New methods for the use of the land:

First underground cold storage
at controlled atmosphere in the world
realized by Tassullo Materiali S.p.A.
in the “Rio Maggiore mine” (Trentino - Italia)

Tassullo is a leader company, placede in Trentino, in the production of technical building solutions

Tassullo covers all steps of the production:
from the mines to the research,
from the production to the commercialization

St. Peter's Square in Rome: restoration of colonnade, statues and fountains

Model 1: traditional extraction

NECESSARY ELEMENTS

- Superordinate planning (authority of the Autonomous Province Trento)
- Mining project
- Total utilization (regulatory obligation)
- Environmental restoration at the end (example: reservoirs, restoration of the green, recovery to agricultural purposes…)

STONECHANGE 2016 - STONE SECTOR and CHANGING TRENDS

Carrara 16-17 June 2016

1909 – 2004
Traditional mines

2004 – future
Underground mines

How can we extract raw materials in an eco-friendly way?

From 2004
Research for underground opportunuties

Internal team R&D

+

Certified internal planing team

+

UNIVERSITY OF TRENTO

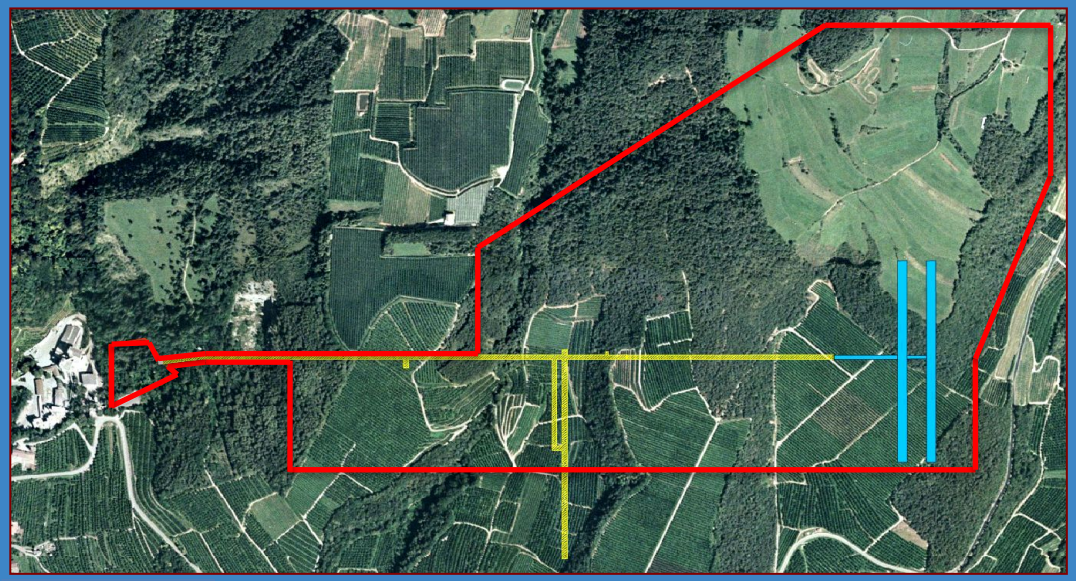
UNIVERSITÀ DEGLI STUDI DI PADOVA

NTNU
Norwegian University of Science and Technology

Scientific collaborations

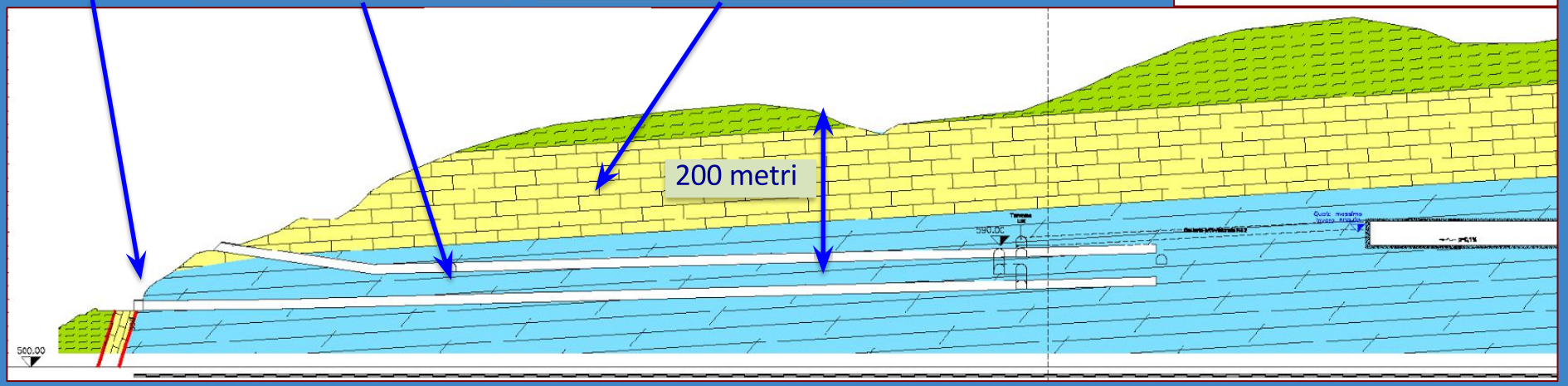
New methods of use of the land

Rio Maggiore mine



Size: 800.000 mq
Dolomia stone bench: 150 m
Beginning of the mining: anno 2004
Extracted volume: 700.000 mc
Mineable volume: 7.600.000 mc

Entrance | Dolomia stone | Waterproof stone



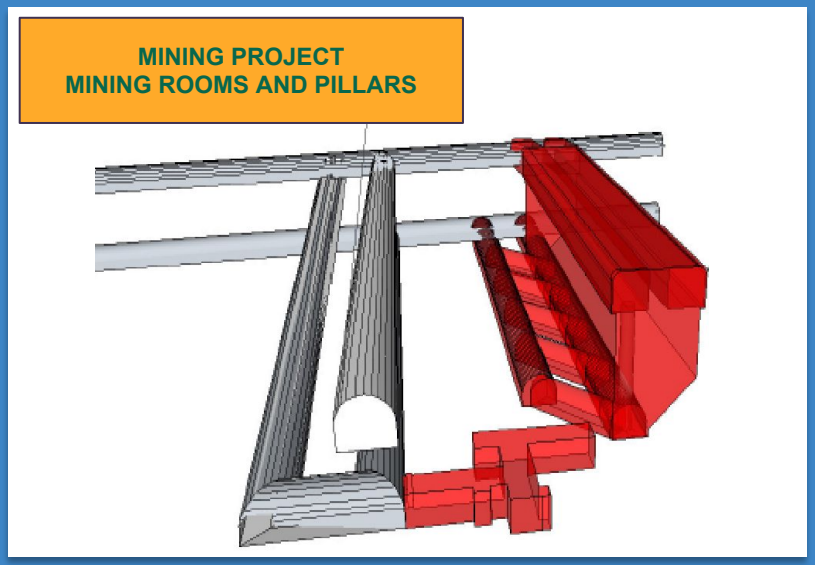
Dolomia stone mining

Quality of the raw material

The very low humidity, the purity and colour constancy of the stone make it possible to obtain mortars of a very high quality

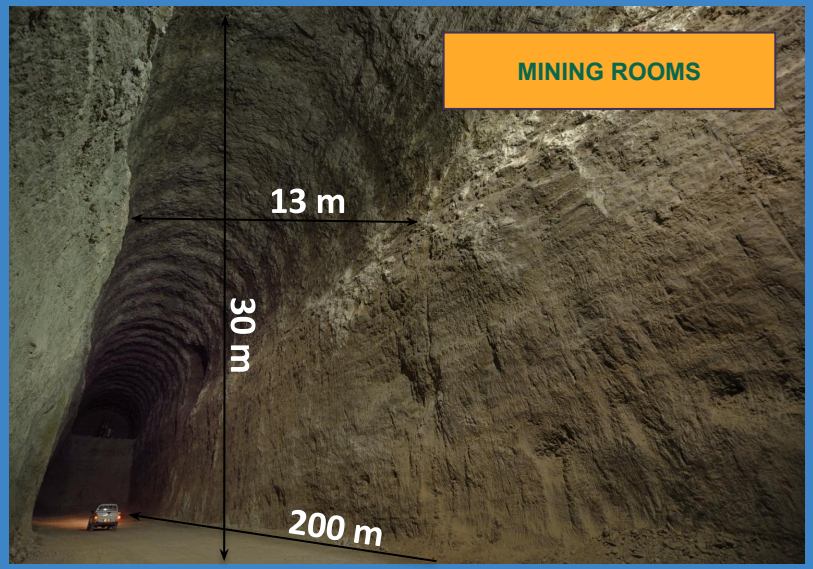
Raw materials: gravel, sand, filler

Model 2: underground mining "mining rooms and pillars"



