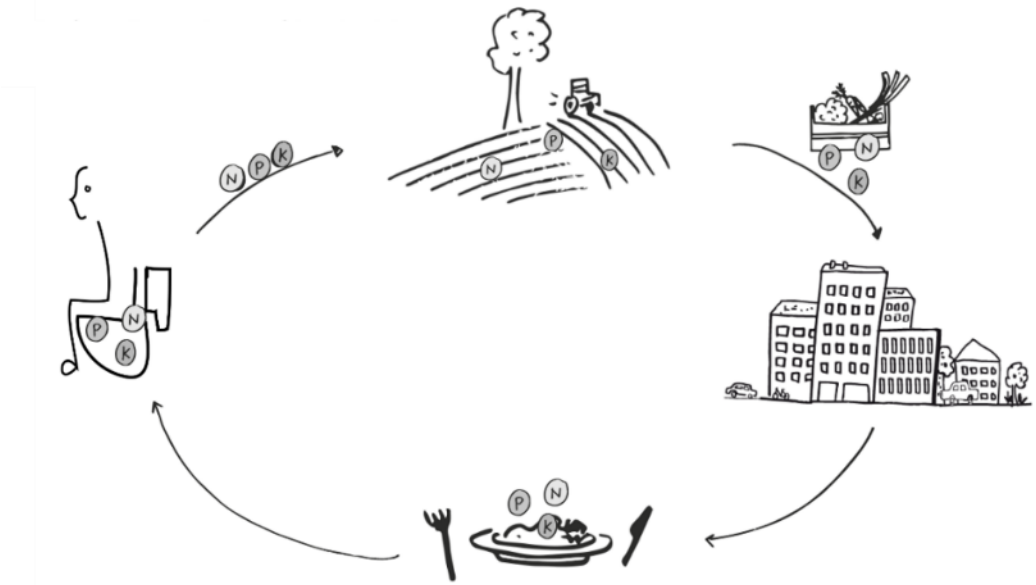
Image : Louise Raguet

Research/action program on nutrition – excretion systems and human excreta management

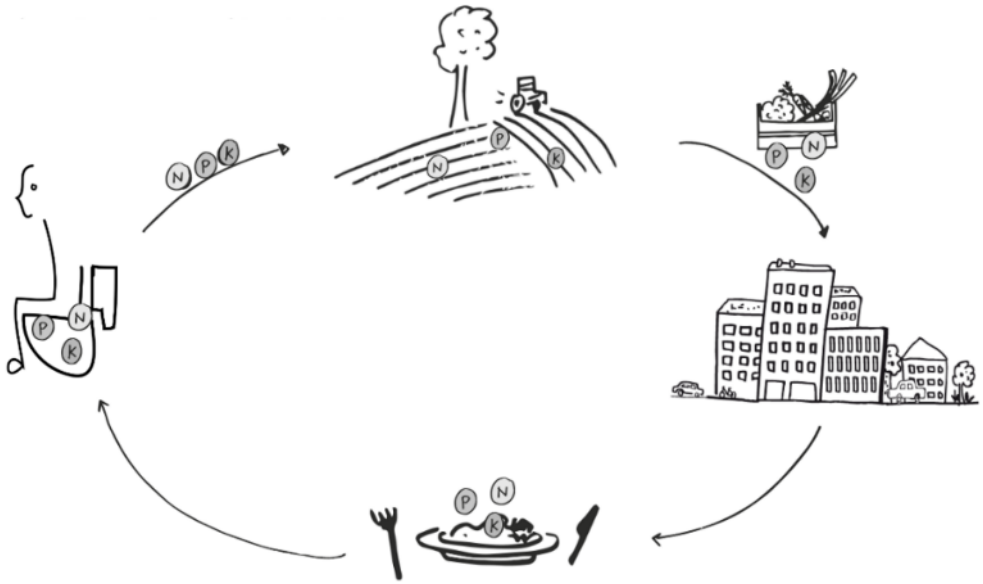


Marine Legrand.
Research fellow, LEESU, ENPC, IP-Paris, France
marine.legrand@enpc.fr www.leesu.fr/ocapi

Image : Louise Raguet

OCAPI

Research/action program on nutrition – excretion systems and human excreta management



www.leesu.fr/ocapi

- Launched in 2015
- Interdisciplinary and systemic approach
- National ressource center on source separation and agricultural recycling of human excreta

Research/action program on nutrition – excretion systems and human excreta management

OCAPI

Scientific team

Leesu – laboratoire eau environnement systèmes urbains

metis UMR 7619

EcoSys

Géographie-cités UMR 8504

SADAPT

TEAM (Cerema)

