

# The Nubian Vault Programme

A cross-cutting development initiative in the Sahel

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# The Housing Challenge in the Sahel

- > Deforestation, climate change, population growth
- > Traditional timber / straw roofs no longer possible
- > Millions of families living in precarious unhealthy tin-roof shacks
- > High cash cost of imported roofing sheets, timber, cement..



Urgent need for an alternative adapted architectural solution...  
...addressing housing, economic and rural development,  
and climate change adaptation and mitigation

# I THE NUBIAN VAULT TECHNIQUE





Mud brick vaults in the  
Ramesseum, the temple  
of Ramses II, Luxor, built  
around 1250 BCE

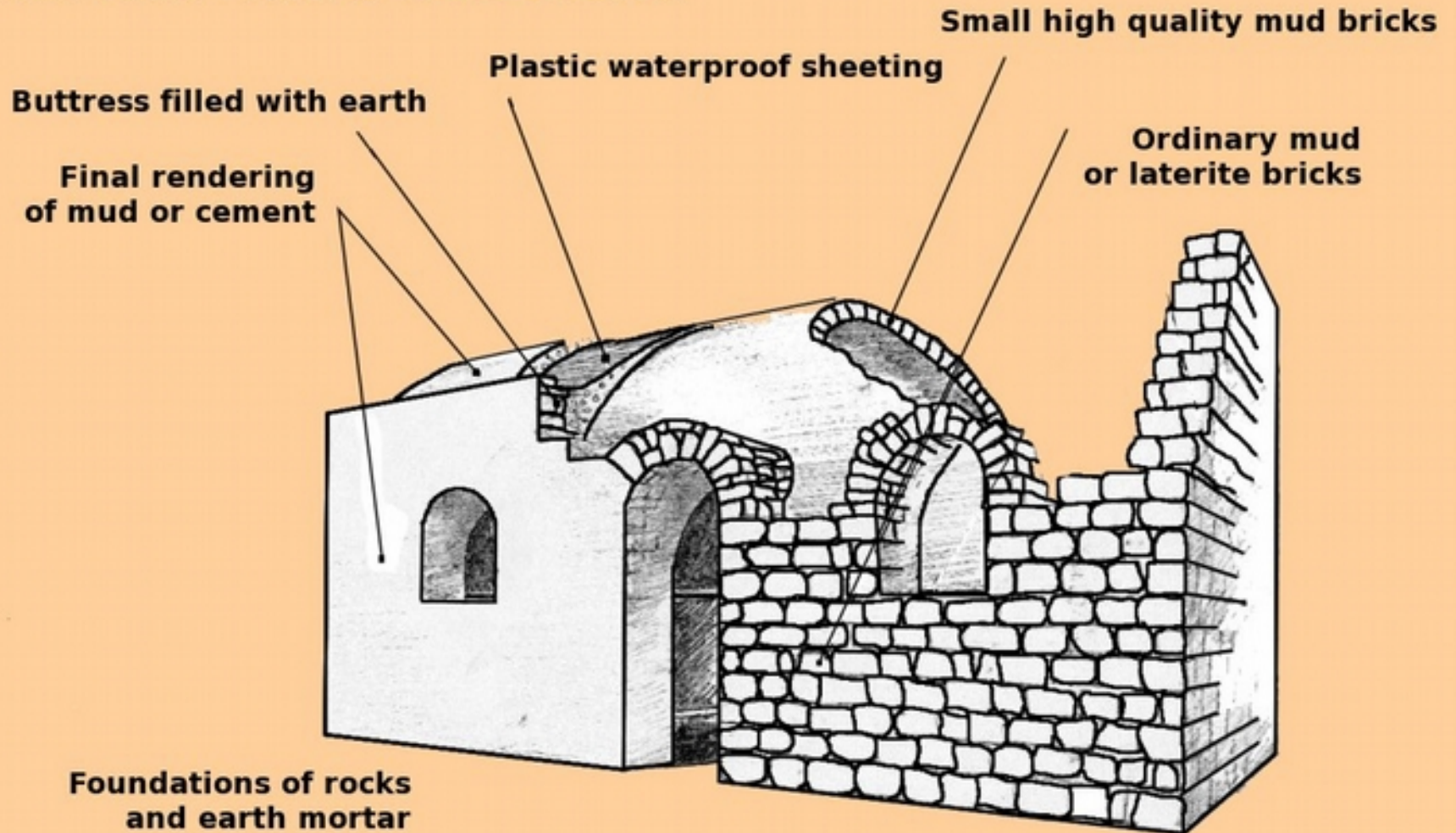






# AVN's standardised Nubian Vault (NV)

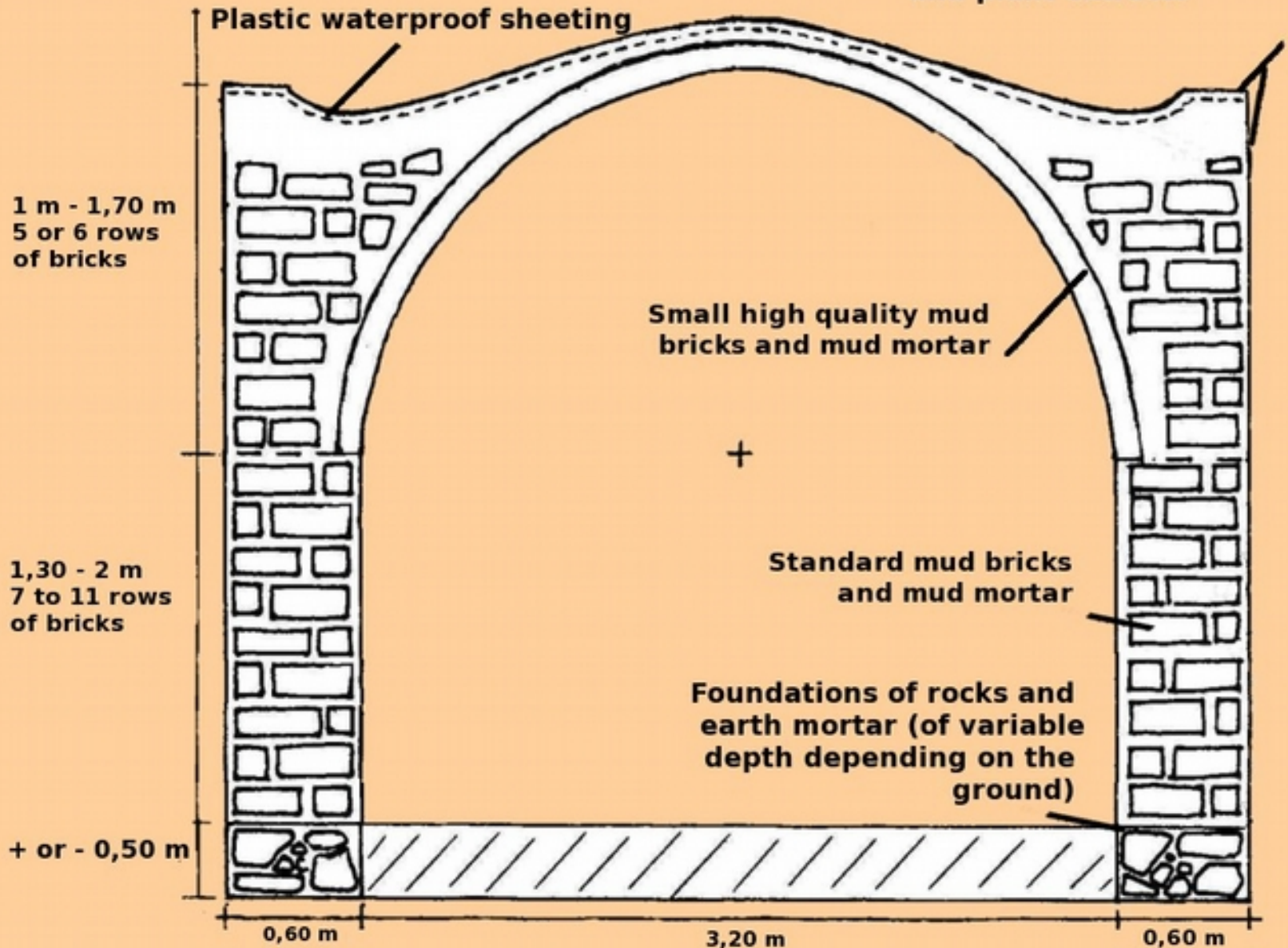
## Nubian vault - lateral cross-section





# Nubian vault - vertical cross-section

Surface rendering :  
mixture of mud and mineral  
and plant extracts





Twin-vault village house under construction, Burkina Faso