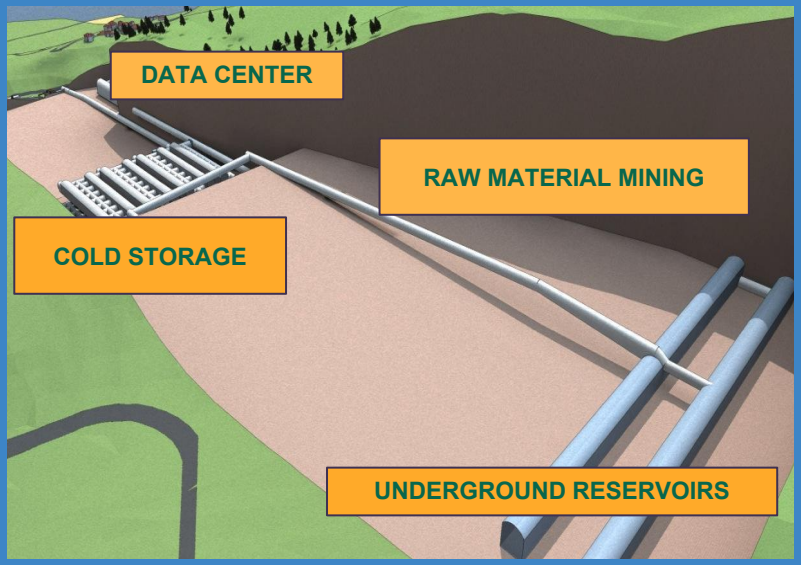
NECESSARY ELEMENTS

- Superordinate planning (authority of the Autonomous Province Trento)
- Mining project (mining rooms and pillars)
- Total utilization (regulatory obligation)
- Environmental restoration at the end



Tassullo, encouraged by the Autonomous Province of Trento, tried to identify the possible restoration project for an underground location

Model 3: Integrated undergrounf mining



NECESSARY ELEMENTS

- Superordinate planning (authority of the Autonomous Province Trento)
- Mining project (suitable for a new use)
- Total utilization (projects for a new use: it is necessary todisregard the point of the total utilizaztion of the vein)
- Superordinate planning Autonomous Province Trento (modification of the mine legislation)

SPECIFIC MODIFICATION OF THE REGULATION
Mine legislation L.P. 7/2006 – art. 5 bis

Provincia Autonoma di Trento

Art. 5 bis

Disposizioni per l'utilizzazione dei volumi oggetto di coltivazione di cava

1. La Provincia, i comuni o altri soggetti pubblici o privati possono realizzare o installare nell'ambito dei volumi sotterranei, oggetto di coltivazione delle cave ai sensi di questa legge, strutture destinate alla conservazione di prodotti agricoli o finalizzate ad altre attività economiche o non economiche, anche mediante la differenziazione della destinazione d'uso dei vuoti di cava rispetto al soprassuolo. Il progetto di coltivazione della cava può essere definito in relazione al successivo utilizzo dei volumi, anche in deroga ai criteri di proficuo, corretto e integrale sfruttamento del giacimento.

2. Gli interventi previsti nel comma 1 possono essere realizzati sulla base di un apposito accordo di programma stipulato tra il soggetto titolare della concessione o dell'autorizzazione alla coltivazione della cava, il soggetto utilizzatore dei vuoti minerari, il comune territorialmente interessato e la Provincia. L'accordo può prevedere anche la possibilità di realizzare opere in superficie se sono direttamente connesse a quelle realizzate nei volumi sotterranei. Su iniziativa dell'ente o del soggetto proponente, lo schema di accordo di programma, corredato da appropriati elementi cartografici inerenti la localizzazione dell'intervento, è affisso per la durata di trenta giorni all'albo del comune territorialmente interessato. Chiunque, nel periodo di affissione, può presentare osservazioni al comune, che sono considerate ai fini della sottoscrizione definitiva dell'accordo.

- Possibility to install, inside the mine area, facilities for the storage of agricultural products or other business activities
- Possibility to disregard the point of the profitable, proper and total utilization of the vein
- Necessity of a program agreement

PROGRAM AGREEMENT WITH THE PARTNERS
(exception to the mine legislation, exception to the standard planning)

C.M.F.

- Resource water
- Realization of water basins
- Payment for the basins

- Payment water utilization
- Cooling of the refrigeration systems through geothermal science