Scientific partners

École Nationale des Ponts et Chaussées

Institut Polytechnique de Paris

INRAE

AgroParisTech – Talents d'une planète soutenable

Cerema – Climat & territoires de demain

PIREN Seine

Université Paris-Saclay

eawag

Fédération Île-de-France de recherche en environnement

Université Gustave Eiffel

Futurs Urbains – Urban Futures

UPEC

LabEx BASC – Biodiversité, Agroécosystèmes, Société, Climat

INSA – Institut National des Sciences Appliquées Toulouse

CSTB – le futur en construction

tbi – Toulouse Biotechnology Institute

Technical and financial partners

République Française

Agence eau Seine Normandie

ADEME

ANR

Ministère de la Transition écologique et solidaire

FranceAgriMer

Horizon Europe

SIAAP – Service public de l'assainissement francilien

Ville de Paris

syctom

L'Institut Paris Region

École Polytechnique – Université Paris-Saclay

Les Greniers d'Abondance

Chambre d'agriculture Interdépartementale Île-de-France

Paris-Saclay

Métropole Grand Lyon

Toulouse métropole

RAE – Réseau de l'assainissement écologique

ARCEAU Île-de-France

P2GreeN

LabEx BASC – Biodiversité, Agroécosystèmes, Société, Climat

Marie Skłodowska-Curie Actions – Research Fellowship Programme

Le sommer environnement

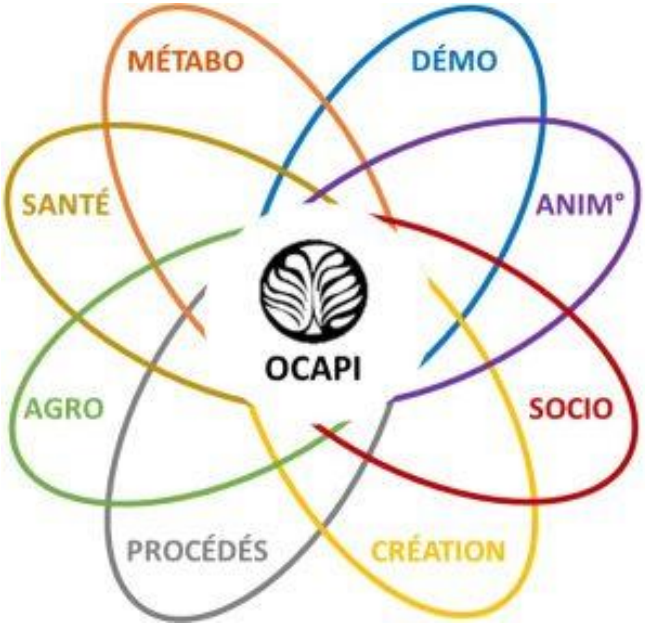
SEDE Environnement

Solagro

Terre&Cité – Plateau de Saclay

Association Pôle Végétal Loire Maine

Research/action program on nutrition – excretion systems and human excreta management



8 research axis

- Metabolism
- Agriculture
- Social & cultural changes
- Health
- Treatment Process
- **Demonstration**
- **Knowledge transfer**
- Creation

Paris region :
an important case study

Paris region
An important case study for urine diversion

Emblematic pilot projects

Building European Space Agency, etc.

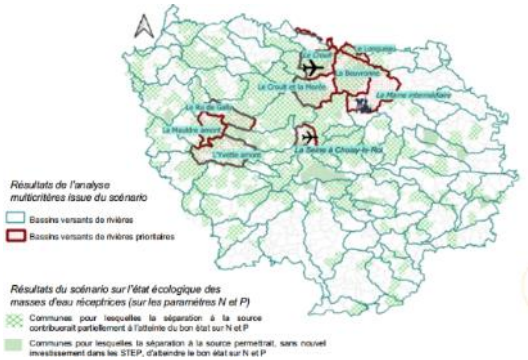
District Saint-Vincent de Paul

Urban planning « Saclay » urban development

Publication of regional strategies

Regional water agency (AESN)

Urban planning institute
(Institut Paris Region)



Saint-Vincent de Paul (Paris 14e) : Experimenting urine source separation in the dense city

