ARRDHOR
CRITT HORTICOLE

TOIT TOUT VERT

Centre Régional d'Innovation et de Transfert de Technologie

Toit Tout Vert - Intensive urban farming under a greenhouse on a roof in Paris

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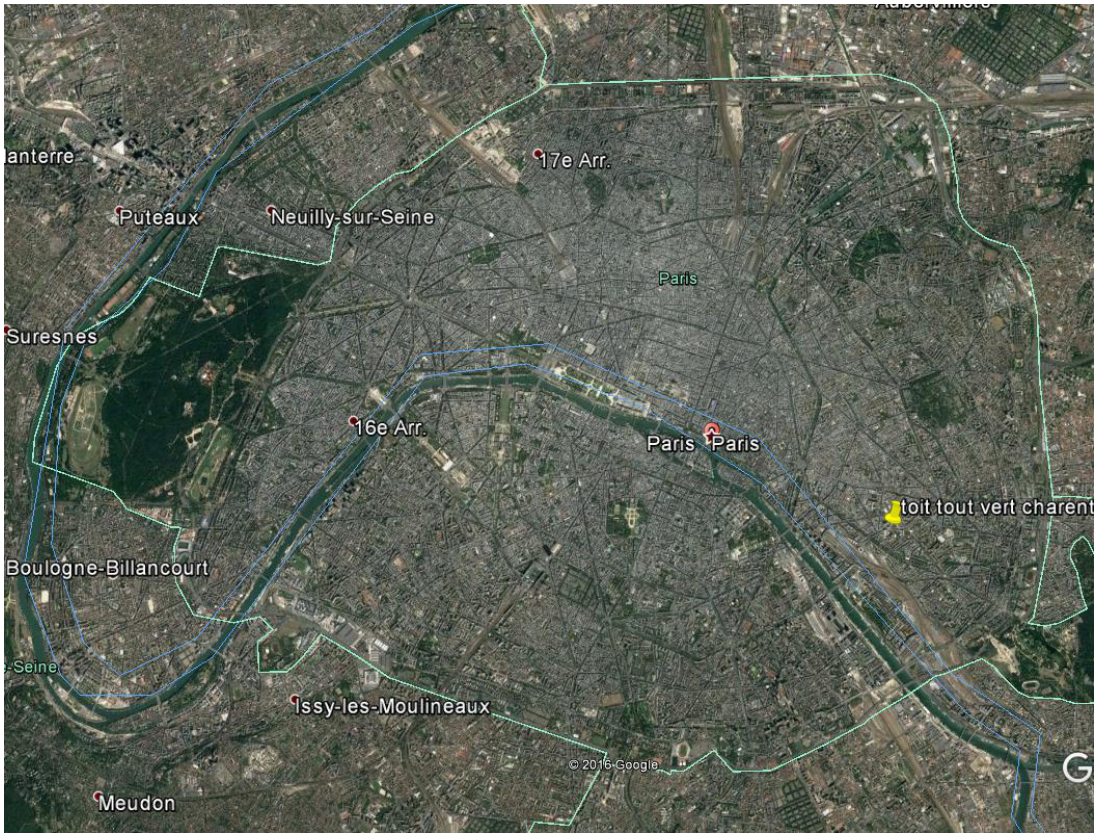
Local context in Paris

- Paris Inner City : 2,22 millions inhabitants (21000 people/km²)
- Greater Paris : 12 millions inhabitants (1000 people/km²)



How to green Paris ?

- No surface available at the ground for planting : the only way is greening the buildings
- Local authorities have launched in 2014 a plan « greening 100 ha of building »
- According to« Ville de Paris »: 460 ha of flat roof may be greened, including 80 ha easy to green:
  - ✓ > 200 m²;
  - ✓ access,
  - ✓ no existing equipement

Urban farming ?