- Irrigation system
- Payment for the basins

TASSULLO

- Payment for the surface
- Right for the area

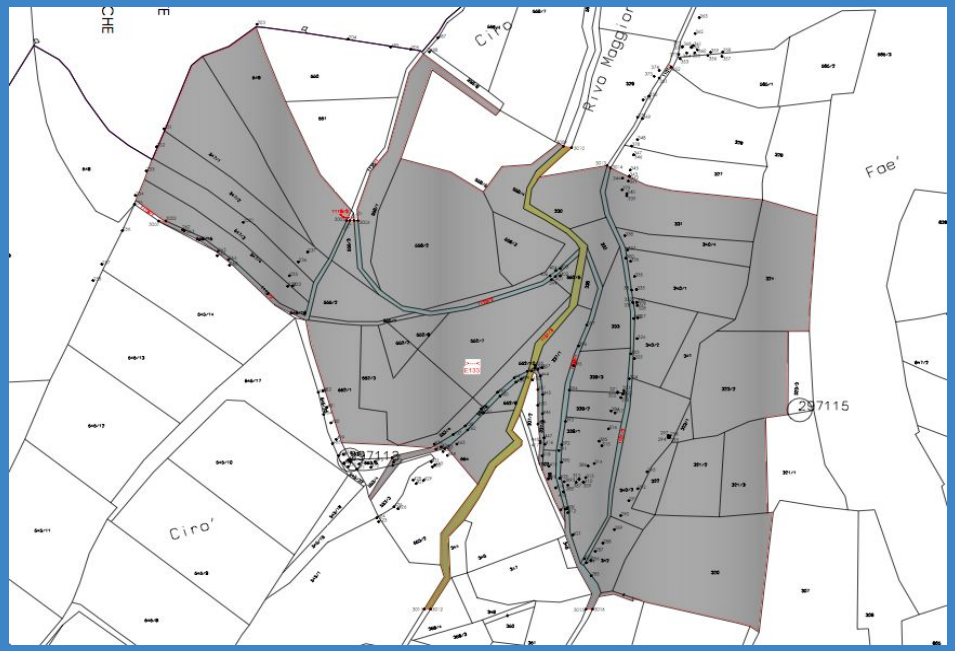
OWNERS OF THE LAND

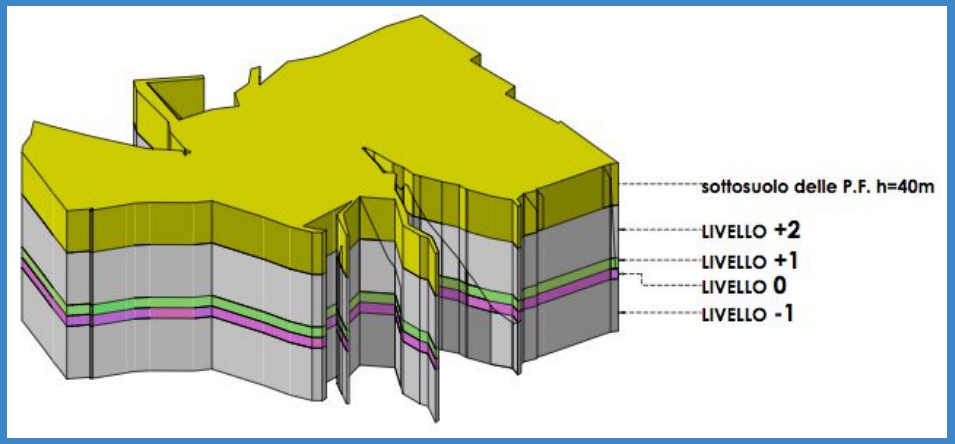
Melinda® D.O.P. MELA VAL DI NON

- ➔ Mineral processing
- ➔ Development of new products
- ➔ Create value through research
- ➔ Asset enhancement
- ➔ Relationship with important universities
- ➔ Positive outcome for the products connected to the project
- ➔ High exposure on the market

- ➔ Energy cost reduction
- ➔ Land saving
- ➔ No danger of fire
- ➔ Trough geothermal science no water consumption
- ➔ Realizaztion of innovative facilities at lower costs
- ➔ In case of blackout, higher safety in the storage
- ➔ Lower insurance costs
- ➔ Reduction of the cooling power
- ➔ Fast cooling of the apples, and so higher quality
- ➔ High expousure on the market (free marketing)

UNDERGROUND PROPERTY





- The area of the mine is divided, on the surace, into about 250 different parcels which belong to 200 different owners
- Tassullo acquired the right for the underground area from a depth of 40 meters under the surface

Melinda® underground storage room
10.500 tons

Tuenetto, Rio Maggiore – Melinda's underground storage room

Heat transfer coefficient from rock to air

$$h = SIF \bullet (h_o + 1.8 \bullet \_ t^{0,33}) \left(17,5 \frac{P}{\_ t} + 1 \right) \; W/m^2 K \qquad (2)$$

where:

SIF	=	surface increase factor of the rock as referred to a smooth surface
h_o	=	heat transfer coefficient due to forced convection e.g. a function of air velocity in the store
t	=	temperature difference between rock surface and cold air
p	=	vapour pressure difference between rock surface and cold air. For a dry rock store (no water leakage) p = 0.