No timber shuttering or form-work needed  
Vault radius defined by cord slider on guide cable



Use of the guide cable & cord to define the vault radius





Reinforced concrete post & beam for church, Burkina Faso



Cement render over 'stony' mud bricks, urban house, Senegal



## **II THE AVN PROGRAMME**

# The Nubian Vault Association (AVN)

- > Founded in 2000 by Thomas Granier, French mason, & Seri Youlou, Burkinabe farmer
- > Inspired by Hassan Fathy (*Architecture for the Poor*)
  - > Earliest constructions in Boromo, Burkina Faso
  - > 20% average annual growth rate over last 10 years
    - > 60 full-time staff in 2021
    - > Annual budget of 2.4 M € in 2021



NV buildings in Boromo, Burkina Faso





Seri Youlou & Thomas Granier in Boromo

# The AVN Network in the Sahel



**Deployed in 5 countries & 13 regional and national centres  
with 50 local employees**



# Results as of July, 2021



**53,000** beneficiaries living in or using a NV building



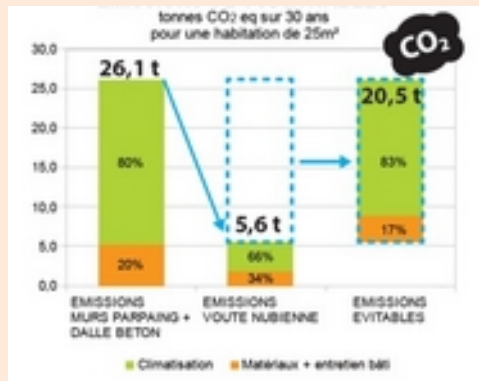
**5,180** construction projects completed (=145,200 m<sup>2</sup>)