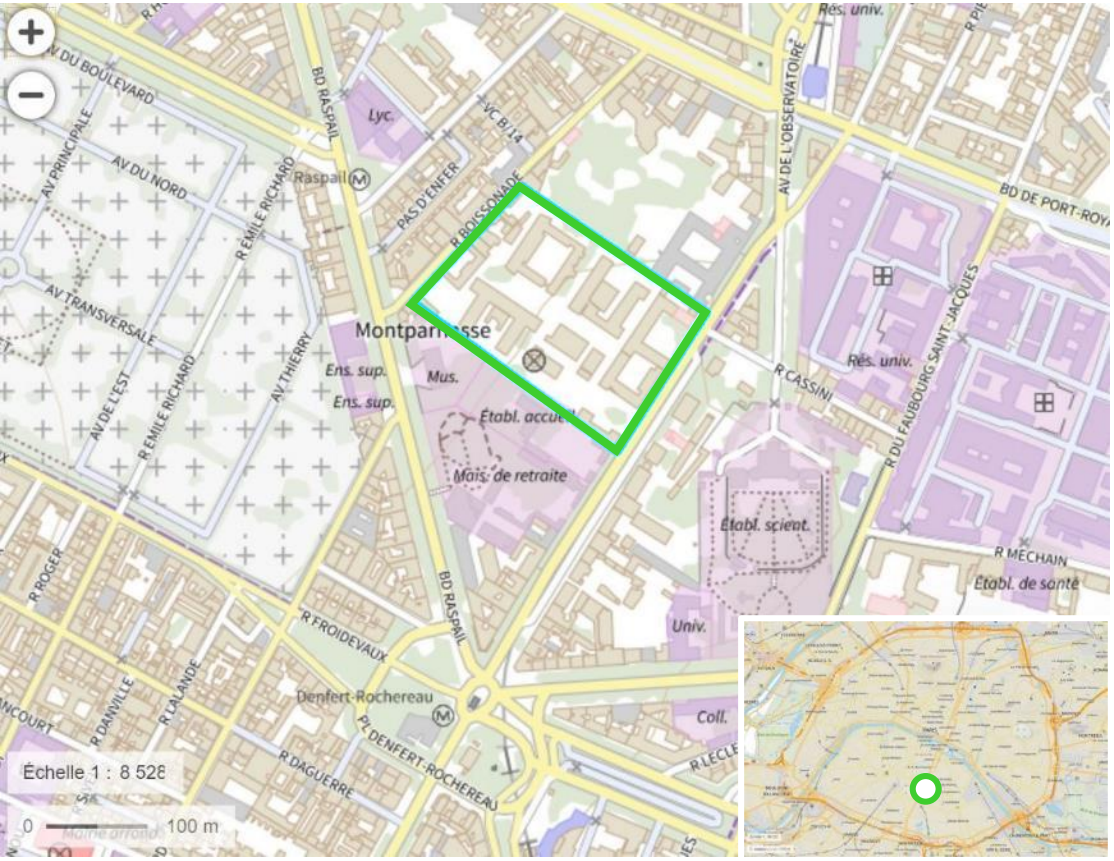
PARIS

Saint-Vincent-de-Paul neighborhood

Surface : 3,4 ha

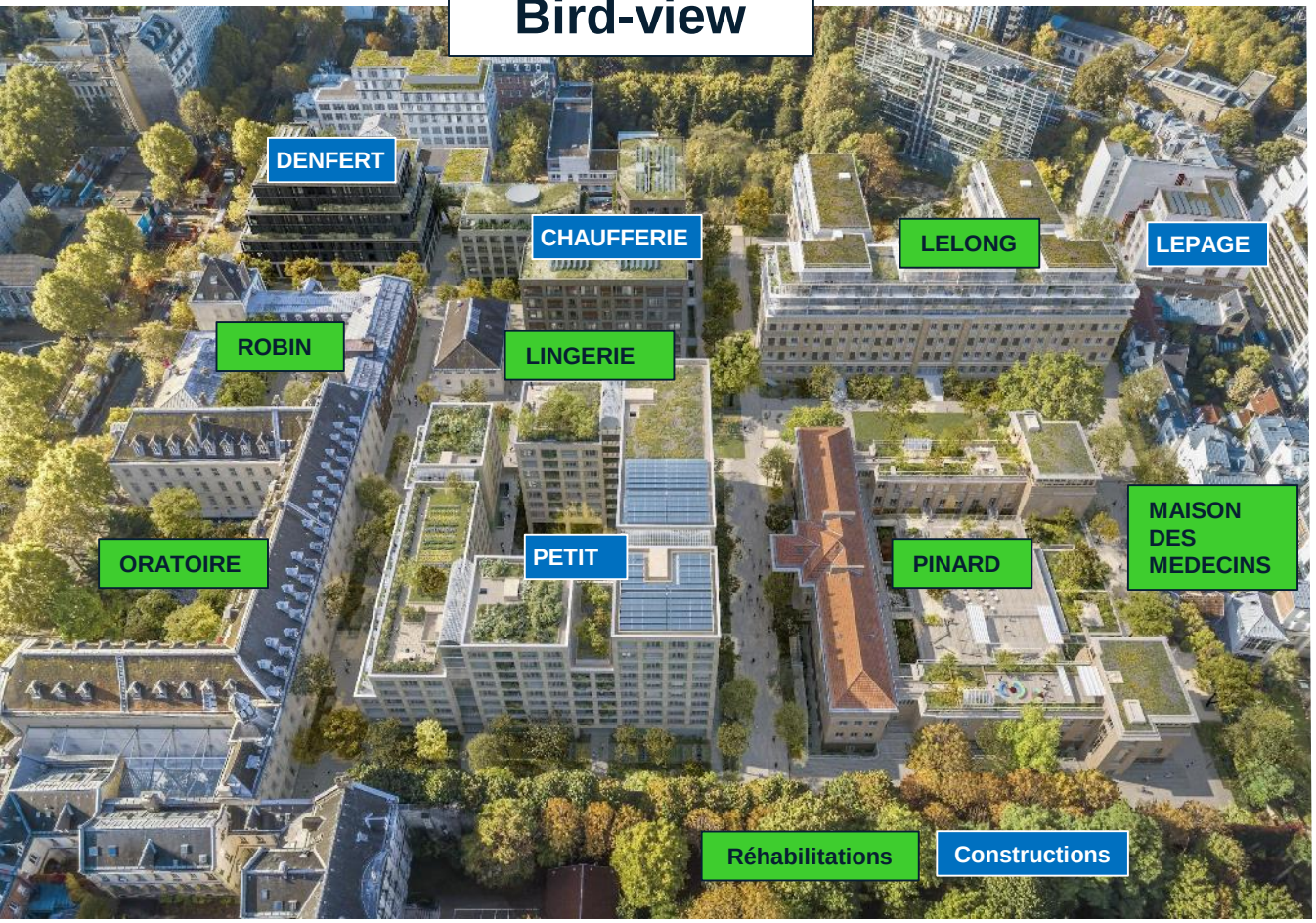
Localisation : 14e district of Paris (city center)