NTNU SINTEF

The energy consumption of the underground cold storage in 70% lower than above the ground;

- EINAR BROCH, UNCONVENTIONAL USE OF THE SUBSURFACE, ILLUSTRATED BY EXAMPLES FROM THE NOORDIC COUNTRIES
- VI Australian Tunneling Conference, Melbourne, March, 1987
- Esperienza Tassullo-Melinda in cella prototipo 2012-2013

The scientific fundamentals

Torra dolomia stone

Age: 170 million years
Temperature: 10 °C
Specific weight: 2.800 kg/mc

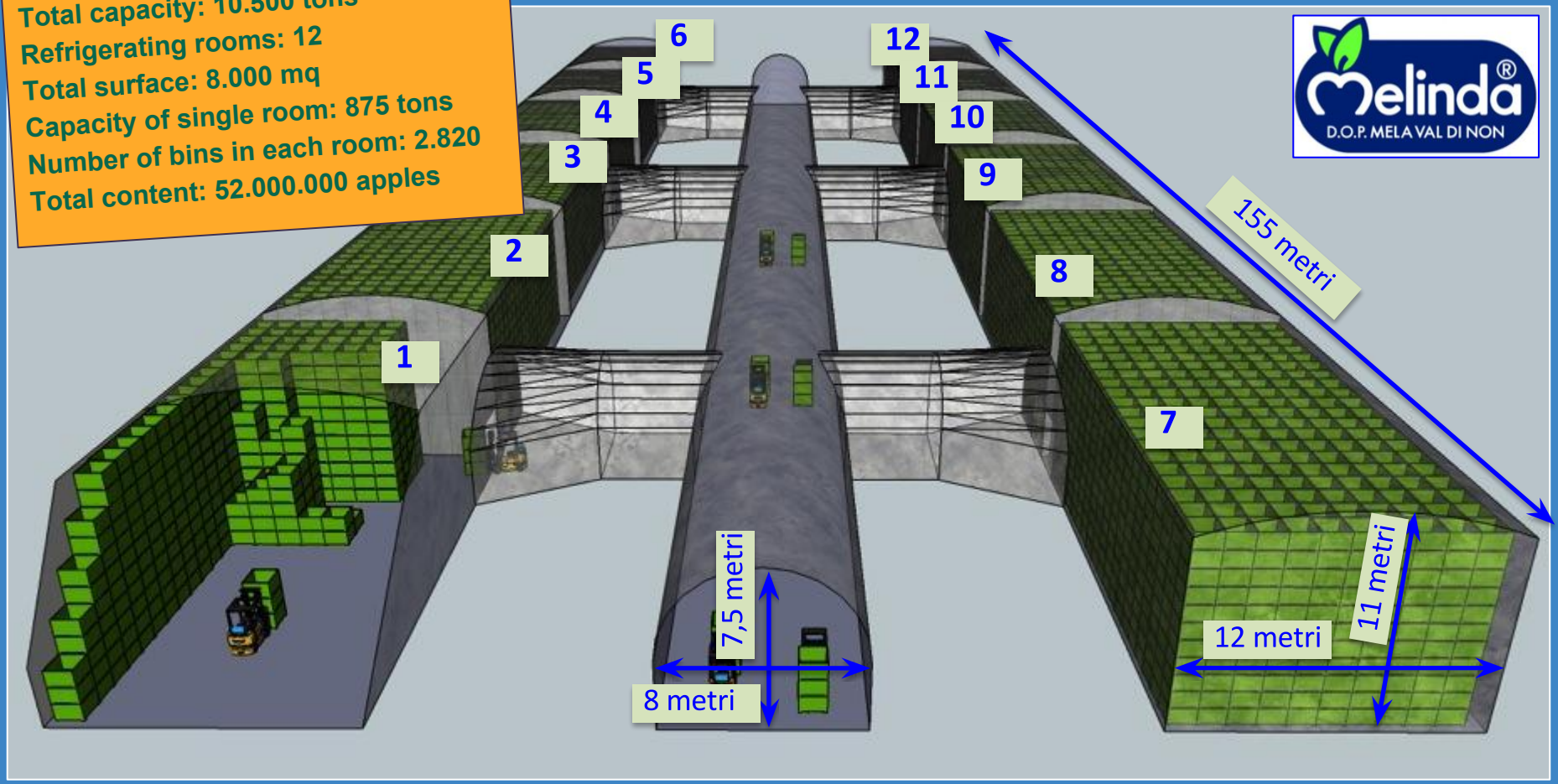
=

The stone is a natural energy accumulator

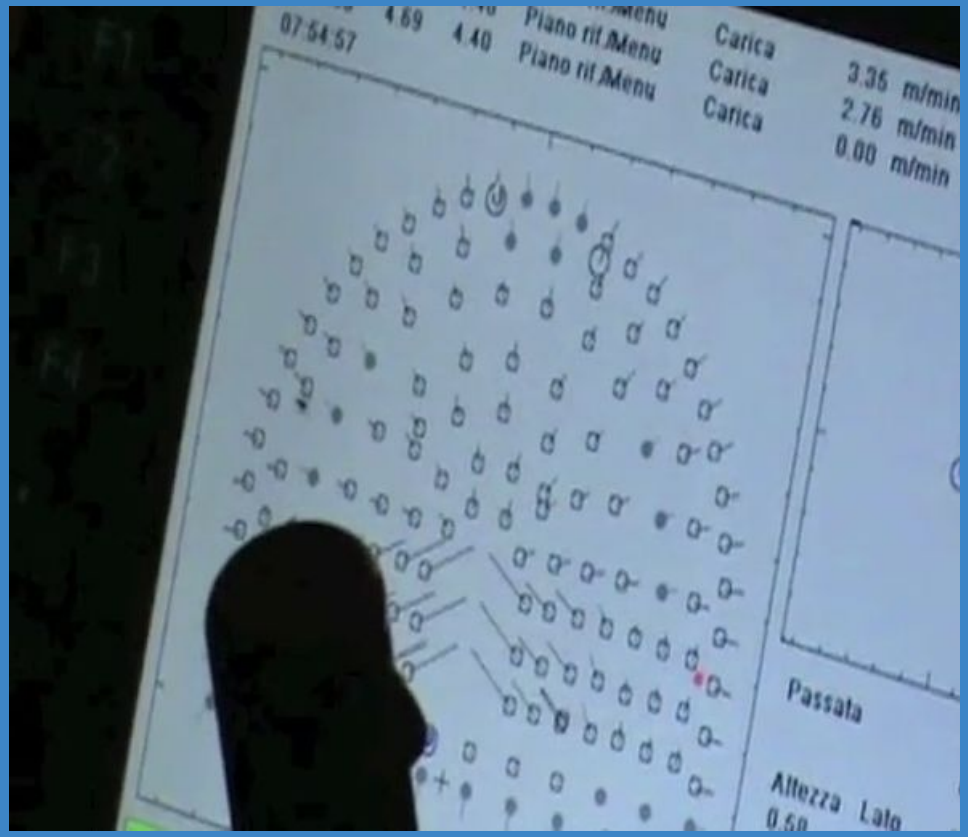