- The plan « 100 ha of green building» implics also Urban Farming, under several type :
  - ✓ Shared garden, with more or less social aims
  - ✓ Support of a peri urban agriculture (greater Paris)
  - ✓ Settlement of new private entreprises in the center fo Paris

- To develop Urban farming, City of Paris launched in 2016 a contest « Parisculteur » :

Focus on vegetables distribution in Paris

- High population density leads to traffic jams and air pollution
- This makes fruits and vegetables delivery difficult.
- Most of Parisian retailers (more than 6000) go daily to Rungis (wholesale market) early in the morning to get their supplies
- This supply chain is efficient, but means delays and loss of quality

Project partners : Toit Tout Vert

- Toit Tout Vert (TTV)'s aim is to be a new actor in growing, selling and supplying vegetables in urban areas :
    1. in Paris,
    2. in other big cities in France
    3. abroad

by building and leading greenhouses on roofs

Project partner : CRITT Horticole

- Technological Ressource Center in horticulture, certified by the French ministry for research. A team of 10 engineers, doctorates and technicians.
- Activities in horticultural industry: public services, greenhouse engineering, technological and economical studies…
- Research programs: plant dyes, micro algae, green building

Challenges

Simultanously :

- Satisfy customer's needs :
  - ✓ safe and tasty products,
  - ✓ normal price (not a luxury price),
  - ✓ picked up at the best degree of ripeness, a few hour before delivery
- To be economically viable, without any susbsides
- Manage a greenhouse on a roof without any conflict with neighborough and buildings users (offices, appartments, schools…)
- To have the best exchanges as possible with locals networks and associations
- To be environnmental friendly

Process (1/2)

1. Find a roof suitable for building and leading a greenhouse
2. Be an actor of the social environnement
3. Define the range of products
4. Define distribution and commercials questions
5. Define the cultural methods

Process (2/2)

6. Design the production means
7. Proove rentability
8. Find financial means
9. Get public authorization
10. Implement the solution and start growing…

Seeking a spot

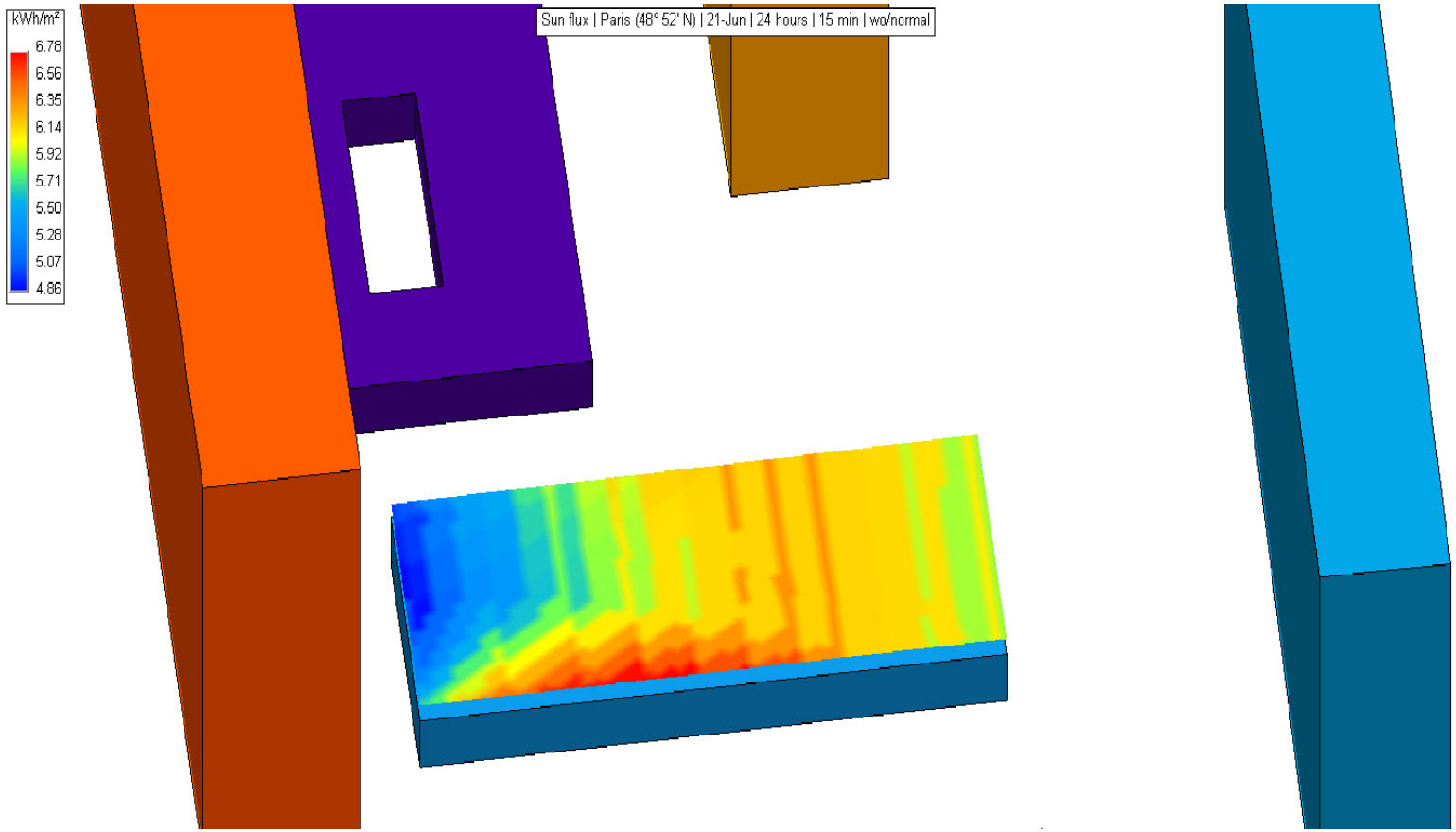
Constraints :