Local density : 24 000 inhabitants / km²

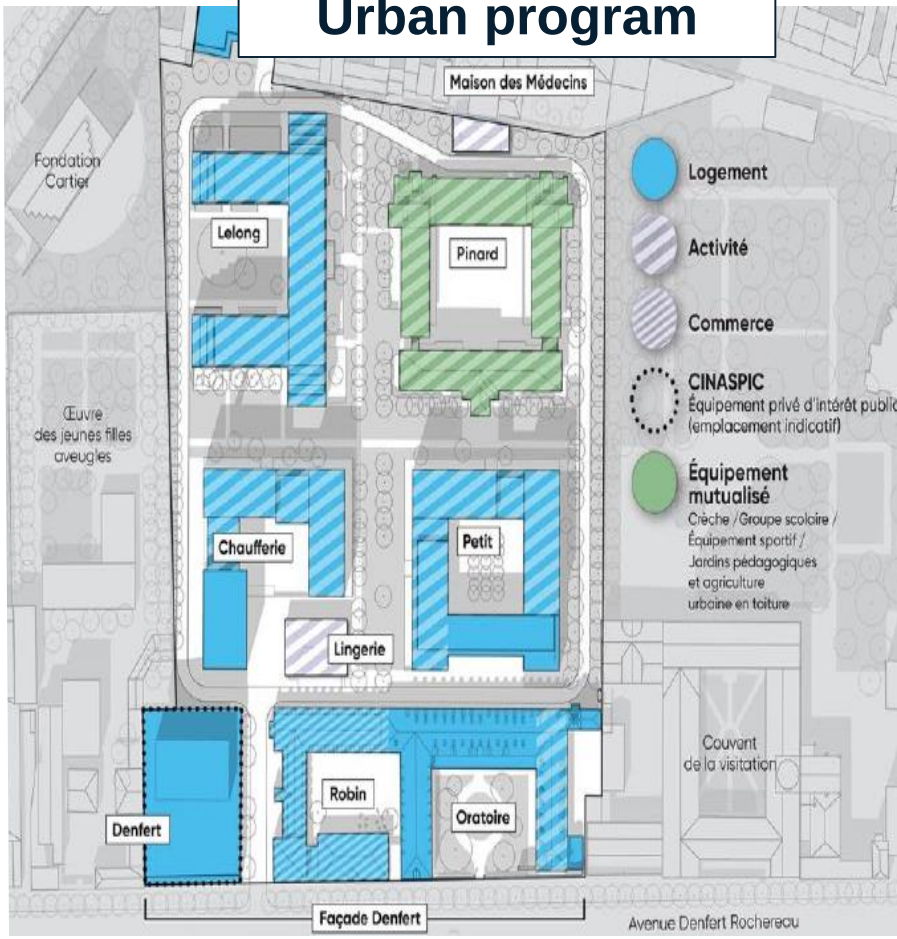


Programmation

Bird-view



Urban program

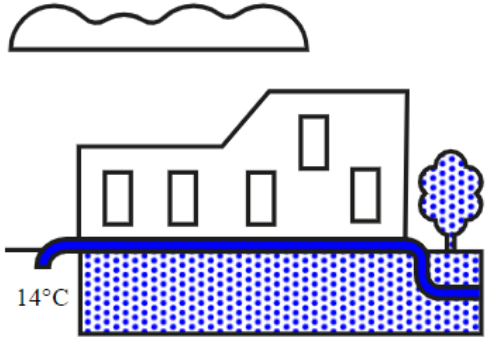


Urban developer : P&MA

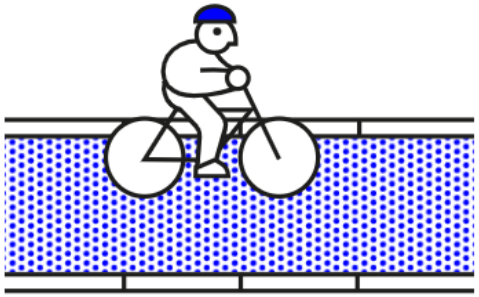
60% of existing buildings renovated
+ 4 new blocks

- **600 dwellings** (40 200m², social, intermediary and first-ownership)
- economic activities (8 500m²)
- private cultural facility (4 000m²)
- public equipment (incl. school, gymnasium (5 000m²)

