

Refurbishment of small hydropower plants and green certification: the first successful case in Italy”

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ELECTRICAL MARKET

DL 16 march 1999 n. 79

Purchasers

Producers and importers of electrical energy coming from non renewable sources have the obligation, beginning in 2002, to put in the national electric system a fixed portion (the 2%) of energy coming from Renewable Energy Sources plants or by purchasing Green Certificates.

Products: *Green Certificates*

One each 100 MW are directly associated to the energy produced by “Plants Fed by Renewable Energy Sources” commissioned or refurbished after the 1 of April 1999.

Sellers

Plants labelled as a “Plant Fed by Renewable Energy Sources” issued by the National Transmission Grid Operator (GRTN) according to the criteria fixed by the Decree of the Minister of the Industry issued on 18 march 2002, have the right for Green Certificates emission for eight years starting from the end of the commissioning and testing period.

Market Place

Green Certificates are traded at the Energy Stock Exchange or in direct bilateral trading.

GREEN CERTIFICATES

The right for Green Certificates emission for eight years belongs to the Renewable Energy Sources Plants commissioned or refurbished or upgraded after the first of April 1999.

NEW PLANTS Green Certificates refer to the whole production

OLD PLANTS Green Certificates refer to the higher production plus a part of the production before refurbishment; that portion is stated by law and it is higher as higher is the amount of the investment.

PRICE

The price of Green Certificates is determined by trading.
The cap price for 2002 was 8,418 €cent/kWh.