**1,150** active NV apprentices, masons, artisans and entrepreneurs



**1,500** localities with at least 1 NV



**136,000** tonnes of CO<sub>2</sub> eq potentially economised



**4.9** million euros generated in local circuits



# **III NUBIAN VAULT BUILDINGS**

# A Nubian Vault building is...

- > durable (solid, weatherproof...)
- > comfortable (thermal mass, sound proof..)
  - > eco-sustainable, low carbon footprint
  - > affordable (self-build, mutual aid...)
- > uses locally sourced labour & materials
  - > easily replicable, standardised
  - > roof terrace & upper storey possible
  - > modular, later extensions possible



Single vault village house, Mali - 86% of NV buildings are houses for rural families, AVN's key target group





Traditionally decorated single vault house, Benin



Two-vault village house with roof terrace, Burkina Faso



Two-storey village house with roof terraces, Burkina Faso





Interiors of NV village houses, Burkina Faso



Merchant's house, Mali





*NV poultry shed, Ghana - 9% of NV buildings are for agricultural use - storage of crops, livestock ....*





Onion storage barn, Mali



## Community Centre, Senegal

- 5% of NV buildings are for community use  
(health centres, literacy centres, schools, mosques..).





NV school building, Kati, Mali





Single vault school classroom, Koeni, Burkina Faso



3 vault classroom, concrete post & beam, Djindjinebougou, Mali



Health centre, Taif Tiekene, Senegal





Church in Petit Balé, Burkina Faso



Village mosque, Mali



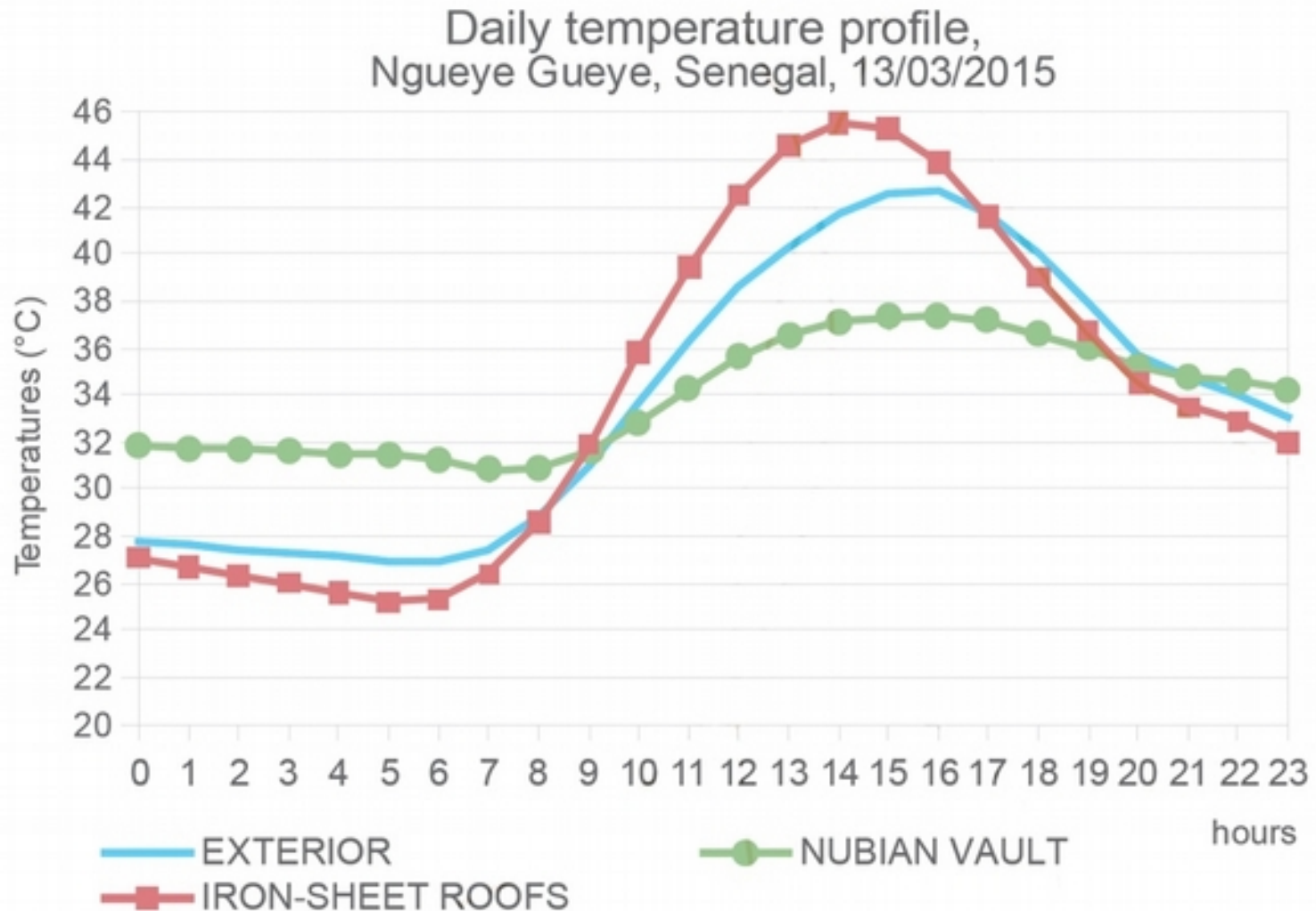
Sheikh Zayed Village for refugees, Diakré, Mauritania  
(51 NV houses, maternity clinic, mosque & school )