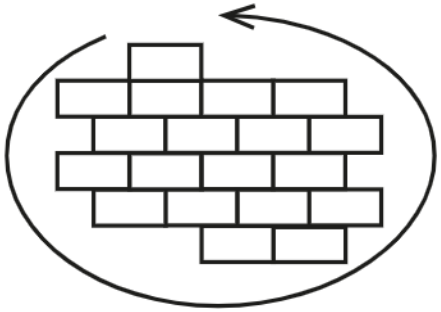
Environmentam approach



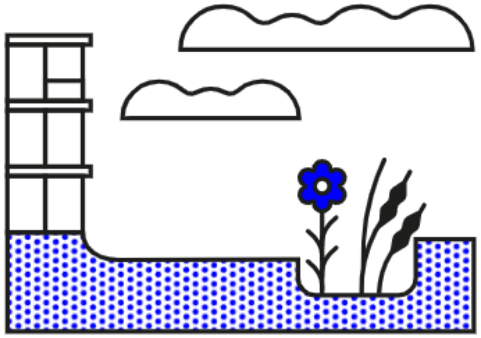
Energy production
and consumption



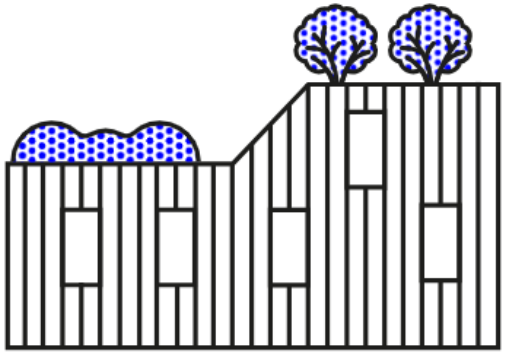
Sustainable mobility



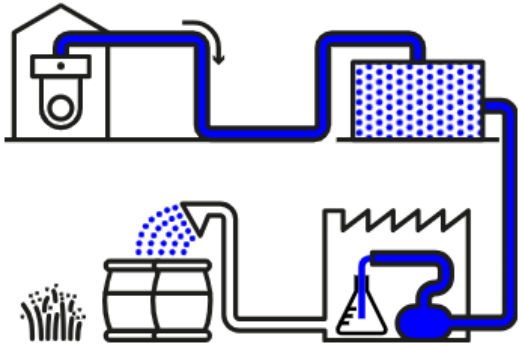
Building materials :
sobriety and reuse



Sustainable
management o water
and biodiversity

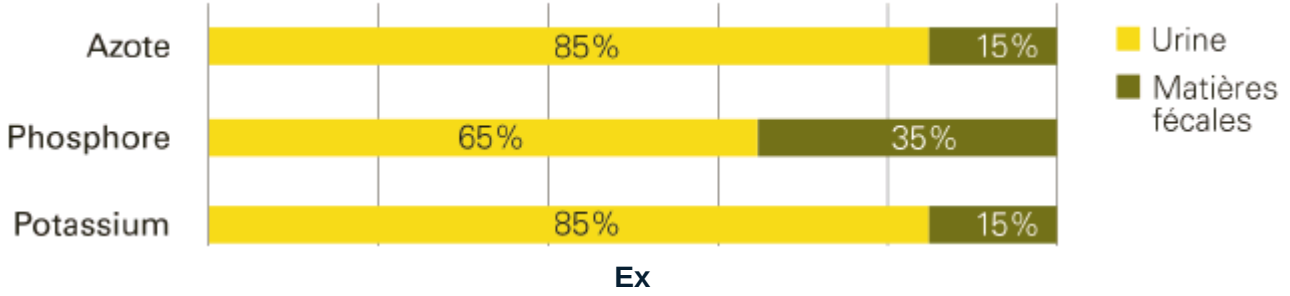


Bio-based and
adaptable
construction



Urine source separation
and valorisation

Wanted : human urine !



Today :

Fertilizers production for agriculture

- Synthetic fertilizers
- Based on fossile ressources extraction outside Europe.

- pollution
- Non-renewable resources, energy
- Extra-european dependancy

Urine management

- Urine = nitrogen and phosphorous
- All-to-the sewer, WWTP (incomplete treatment)
- pollution
- Energy consumption
- WWTP saturation

What if urine became a fertilizer ?

- Strengthening the resilience of Paris and the Île-de-France region
- Developing the region's circular economy
- Supporting innovation that benefits the environment
- Changing the sanitation paradigm

Urine source separation

Urban environment: consumption of agricultural products

Urine diversion and collection

Urine transport to a treatment facility

Urine treatment > production of a fertilizer

Rural environment :

Use of urine derived fertilizer

Innovations on urine management in Saint-Vincent de Paul district :

- **Scale of urine collection (large area)**
- **Public underground urine transport network**
- **On-site urine treatment**
- **Urine derived fertilizer can be selled (marketing authorization)**

History of the project

2016 : creation of the urban development zone, « ecological demonstrator »

- « triple ZERO » district : zero carbon, zero waste, zero effluent
- Stimulating social and ecological innovation

.2018 : adding of urine source sepation to the urban program

2019/2020 : a little back-up

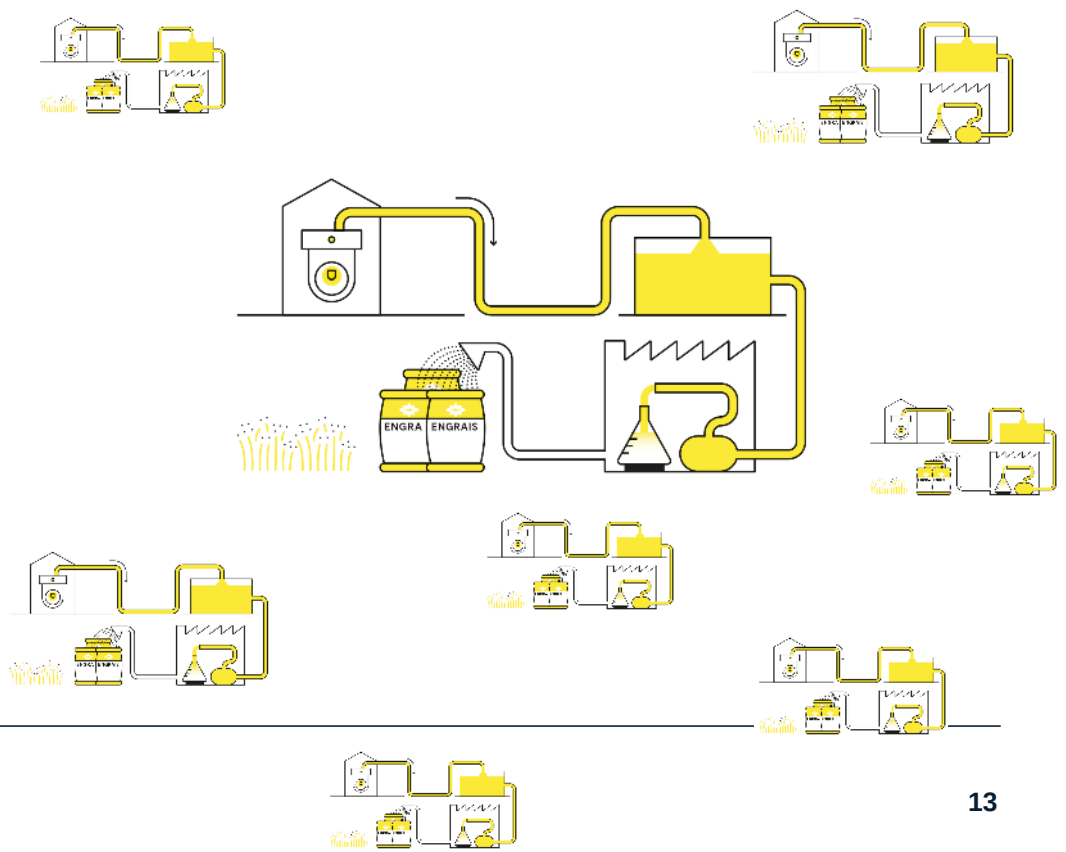
- Consulting mission : « urine strategy »
- Master plan for separate urine management for the urban development project