- Minimum area : 1500 m²
- Roof free of any activity and any equipment (chimneys, antennas…)
- High Load capacity (> 400 kg/m²)
- Easy access from the ground
- Compatibility between agriculture and building users
- Minimum of shades from surrounding buildings
- Building's owner agreement

Result

- After long and methodic research, TTV found a roof rue de Charenton : ~ 1000 m² at the first floor
- Owner : Paris Habitat (Public social agency who provide appartments for family and worker)
- Building use : Industrial cleaner (compatibity with growing)
- Low shade level from other building
- Easy access from the ground level
- Inside a popular neighbourhood

Light energy during 24 h (21/06)



Product's range

- High value products when fresh (quality, taste)
- Species grown under greenhouse
- Crop season as large as possible (consummers need to be supplied 12 months a year)
- The range was discussed to a consummer pannel. The result is
  - ✓ Tomatoes,
  - ✓ Peppers,
  - ✓ Radish,
  - ✓ Zucchini,
  - ✓ Lettuce,
  - ✓ Mushrooms

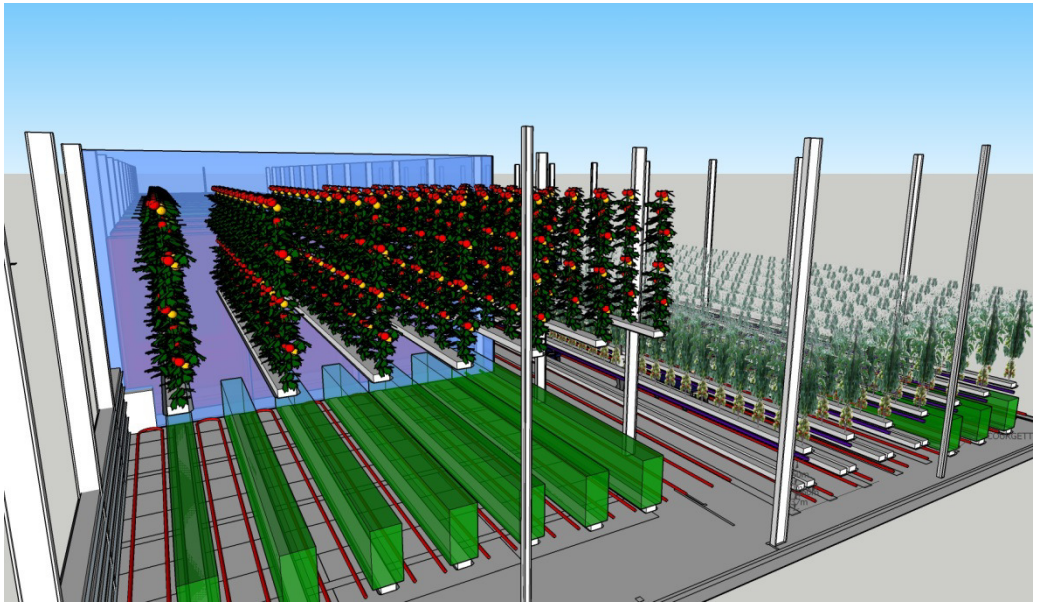
- For Potatoes, carrots, cabbages, leeks (grown in soil, need a lot of space…) :
- Partnership with organic grower (outside Paris)