Diakré village house and owner

# Thermal comfort data



# **IV AVN's DEVELOPMENT STRATEGY**



# **AVN's Development Strategy**

## **Three transversal themes**

**Habitat (housing, community, agriculture...)**

**Economic & Rural Development**

**Climate Change Mitigation & Adaptation**

# Three Complementary Axes



## **A ROOF**

Involve stakeholders in the diffusion of the NV concept



## **A SKILL**

Strengthen the skills of the NV trades sector



## **A MARKET**

Stimulate the demand for NV construction

**Reminder - AVN neither builds nor sells houses :**

**« Rather than giving people fish, teach them to fish for themselves, to make their nets and sell the fish »**

# A Roof

The goal: *to create & accelerate the demand for adapted bioclimatic construction*

- > *AVN regional offices in small towns*
  - > *awareness raising*
- > *pilot villages & credible 'champions'*
  - > *local stakeholders*
  - > *demonstration buildings*
- > *formal recognition / standards compliance*





AVN Regional Office, Koutiala, Mali



AVN Regional Office, Garu, Ghana





Village awareness-raising meeting, Burkina Faso



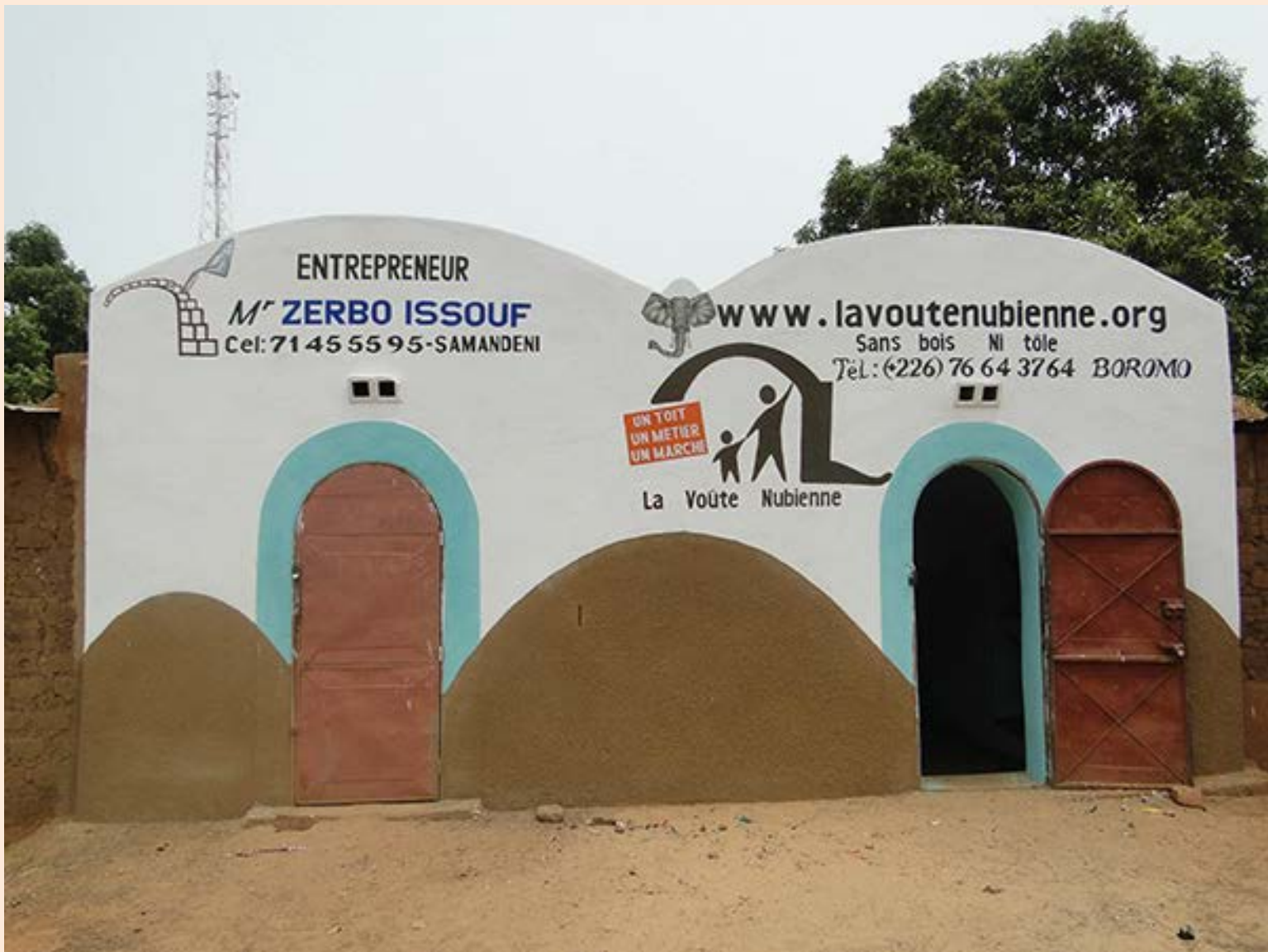