Oct. 2020 : let’s go

- Aproval of the project « urine in St Vincent de Paul » at the project steering comittee (elected municipal officials

Goals of urine source separation at the scale of SVP district

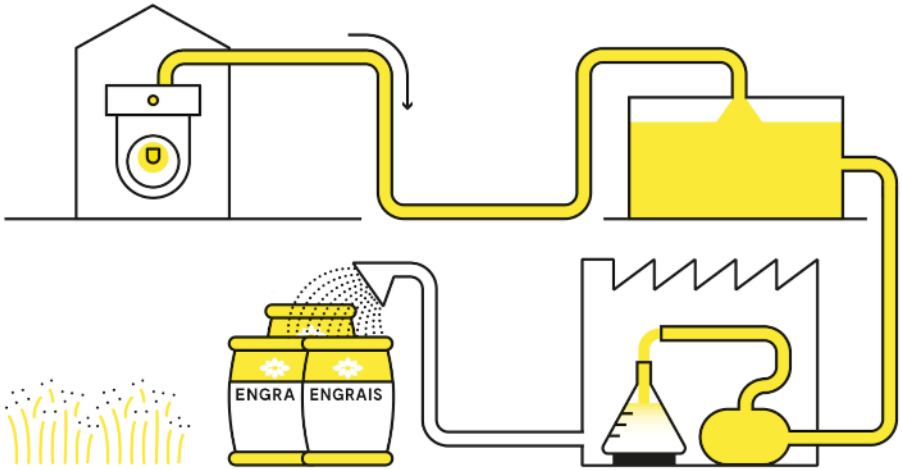
- Imlpementing a new, low-impact sanitation system by collecting urine at source for all genders.
- Integrating the collection system into the architecture and public space, ensuring its reversibility
- Verify the business model and define a governance model for operations
- Developing urine valorization through the production of fertilizers
- Raise user awareness
- Monitor and evaluate implementation with a view to replicability



Urine source separation : management

- Source separation in buildings
- Separate networks, plugged to the public transportation system (underground)
- On-site treatment and creation of fertilizer

Vidéo (french) : La valorisation de l'urine à Saint-Vincent



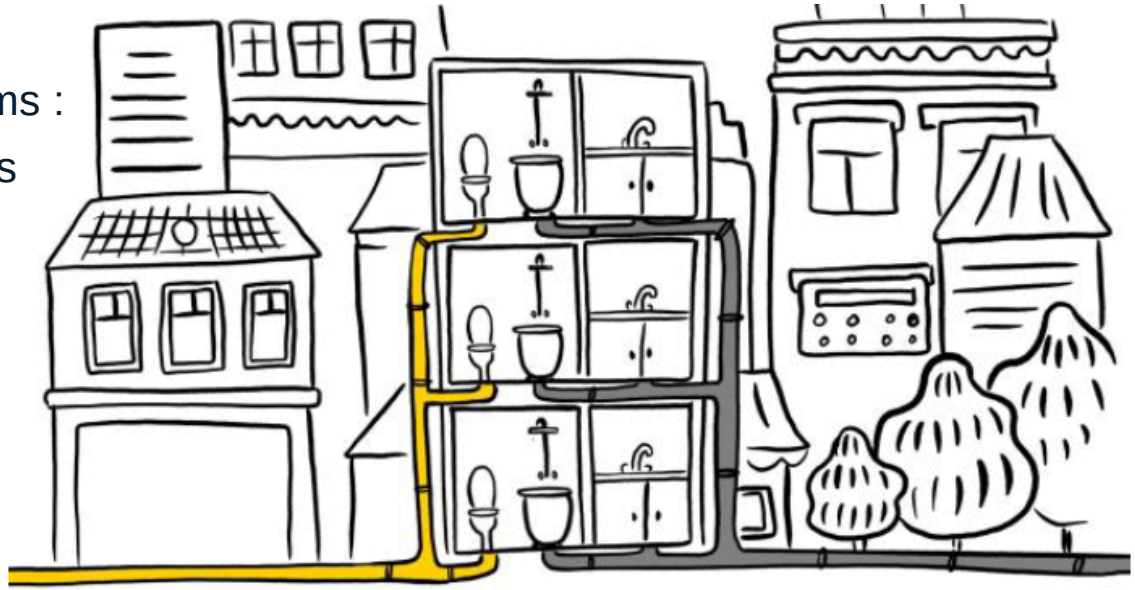
Urine source separation : implementation

Technical specifications imposed to all building programs :

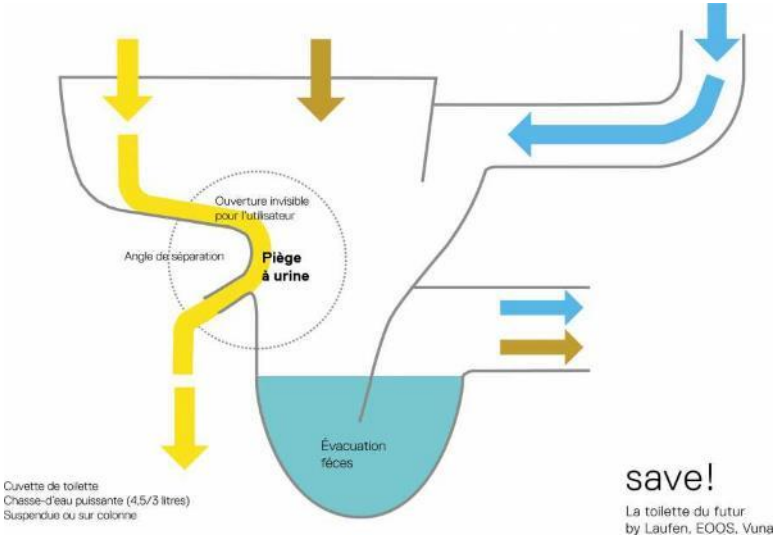
- Urine diversion flush toilets, male and female urinals
- Internal separate networks, plugged to the public transportation system.