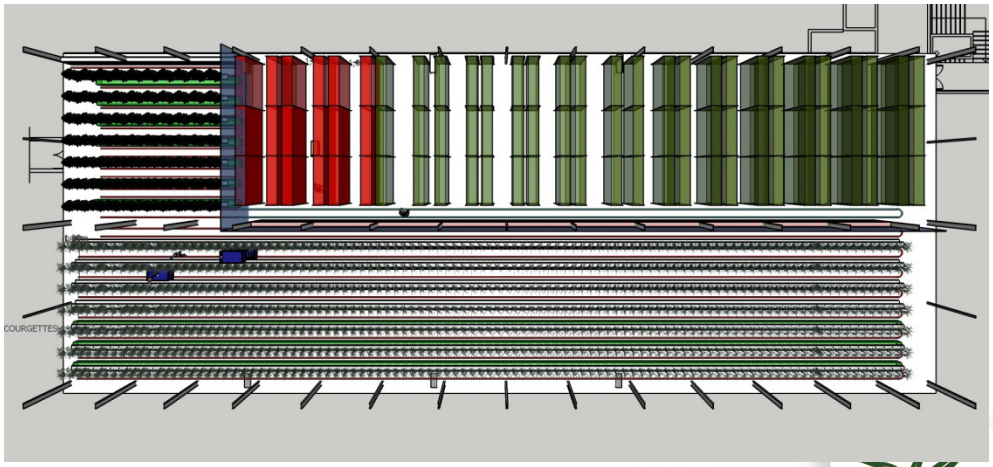
Distribution

- Product sold through a membership system
- Delivery at home weekly
- « CO_2 free » delivery
- Organization of a « community of 500 to 600 locavores » , located at 1500 m away maximum

Growing methods

- Necessity to reduce the material flow (substrate…)
- Thinking in « 3 d » instead in flat
- Traditional and well-known growing methods for tomatoes and pepper : soilless on organic subtrate (which is reused for mushrooms)





- New growing methods for Radish and Zucchini : soilless, with additional light provided by LEDS

New machinery for growing lettuce and strawberry : The Green Up System

What is Green Up ?

- Green UP is a versatile and high-yield production equipment.
- Designed and optimized for urban culture, but can be used in other context.
- It integrates the main requirements :
  - ✓ silent operation,
  - ✓ load adapted to existing roofs,
  - ✓ resource consumption and waste production efficient.

How it works ?

- NFT (Nutrient Film Technique)
- 4,5 meters high rotary tower with moving crop gutters : Crop gutters are cyclically going from the base to the top of the tower in order to equally receive natural light.
- Artificial lighting with LED can be added