Melinda® underground storage room
Capacity 10.500 tons

Data

Total capacity: 10.500 tons
Refrigerating rooms: 12
Total surface: 8.000 mq
Capacity of single room: 875 tons
Number of bins in each room: 2.820
Total content: 52.000.000 apples



Building and mining matters: drilling machine working



Building and mining matters: planning and execution

Building and mining matters: explosive load

Building and mining matters: connection check and explosion

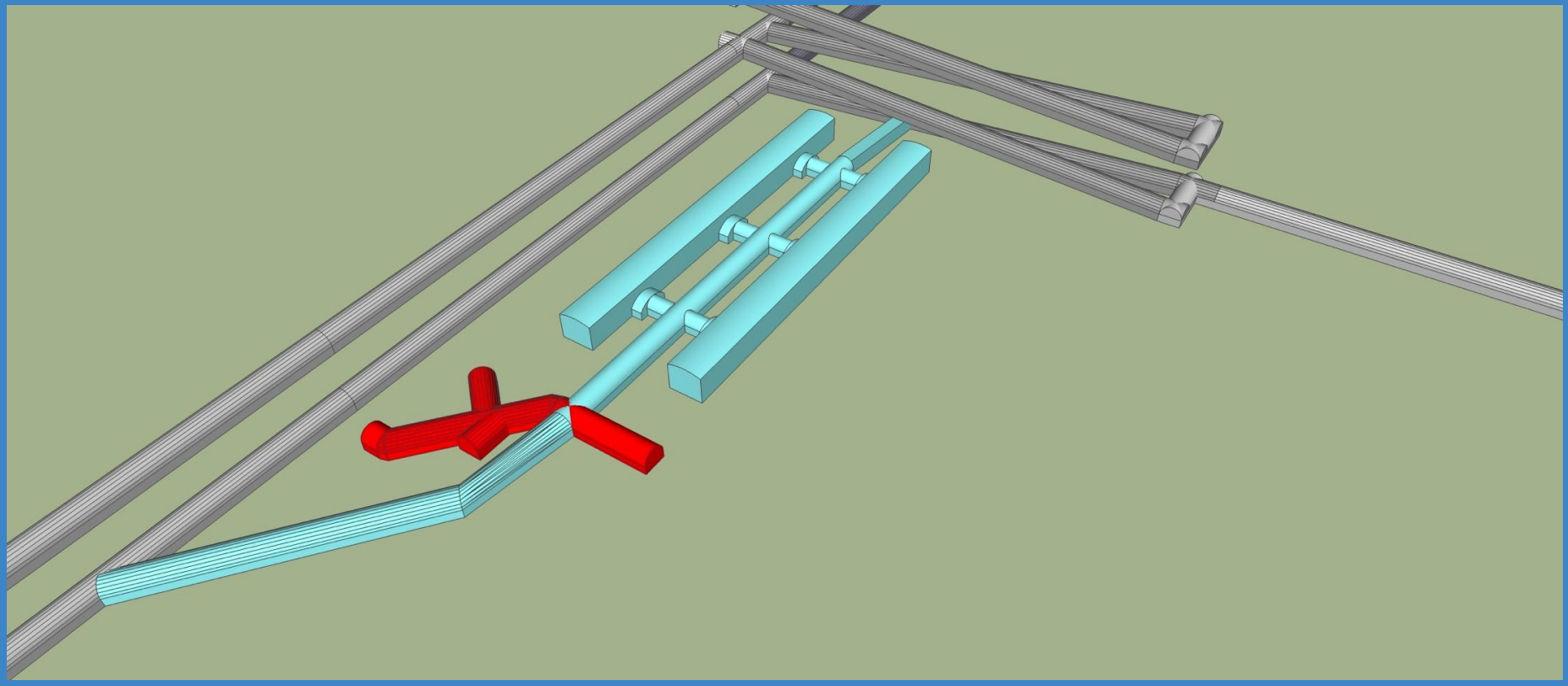
Building and mining matters: transfer to the chipping plant

