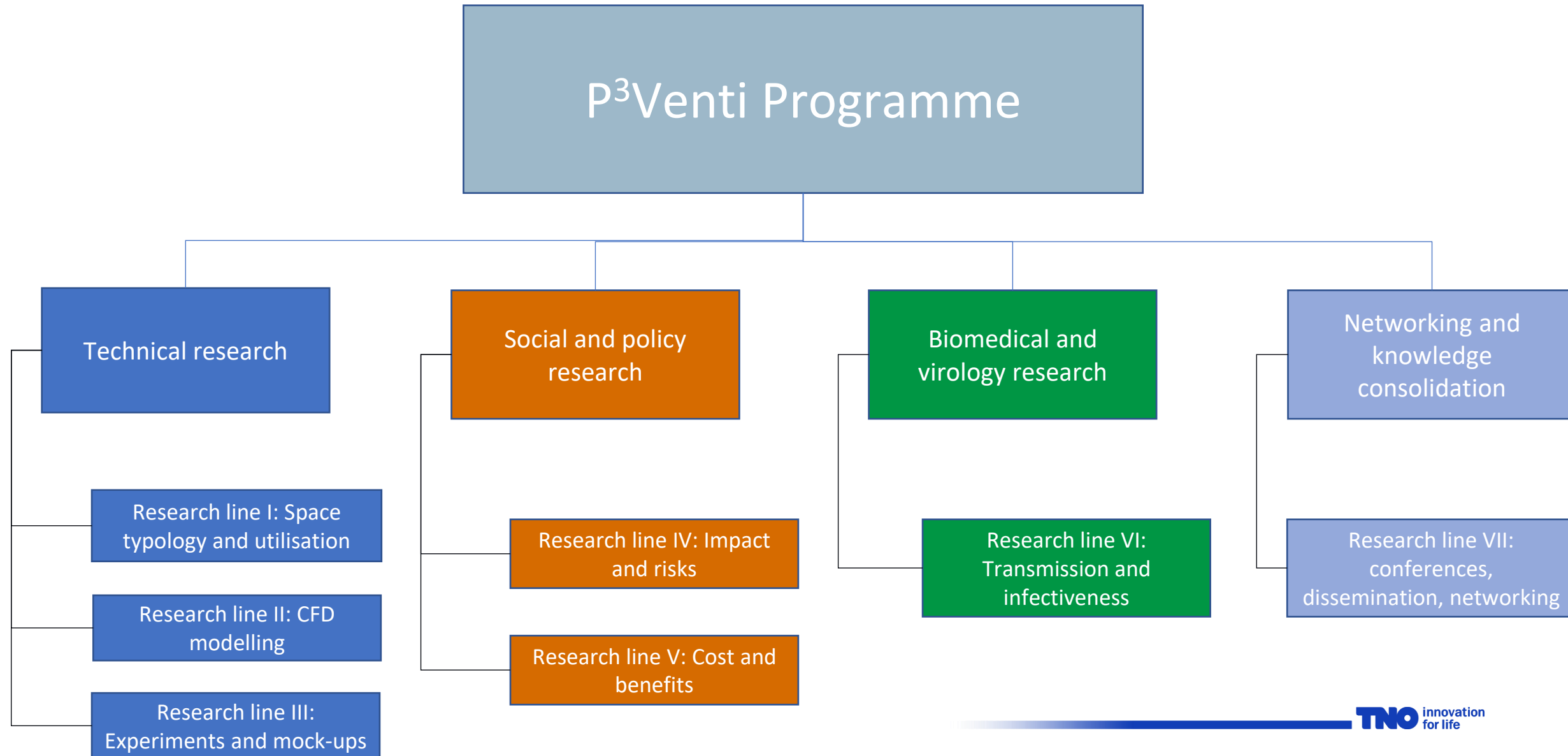
P³Venti research programme

Applied research to generate actionable knowledge for public authorities and stakeholders in priority sectors