# A Skill

The goal: *to provide a continuing supply of skilled masons to meet the growing demand*

- > *role of AVN regional centres*
  - > *cascading of recruitment*
- > *training & construction during the dry, fallow, season*
  - > *dual on-site and classroom training*
  - > *network of trainer masons (currently 54)*
  - > *progression from apprentice to entrepreneur*
    - > *formal recognition of competence*
- > *inclusion in Professional Training Centre curricula*



77 NV masons from Burkina Faso receive formal certificates of competence (August 2021)



NV entrepreneur's premises, Samandeni, Burkina Faso



# A Market

The goal: *to accelerate the growth of the emerging NV market*

- > *advocacy & fund-raising by AVN-International*
- > *transfer to local operational partners (29 in 2021)*
  - > *role of AVN regional centres*
  - > *'adapted housing' micro-finance products*
  - > *cash incentive schemes for rural clients,*
- > *climate adaptation & attenuation funds (climate justice)*
  - > *trading of NV carbon credits / offsetting*

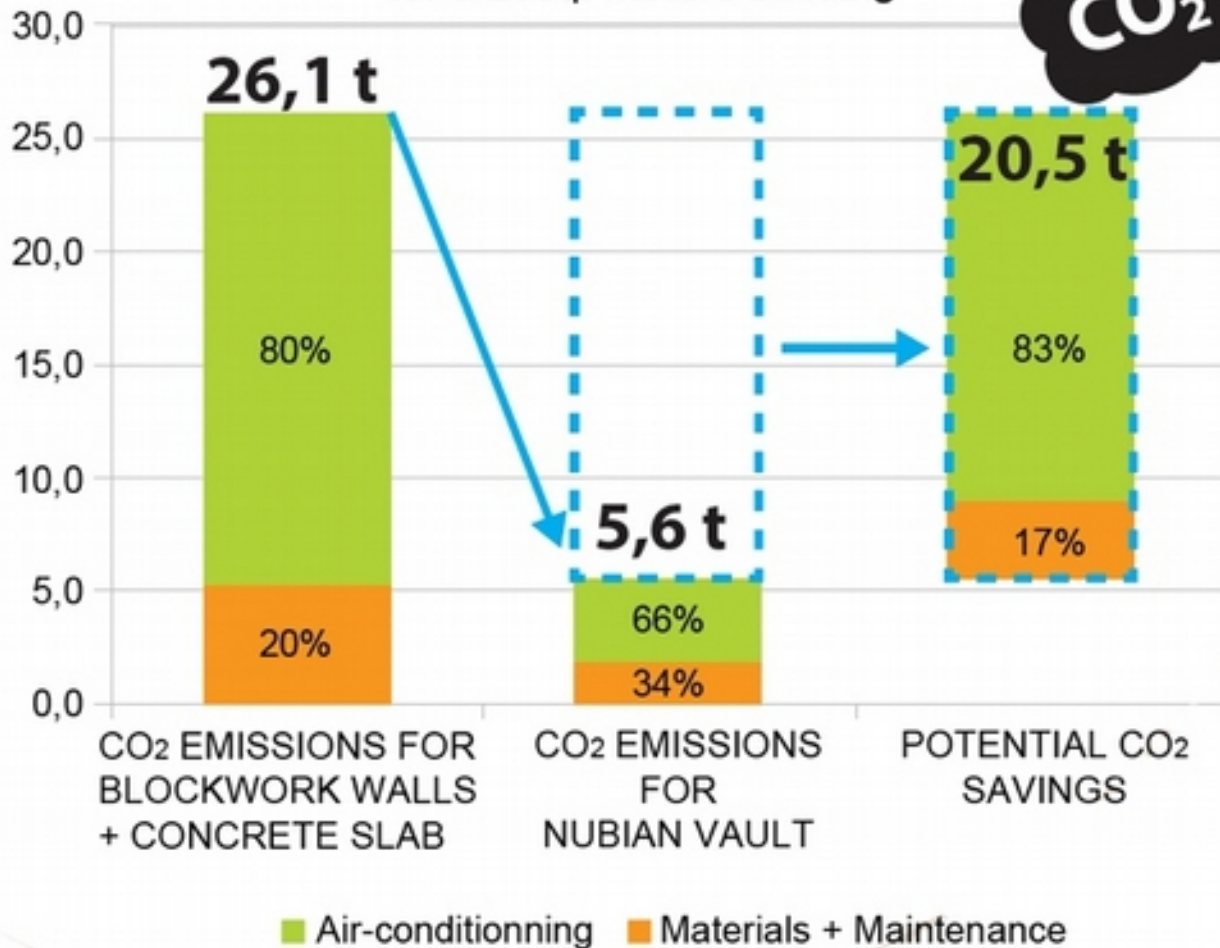
# Construction Incentive Coupons (CIC) & NV Carbon Credits (NV-CC)