First buildings delivered at end 2026, up until 2028.

These toilets, urinals, and networks require new behaviors from users.



LAUFEN (SAVE)

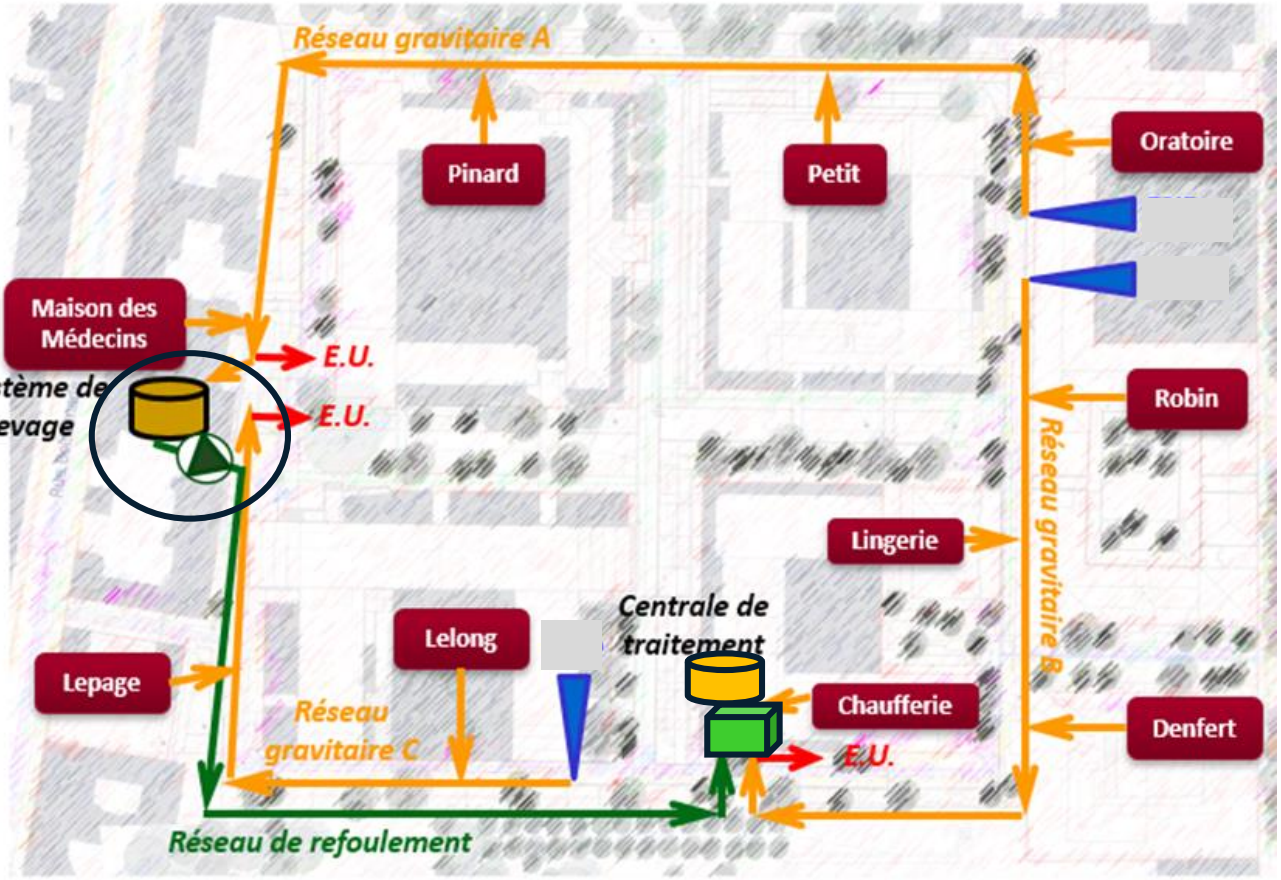


WOSTMAN

Female urinal
MARCELLE

Implementation : public transportation network

- Gravity pipes
- Discharge pipes
- pumping station
- tanks
- Water flush



Volume collected ~ 1900L/day of urine

Fertilizer manufacturing

Basement

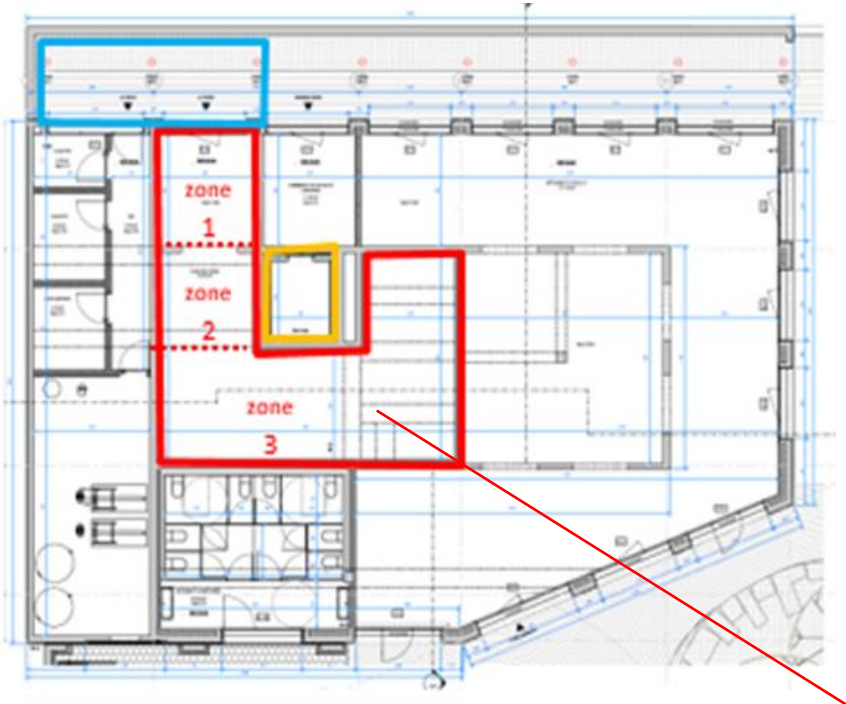
- 70 m²

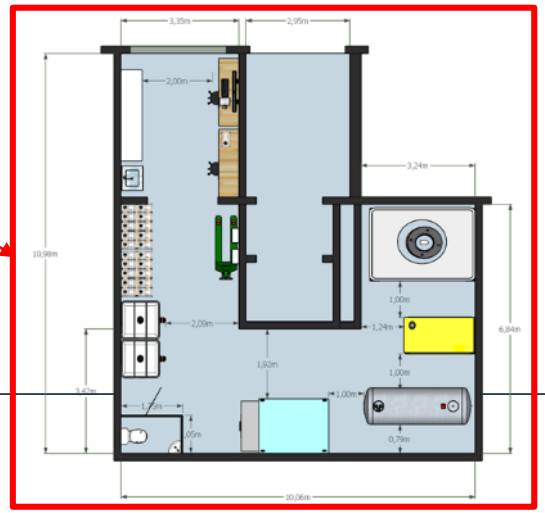
Underground tanks

- Urine 15 m^3
- Fertilizer 25 m^3

Technology

- nitrogen stabilization treatment process, carbon filter and concentration
- Up to 2 m^3/day
- Production of a natural fertilizer (estimate: 15L of urine -> approximately 1L of fertilizer)





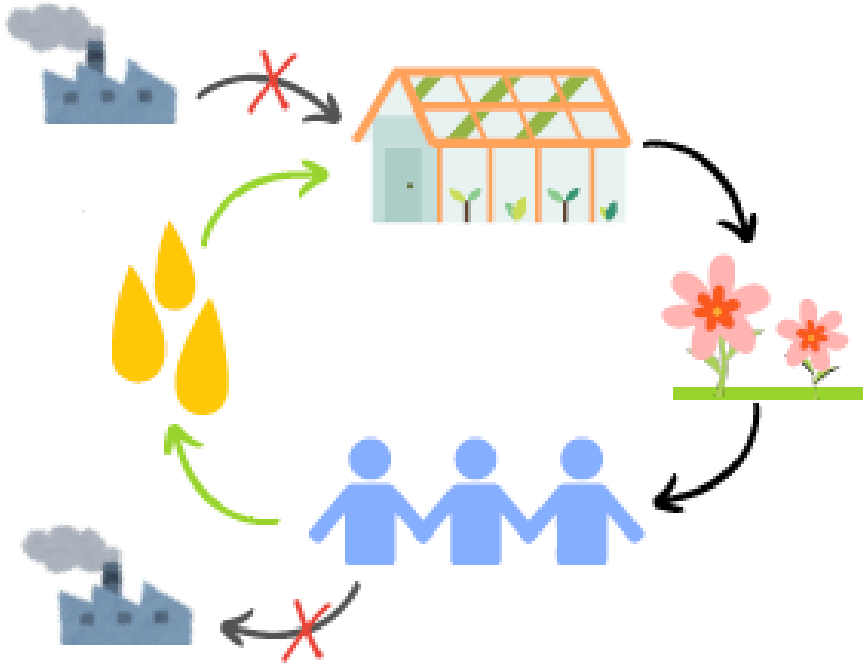
Fertilizer manufacturing

Global Performance Public Procurement

- for the design, construction, operation and maintenance of the urine treatment and recovery plant + operation and maintenance of the installed urine network
- Consultation launch: December 2025
- Expected launch: May 2026
- Duration :

  Central part of the contract : 55 month (7 + 48) ;

  renewable part of the contract : 24 months (renewable 1 time).



End-Users of the Urine derived fertilizer

- Parks and gardens department (plant nurseries…)
  - **(experiments in progress)**
- Externally: distribution, sales to individuals or farmers

Sharing the experience

European project P2Green

(financed by : Horizon)

Develop a common methodology for the collection and reuse of urine and feces at the European level

European project REV:EU

(financed by : Driving Urban Transition)

Urban living labs about urine and greywater recycling for city greening
(Sweden, Norway, France)

Research action program with ENPC and CEREMA

- Study on the organization of stakeholders and governance implemented during the construction and operation phases
- Formulation of implementation recommendations for the widespread adoption of separate urine collection in the city

Participation in numerous events

- Symposiums, conferences, etc.
- Press articles, podcasts
-
- First prize, jury's favorite, Paris de l'Innovation – 2024 edition
- Courses at ENPC