LESINA HYDROELECTRIC PLANT

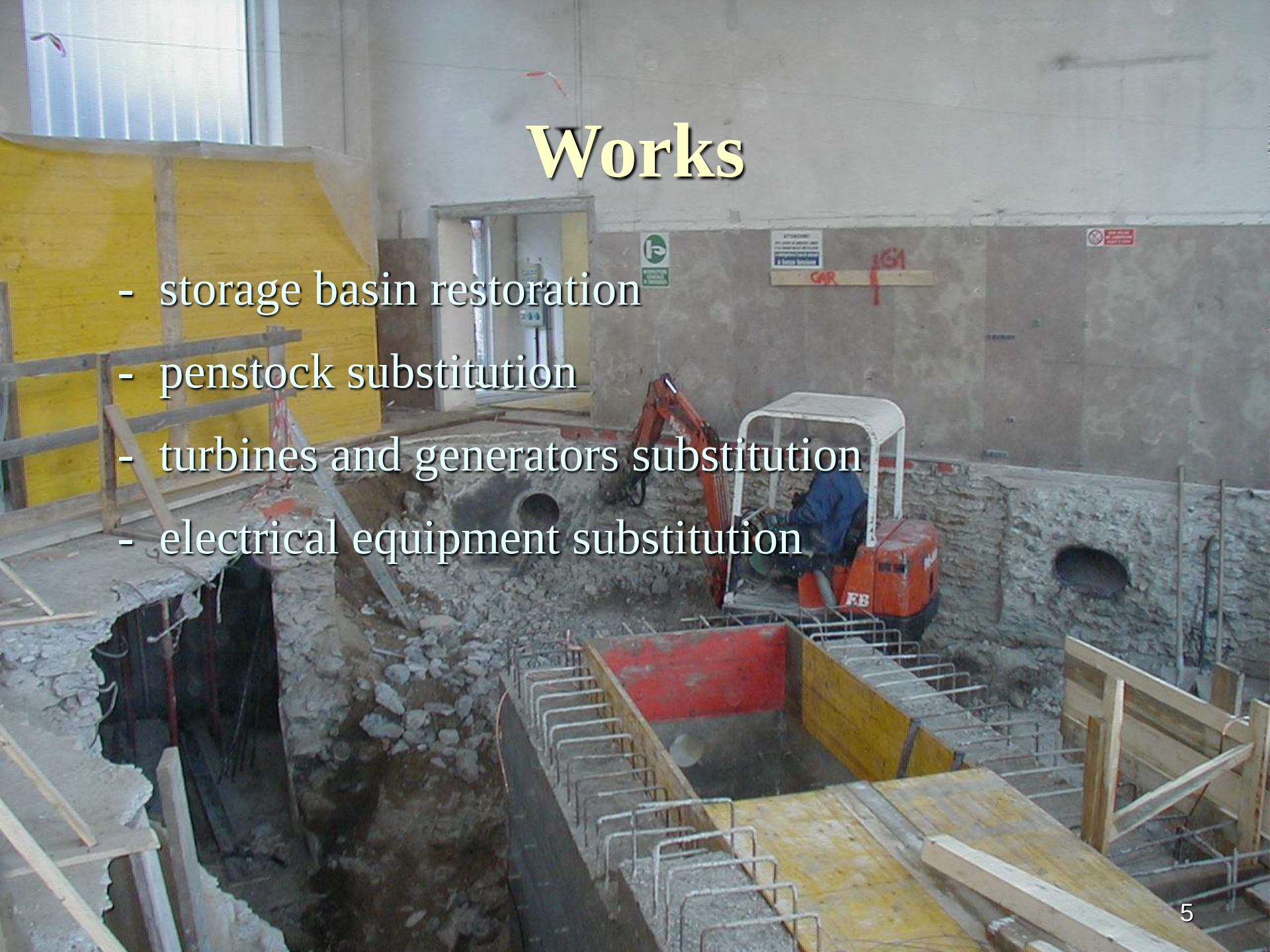
a successful case study



Constructed in the 1940 in Valtellina, a long valley in the Alps mountains, just 90 km north of Milan, Lesina plant is an average lay-out: diversion works, side hill open channel, storage basin, penstock, powerhouse and tailrace channel.

Works

- storage basin restoration
- penstock substitution
- turbines and generators substitution
- electrical equipment substitution



The new penstock



The new turbines and generators



Results

Main characteristics	Before upgrading	After upgrading
Maximum discharge m ³ /s	1,00	1,50
Average discharge m ³ /s	0,47	0.55
Average net head m	280	285
Average power kW	1.025	1.210
Installed power kW	2.250	3.500
Yearly production MWh	8.980	10.600

Environmental issues

- Restoration and improvement of the small road the access to remote mountain areas
- Removal of the bad visual impact tracks of the skid way built in 1940 to install the penstock
- Reduction of noise due to the installation of 750 rpm instead of the old 1000 rpm units (noise < 84 dBA at 1 m)
- Replacement with a reduced losses resin transformer
- Continuous monitoring of the leakages from the basin
- Reduction of the visual impact of the penstock by using steel anchoring blocks
- Bioengineering techniques for consolidation works along the penstock
- Better exploitation of the water available by an increased efficiency of the units (from est. 78% to 84,13 %)
- Increase in production from RES for 1.620 MWh corresponding to approx. 405 Toe (2.650 Toe taking into account the risk of no future production in case of no refurbishment)
- Reduction in CO₂ and pollutant emissions

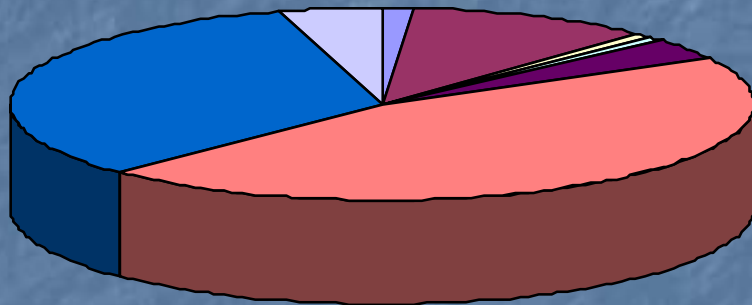
Timing

The works started in October 2001 and in august 2002 the plant began working; in October 2001 the plant received the label of Plant Fed by Renewable Energy Sources and the right of the “Green Certificates” emission:

Activityname	2001							2002									
	giu	lug	ago	set	ott	nov	dic	gen	feb	mar	apr	mag	giu	lug	ago	set	ott
Preliminary design	■																
Construction design and electrical/mechanical specifications	■	■	■														
Tender			■	■													
Works at the basin				■	■	■	■										
Penstock replacement				■	■	■	■	■	■	■	■	■	■	■			
Turbines and generators substitution					■	■	■	■	■	■	■	■	■	■	■		
Beginning of commercial operations																■	

Cost of the project

Cost of the rehabilitation (€)

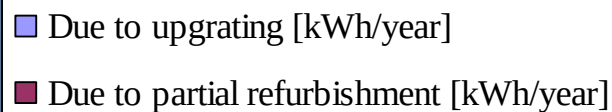
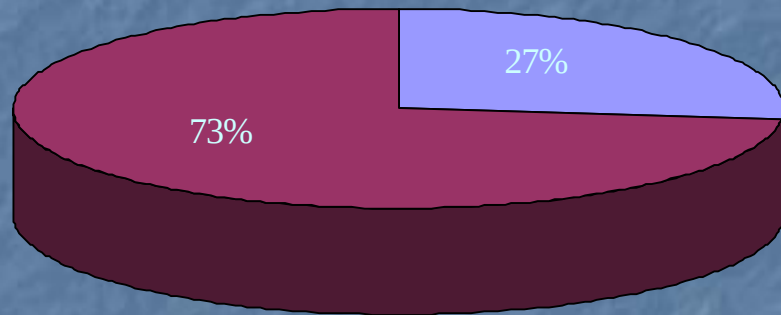