- > financial incentive to client for 25 m<sup>2</sup> NV house of 270€  
( = 15 - 20 % of total construction value & 80 % of cash payment)
  - > + 100 € distribution, monitoring & capitalisation costs
- > a NV house of 25 m<sup>2</sup> generating a reduction of 20 t eq CO<sub>2</sub>  
& a total incentive cost of 370 € >> cost of 18,5 € / t eq CO<sub>2</sub>
  - > income from NV-CC's finances the CIC's
  - > verification: online cartographic registry of NV-CC's

**601 NV houses built in 2020/21 season with CIC's**

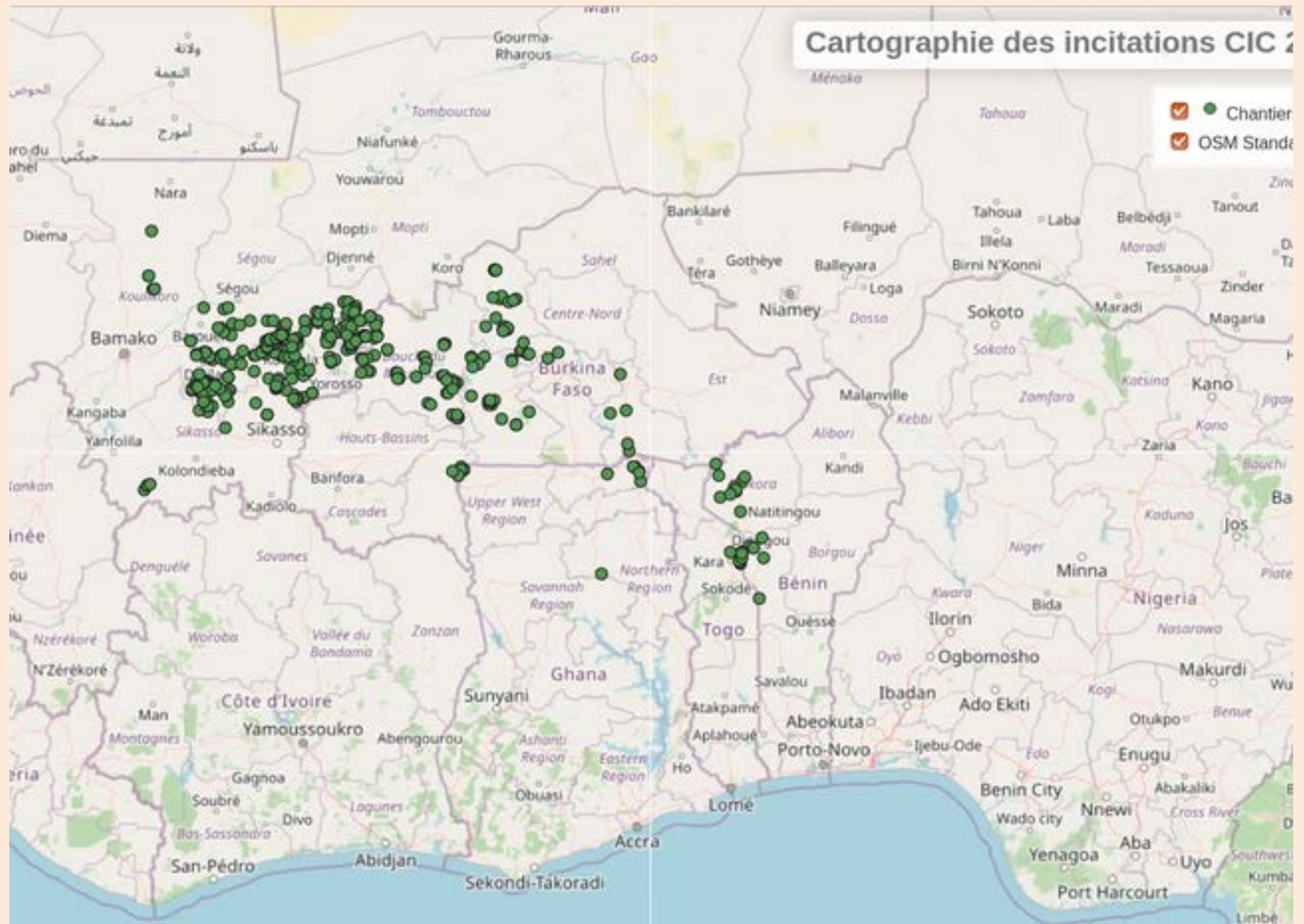
# POTENTIAL CO2 SAVINGS

tons of CO<sub>2</sub> eq over 30 years  
for a 25sq. meters building

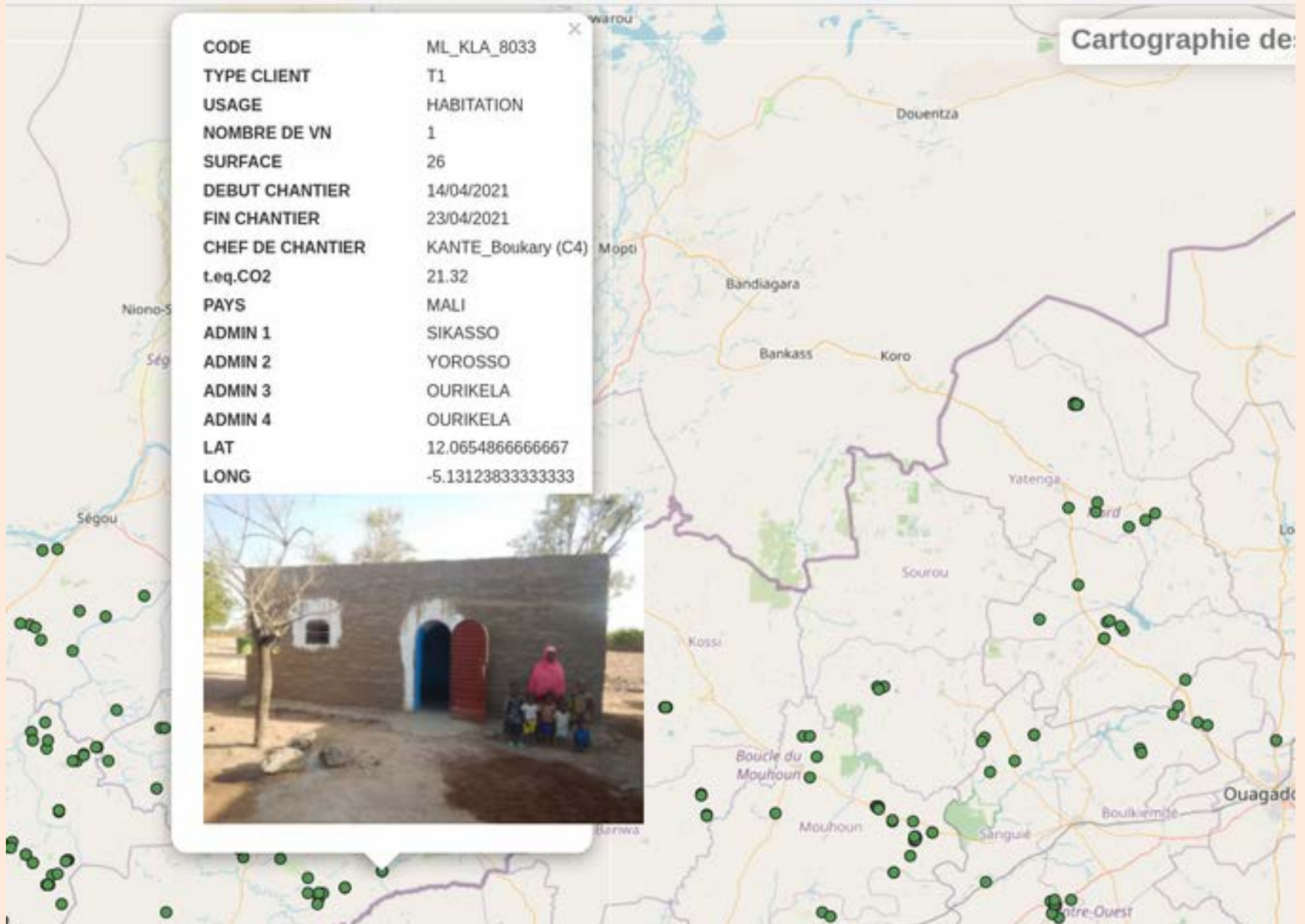


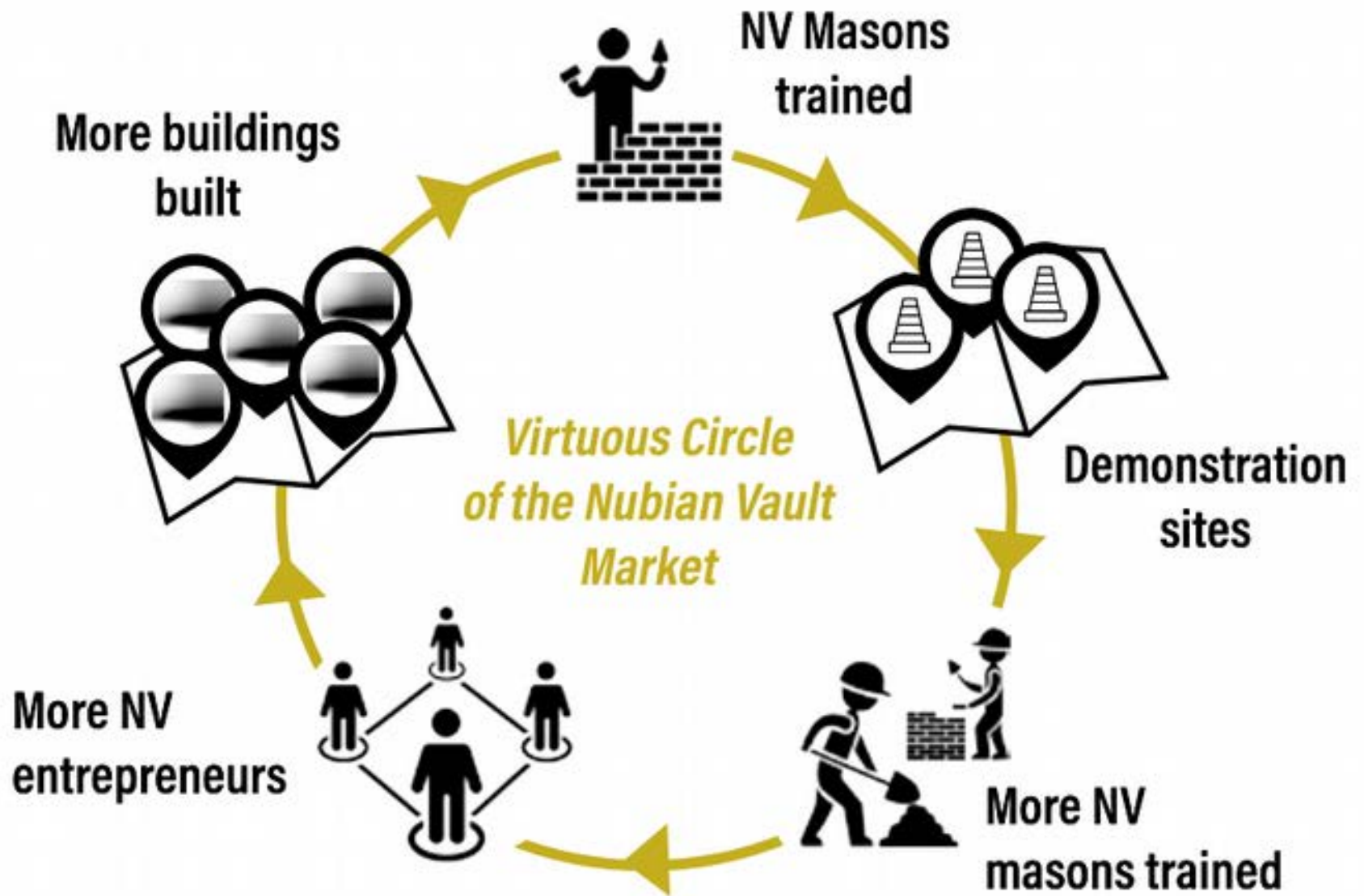


# CIC dynamic mapping



# Example of CIC data







# Evolution of the methodology

**1998 - 2000**

## **R&D and conceptualisation of the NV technique**

- Standardise a locally transmissible adapted technique

**2000 - 2014**

## **Kickstart a NV market**

- Kickstart the market and demonstrate the validity of the solution and its market potential