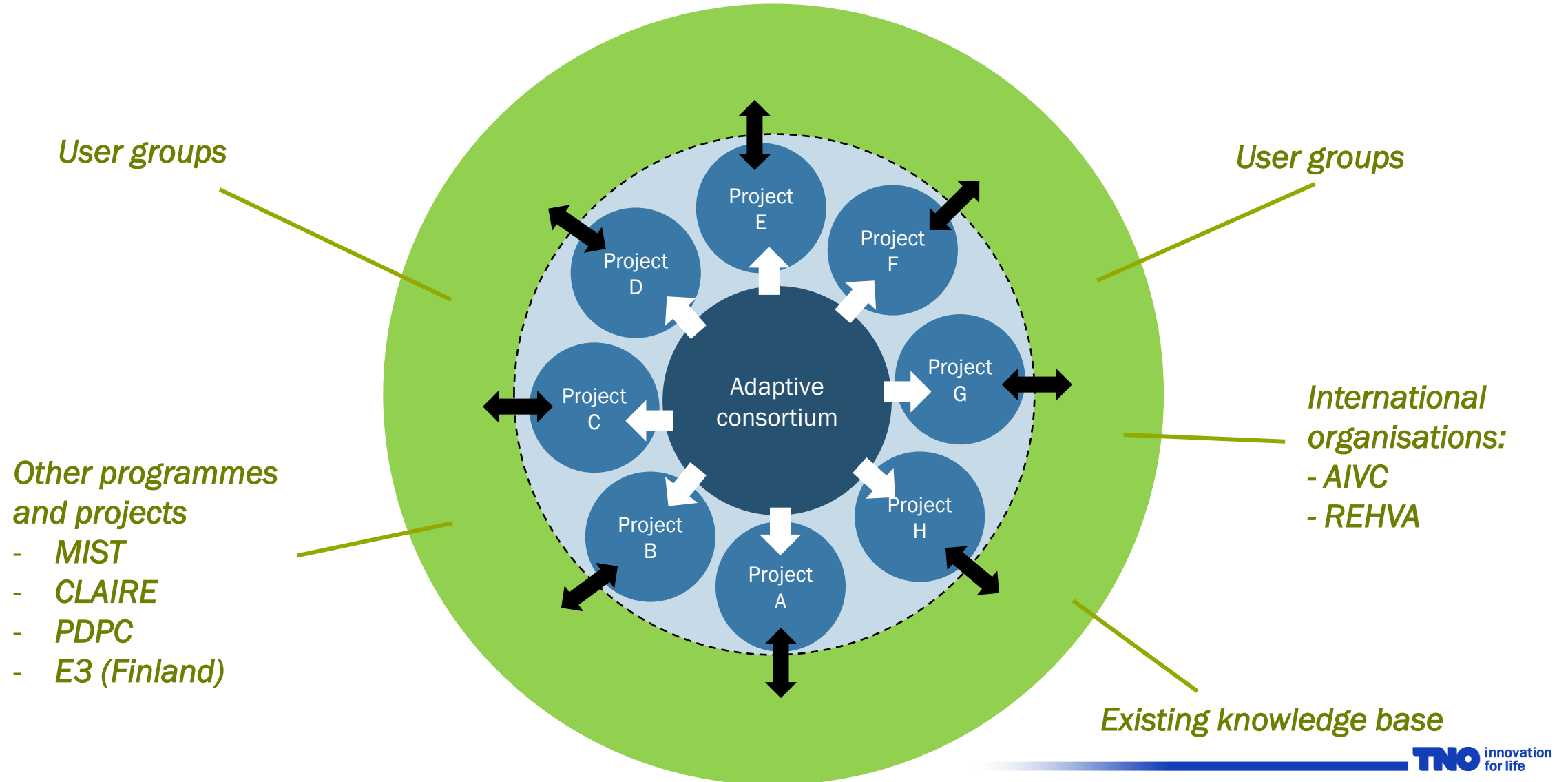
2022 - 2025



Programme structure



Way of working



Getting practical

Research line I: Operational conditions

Occupant interactions

- Location tracking
- Observations
- Semi-structured interviews



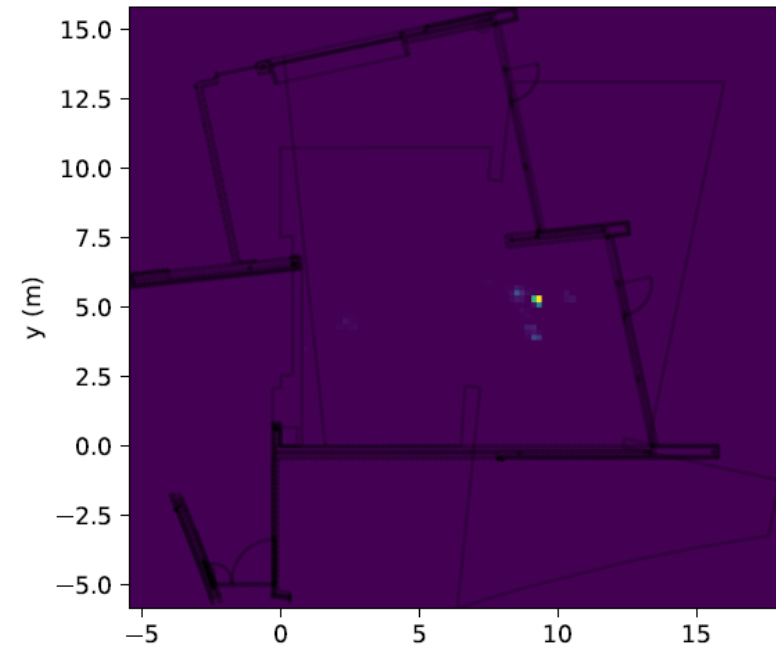
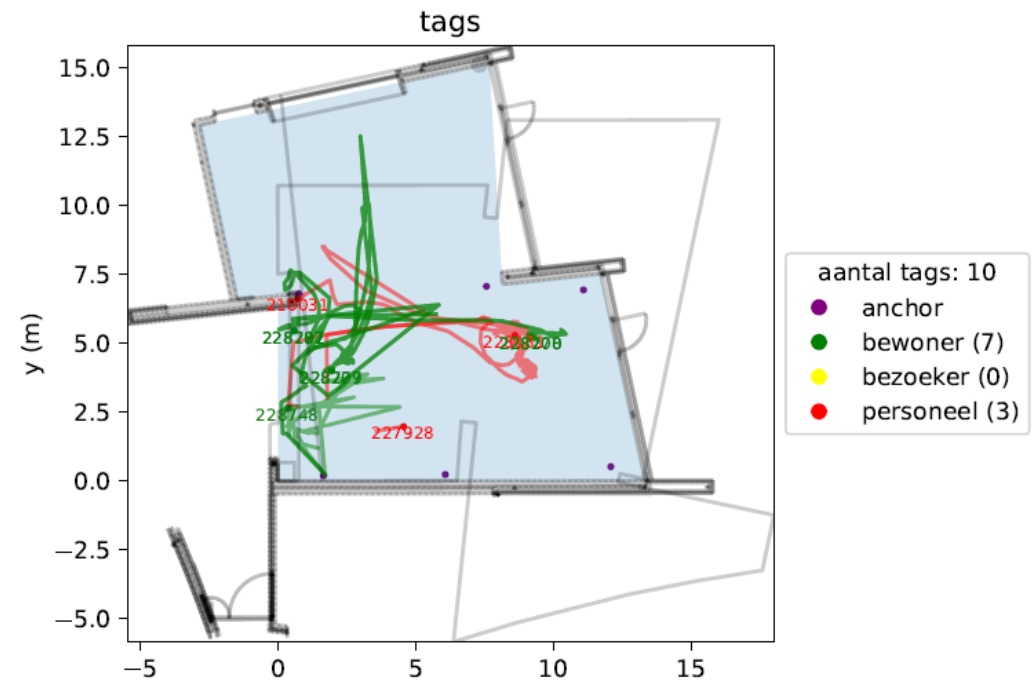
Getting practical

Research line I: Operational conditions

Occupant interactions

- Location tracking
- Observations
- Semi-structured interviews

KINEXON



Getting practical

Research line III: Experimental research

Experiments

Particle counts

- Emitter location
- Air change rate
- Thermal manikins

Air current (vector) measurements



Getting practical

Research line III: Experimental research

Experiments

Particle counts

- Emitter location
- Air change rate
- Thermal manikins

Air current (vector) measurements



In conclusion Don't be a stranger!

Knowledge repository

P³Venti & Claire symposium February 2024

Updates on latest research

Networking across disciplines

Send an email to penvoerder@p3venti.nl to join our network

[P3venti.nl](https://p3venti.nl)

adam.bufacchi@tno.nl

menno.hinkema@tno.nl