GREEN UP


GREEN UP
TOIT TOUT VERT

Production means

- **GREENHOUSE**

Greenhouse type : multispan VENLO

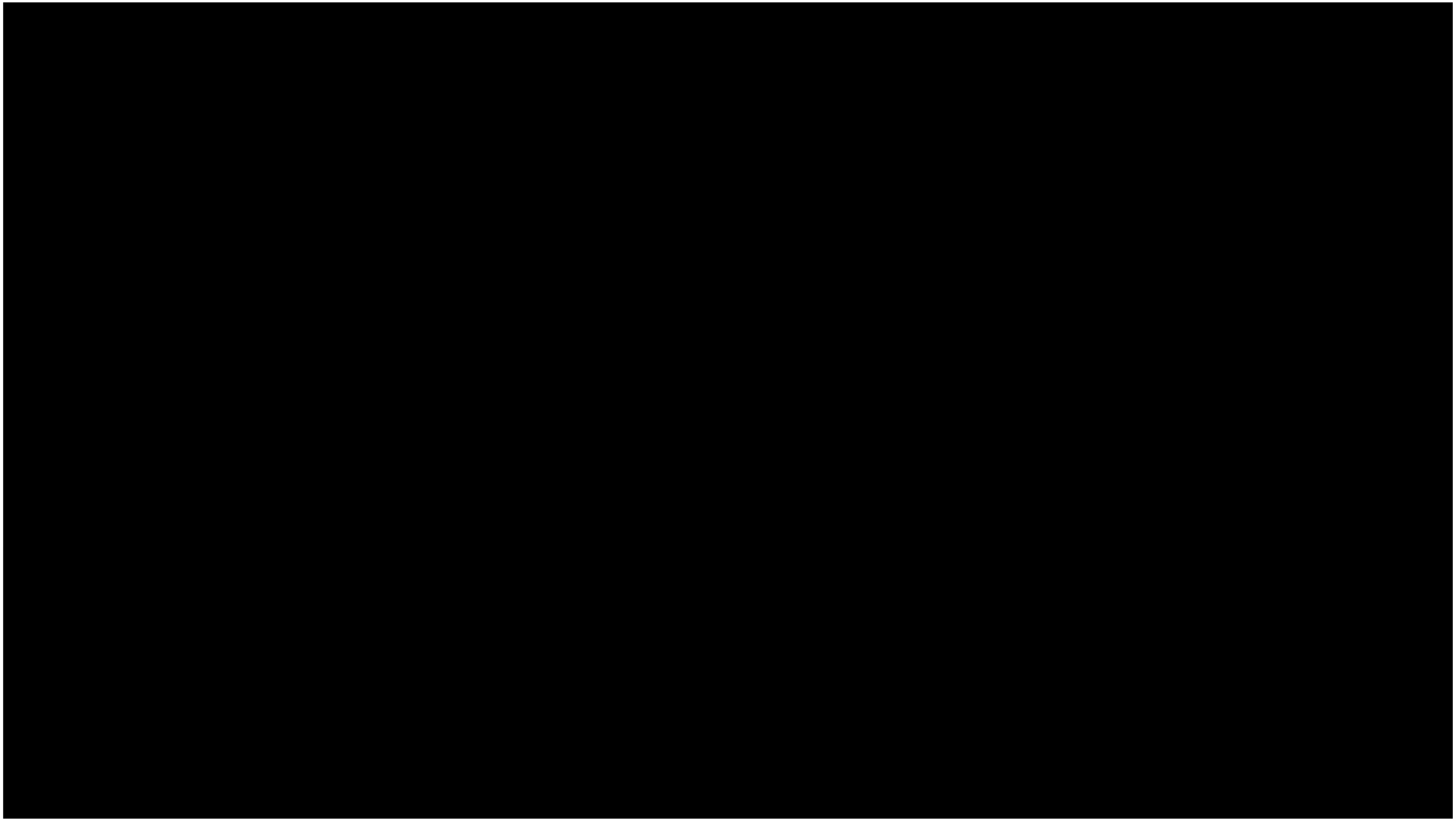
Height under gutters : 7,00 m Compartmentation : 3 independents compartments

- Roof and wall materials : Inflated double layer F-Clean
- Roof ventilation : Double roof vent with independent command

Side ventilator on each compartment

- Shading and energy saving screen : 1 flat screen (thermal and shading effect) under gutters in each compartment

- Heating : energy provided by an urban steam network
- Climate control and nutritive solution managed by computer



Rentability ?

- Economic datas are confidentials
- What is possible to say ?

  Business plans show positives results with :

  - ✓ Carefuly Yields
  - ✓ Without any subsides
  - ✓ Products sold at « normal price »

Financial resources

- Total budget : 2 millions € (investment + working capital)
- Private investors and bank loan
- French government provide a support for 20 % of the total budget
- 80 % is a loan free of interest (16 % of the total amount)
- 20 % of subsides (4 % of the total amount)

Authorizations

- About the building
  - ✓ Waterproofing layer ?
  - ✓ Building's owner agreement

- About Urban's rules
  - ✓ Urban Planning System has changed for several reasons, indeed building greenhouse on roofs
  - ✓ Construction authorization OK in march 2017

State of the project in june 2017

- All technicals aspects are OK :
- Technical means : OK
- Growing methods : OK
- Finance : OK
- Work in scheduled from summer 2017
- Start of growing : winter 2017/2018

Summit

TTV’ s project is now ready to be launched

But it’s a long way : more than 4 years until now

This unusual project was possible thanks to a team with complementary skills :

- ✓ Business
- ✓ Networking
- ✓ Technical skills (building, greenhouse, agronomy)
- ✓ Commercial
- ✓ Communication

Only possible with a high innovation level :

- ✓ growing methods,
- ✓ energy,
- ✓ greenhouse engeneering
- ✓ commercial questions
- ✓ Logistics

Charenton = 1st operation in Paris, results within 2 years

2nd location in Paris under study (one of the Parisculteurs 2016 contest winner), implementation scheduled in 2020

Aim : to create a farm network in Paris, and why not in other cities ?

More information :

- ✓ www.critt-horticole.com
- ✓ www.toittoutvert.fr

Thank you for your attention