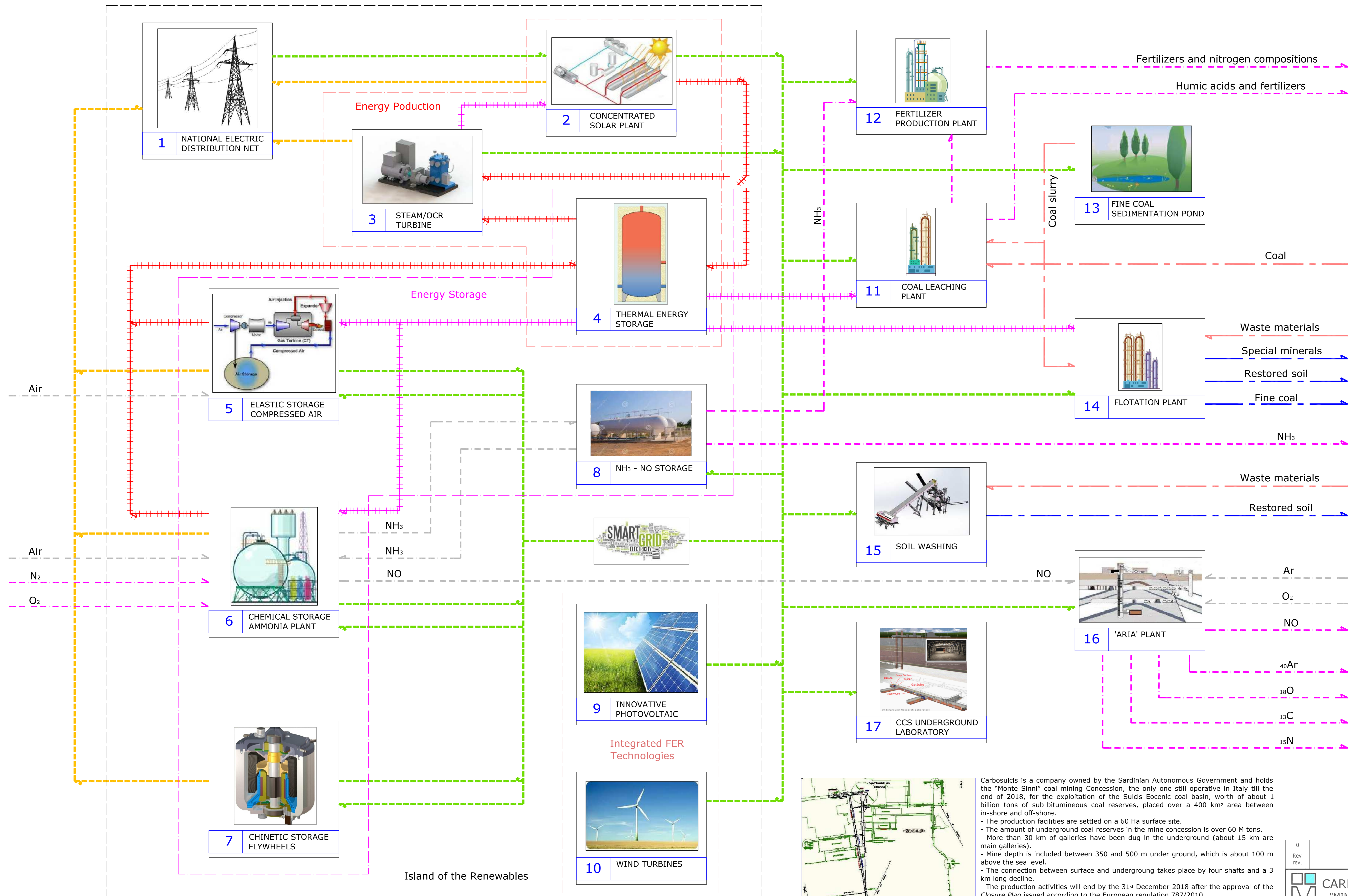


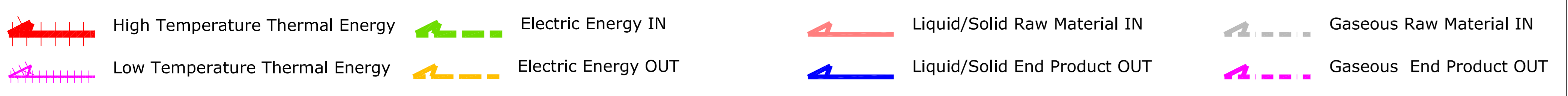
DEVELOPMENT OF CIRCULAR ECONOMY IN THE CARBOSULCIS COAL MINE



Energy Production	1	NATIONAL ELECTRIC DISTRIBUTION NET - The connection takes place by an electric transformer station 150 kV - 6 kV
	2	CONCENTRATED SOLAR PLANT - It consists of a 15.000 m2 solar field (Fresnel lens), 1 MW _e power, 3 MW _t power, with thermal oil
	3	STEAM/OCR TURBINE - It works by a thermal vector at 305°C in / 204°C out temperature. Cooling unit thermal power 3 MW (35°C / 25°C water).
	4	THERMAL ENERGY STORAGE - Innovative thermal oil storage by thermocline technology in only one tank (101°C temperature gradient) - 33 MWh storage capacity to assure 8 hours autonomy.
Energy Storage	5	ELASTIC STORAGE COMPRESSED AIR - Underground Adiabatic Compressed Air Energy Storage: Experimental site 25 m long, 20 m2 section, gallery. Air pressure 60-100 bar, potential power 500-1.000 kWe. Available galleries about 3 km (potentiality over 100 MW). Thermal energy recovery in compression, to thermal storage, to be released in expansion phase.
	6	CHEMICAL STORAGE AMMONIA PLANT - Electricity overproduction to make Ammonia by NO midproduct process. Chemical-Electrical conversion by direct fuel cell.
	7	KINETIC STORAGE FLYWHEELS - Underground galleries allow safety conditions to experimentation for both high mass low speed and low mass high speed flywheels.
	8	NH ₃ - NO STORAGE - Tanks for NH ₃ and NO with pumping systems to distribute the products to other users (Ammonia Plant, ARIA Plant, Fertilizer Plant) or to store the chemicals for market purposes.
FER Technologies	9	INNOVATIVE PHOTOVOLTAIC - Integrated photovoltaic fields on the brownfield of the mine site and on the building roofs (about 16.500 m2 available). Estimated power potentiality 14 MW _e .
	10	WIND TURBINES - Wind park to achieve on the brownfield of the site (about 25.000 m2 available). Estimated power potentiality 13 MW _e .
	11	COAL LEACHING PLANT - By a proprietary European patent, Carbosulcis uses its process to produce humic acids and fertilizers through chemical leaching of the Sulcis coal.
	12	FERTILIZER PRODUCTION PLANT - The increasing market of the fertilizer products encourages the development of innovative plants able to enrich the humic acids through ammonia derived (nitrogen).
End Users	13	FINE COAL SEDIMENTATION POND - The 50.000 m2 surface water pond contains 300.000 ton of thin products (under 120 μm) coming from the coal treatment process (40% fine coal, 60% inerts).
	14	FLOTATION PLANT - The plant makes the recovery of the thin coal from the wastes in the pond. It could even recover metals or special materials for soil treatment and restore purposes.
	15	SOIL WASHING - The revamping of an existing screening plant allows the treatment of waste products from the disposals of the mining activities, aiming at an environmental restitution.