Melinda® underground storage
10.500 tons

Tuenetto, Rio Maggiore mine – Melinda underground storage

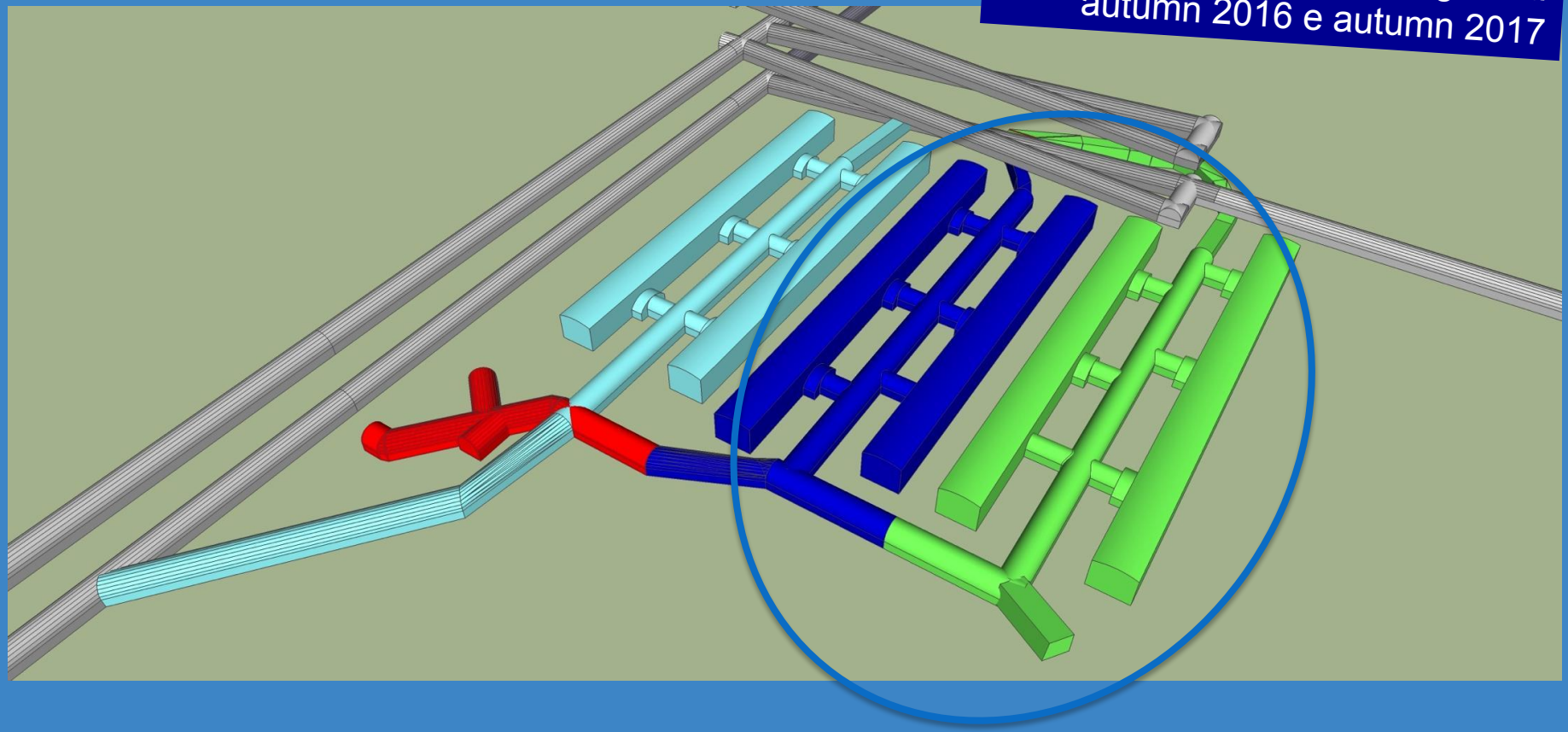
Lot 1:
capacity **10.500 tons apples**

Lot 1
Mined volume: 80.000 mc
12 cold storage rooms
Operating since: autumn 2014



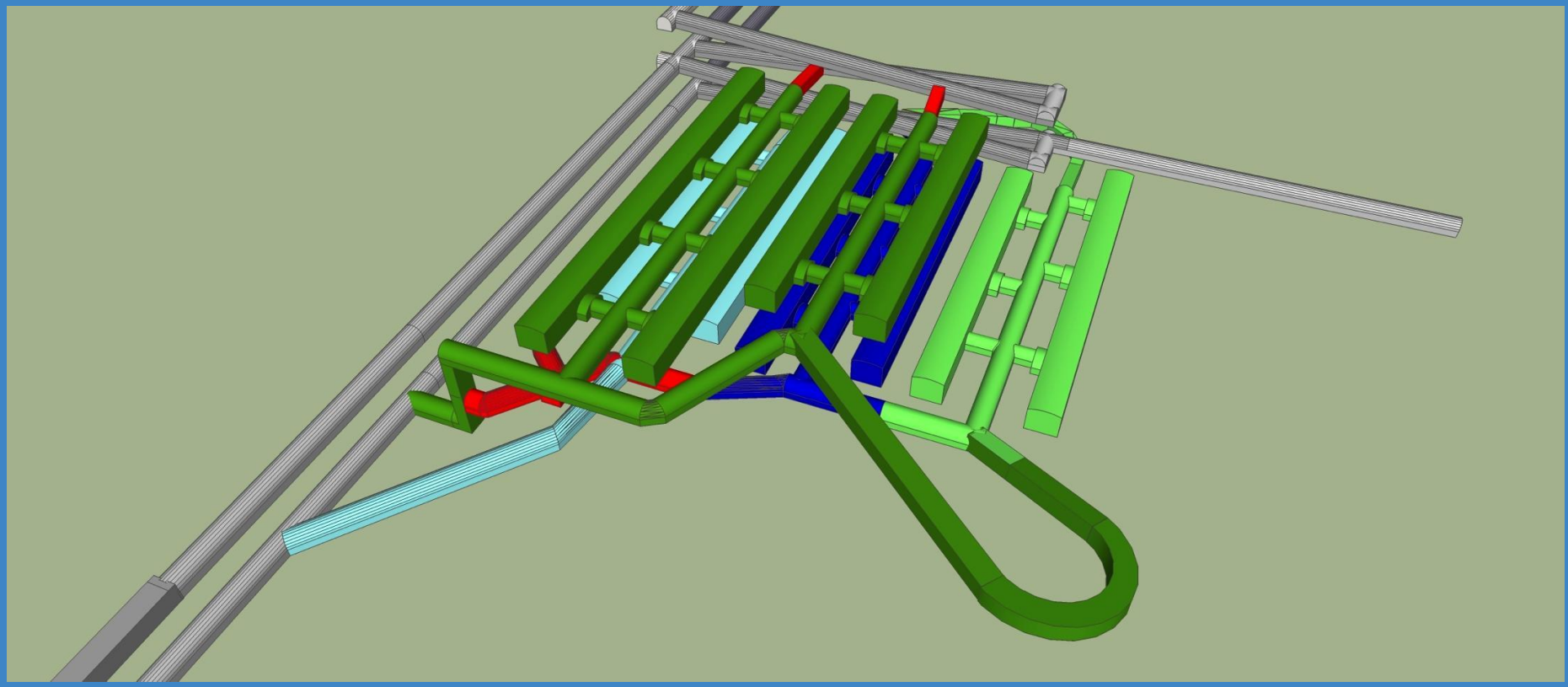
Lot 1, 2 e 3
capacity **29.000 tons apples**

Lot 2 and 3
Volume to by mined: 120.000 mc
22 cold storage rooms
Operating strarting from:
autumn 2016 e autumn 2017



Total project:
capacity **50.000 tons apples**

Totale project
Volume to by mined: 410.000 mc
50 cold storage rooms
End of the works: year 2021



Thank you for your attention

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