- Side hill channel
- Basin
- Overhead travelling crane
- Access road
- Powerhouse civil works
- Penstock and relevant civil works
- Electromechanical equipment
- Engineering

Side hill channel	50.000
Basin	360.000
Overhead travelling crane	30.000
Access road	30.000
Powerhouse civil works	130.000
Penstock and relevant civil works	1.570.000
Electromechanical equipment	1.140.000
Engineering	155.000
Total	3.465.000

Cost of the project

Portion of old energy qualified for Green Certificates (€)



Energy production having right to Green Certificates [kWh/year]	6.075.000
Out of which	
Due to upgrading [kWh/year]	1.620.000
Due to partial refurbishment [kWh/year]	4.455.000



High cost → High portion of energy qualified for Green Certificates

Cost of the project

At the end of bilateral trading the price obtained for Green Certificates was 0,13 €/kWh and the global value of the energy is 0,13 €/kWh. Consequently, thanks to Green Certification of the plant the simple payback period of the investment is 8 years.

CONCLUSIONS

Since 31 May 2003 GRTN has received 165 request for Green Certification of existing hydro plants.

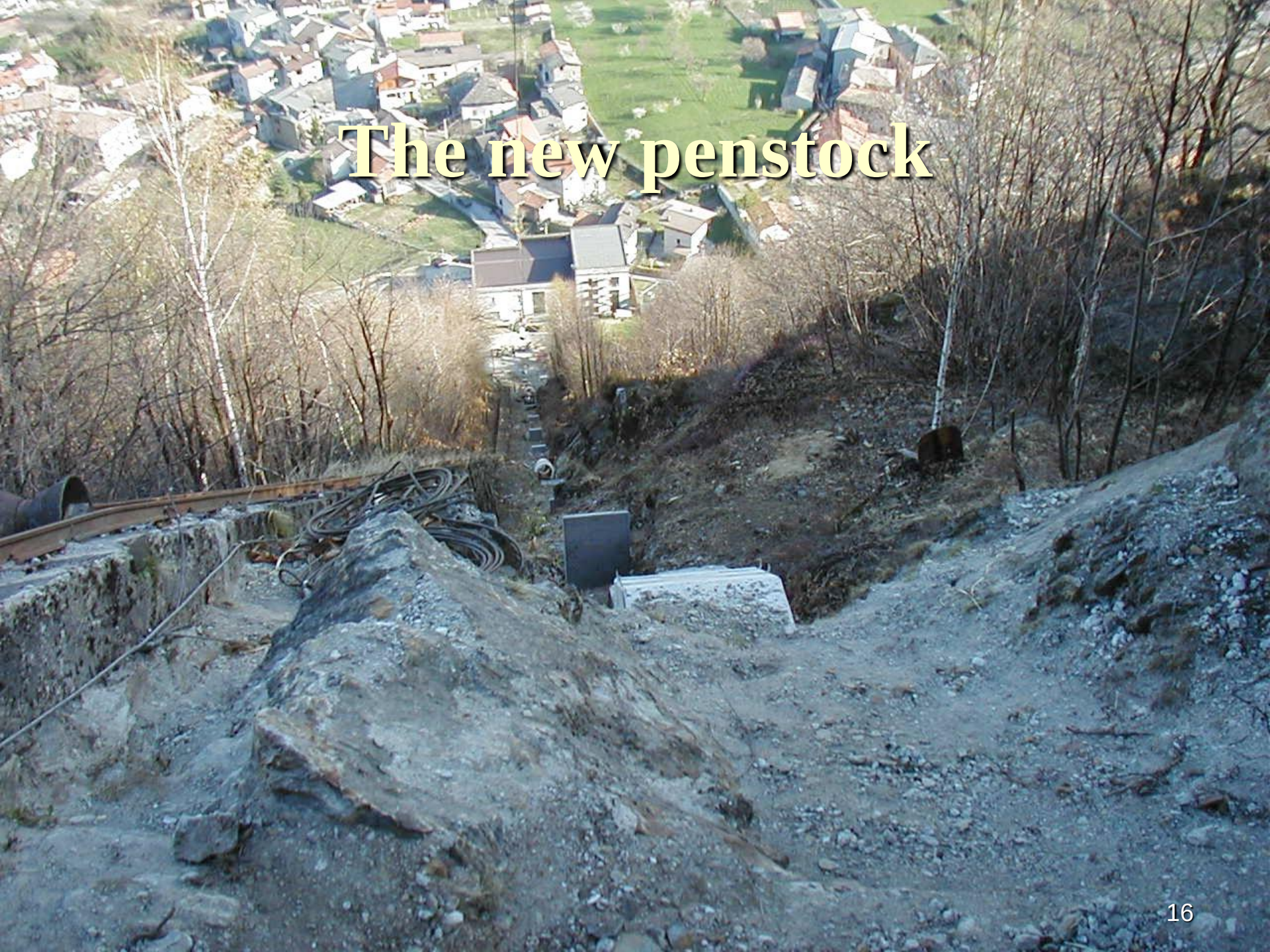
A successful enterprise

LESINA HYDROELECTRIC PLANT

a successful case study



The new penstock

An aerial photograph showing a steep, rocky hillside in the foreground, where construction work for a new penstock is underway. The hillside is dotted with bare, brown trees and some construction materials, including large concrete blocks and coiled pipes. A narrow path or road leads down the slope towards a small village in the background. The village consists of numerous houses with red-tiled roofs, interspersed with green fields. The overall scene suggests a mountainous region undergoing infrastructure development.

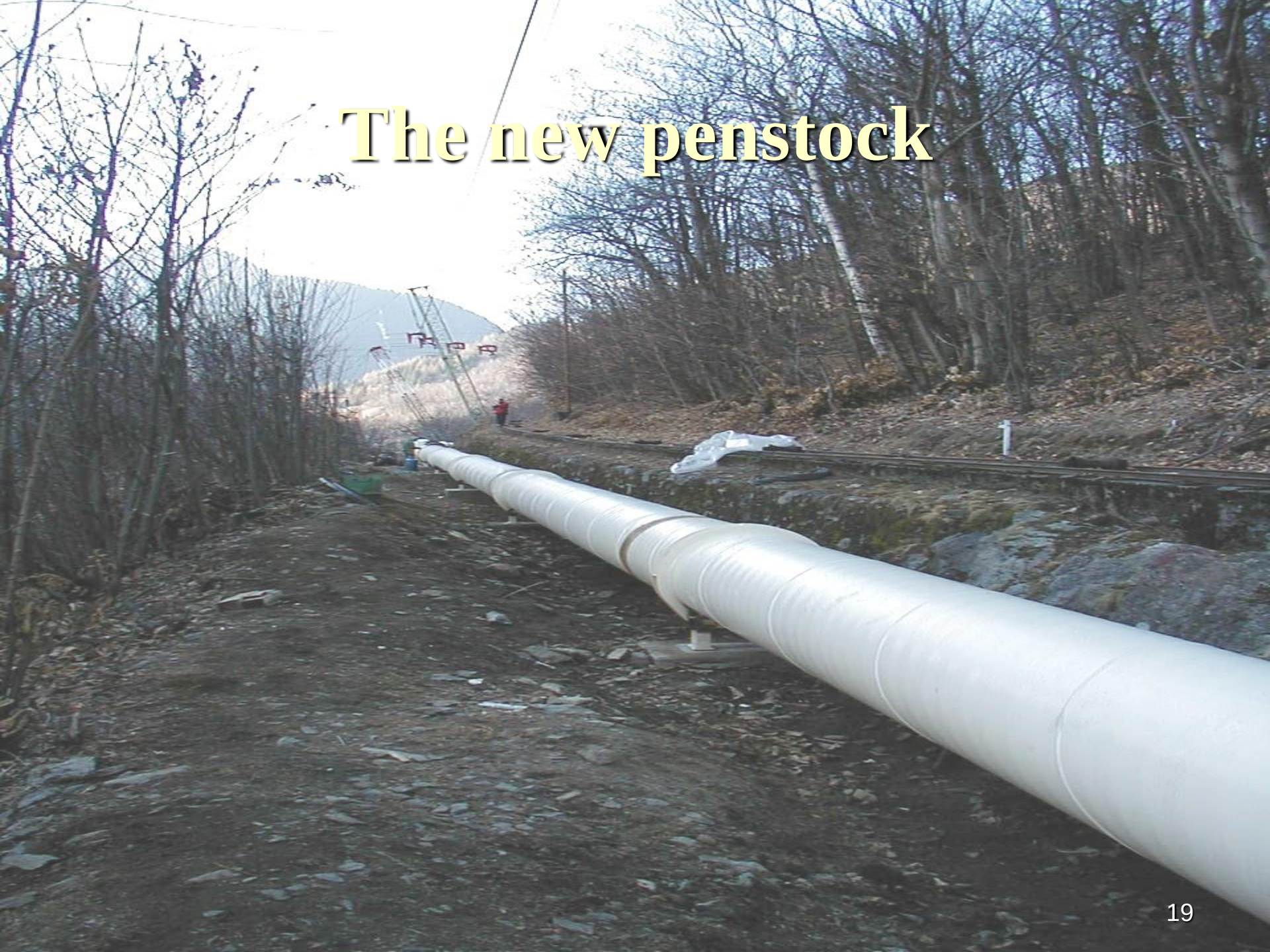
The new penstock



The new penstock



The new penstock



The new electrical equipment