	16	ARIA PLANT - A cryogenic distillation column for the production of special stable isotopes, is a project of excellence with the Italian National Institute of Nuclear Physics. A 350 m deep column in a ventilation air shaft of the mine, will make the production firstly of ⁴⁰ Argon for the DarkSide experimentation, and then for ¹⁸ O, ¹³ C, ¹⁵ N.
	17	UNDERGROUND LABORATORY - The acronym of the project is ULISSE (Underground Laboratory Initiative for Supercritical CO ₂ Storage Experiment). Despite the name it is a 2 km underground gallery dedicated not only to the Carbon Capture and Storage tests but to geological, geophysical and particle physics tests.

Carbosulcis is a company owned by the Sardinian Autonomous Government and holds the "Monte Sinni" coal mining Concession, the only one still operative in Italy till the end of 2018, for the exploitation of the Sulcis Eocene coal basin, worth of about 1 billion tons of sub-bituminous coal reserves, placed over a 400 km² area between in-shore and off-shore.

- The production facilities are settled on a 60 Ha surface site.
- The amount of underground coal reserves in the mine concession is over 60 Mt.
- More than 30 km of galleries have been dug in the underground (about 15 km are main galleries).
- Mine depth is included between 350 and 500 m under ground, which is about 100 m above the sea level.
- The connection between surface and underground takes place by four shafts and a 3 km long decline.
- The production activities will end by the 31st December 2018 after the approval of the Closure Plan issued according to the European regulation 787/2010.
- The Company is carrying out a plan for the reorganization of several different branches, such as the Industrial waste treatment and the research & experimentation activities both on surface and underground. The reorganization will allow to carry on with the industrial activities even after the mine closure, heading for the reconversion of the site.
- According to the Closure Plan the Company is going on with the reduction of the workforce through a policy of financial support to early retirement.
- Carbosulcis now employs less than 200 units and is investing in high level training for the personnel committed to the new activities support.
- Currently the main production enterprise is the treatment of wastes of combustion from the thermal power plant:
 - surface ash disposal: 2 M cubic metres
 - underground ash disposal: 90 k cubic metres



0	Prima emissione/First Issue	F. Pisanu	15/05/2018
Rev	Descrizione kind of revision	Redatto prepared	Controllato checked
Verificato checked	Approvato approved	Data date	
Progetto/project			
CARBOSULCIS S.p.A. "MINIERA MONTE SINNI"			
All.		Oggetto/object	
Commissa/Job n.		RISVI	
Scala / Scale		1:-	
Foglio / Sheet		di	
Formato / Size		A0	
Cod. Arch.			
Lay-out of connections amongst the energy and matter suppliers and users			
CARBOSULCIS si riserva tutti i diritti su questo documento che non può essere riprodotto neppure parzialmente senza la sua autorizzazione scritta. CARBOSULCIS reserves all rights on this document that can not be reproduced in any part without its written consent.			