- **Diffusion methodology**

**2014 - 2018**

## **Densification of the NV market**

- Involve the construction sector, develop NV professional training and increase the demand
- **Training methodology**

**2018 - 2030**

## **Skills transfer and capacity building of partners**

- Mobilise and accompany local actors to implement the NV concept in their own intervention territories
- **Transfer methodology**

# **V CONCLUSION & SUMMARY**

# A cross-cutting Development Strategy

- > habitat (housing, community, agriculture...)
  - > economic & rural development
  - > climate change mitigation & adaptation





# Habitat

Nubian Vault construction used for

- > rural & urban housing
- > community buildings, schools & health centres
  - > agricultural buildings
  - > offices, workshops
- > emergency housing / refugees

Renewal of a Sahelian “Archi-culture”

- > locally sourced materials
  - > labour intensive
  - > roof terraces
- > evolution of traditional skills

**5,180 NV buildings completed**

**53,000 beneficiaries living in / using NV buildings**

# Economic & Rural Development

- > reduction in use of costly imported construction materials
  - > local economic circuits strengthened
  - > development of a new 'green' construction sector
    - > professional training & job creation
  - > reduction in rural exodus / population stabilisation
- > improved health conditions (homes, schools, clinics...)
  - > improved agricultural storage conditions

**1,150 active NV apprentices, masons, artisans  
& entrepreneurs**

**4.9 million euros generated in local circuits**

# Climate Change Adaptation & Mitigation

- > adapted bioclimatic habitat sector & green jobs
  - > comfortable, resistant & durable buildings
- > use of climate funds (Green Fund, Adapatation Fund...)
- > reduced use of high carbon footprint construction materials
  - > use of local materials (earth, rocks, water...)
  - > passive thermal performance of NV buildings
- > low carbon impact over NV lifetime / reduced energy demand
  - > protection of timber and straw resources

**136,000 tonnes of CO<sub>2</sub> eq potentially economised**





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