IEEE

2003 IEEE Bologna PowerTech

June 23-26 University of Bologna, Bologna, Italy

A Research on Plants for In-Situ Vitrification of Contaminated Soils

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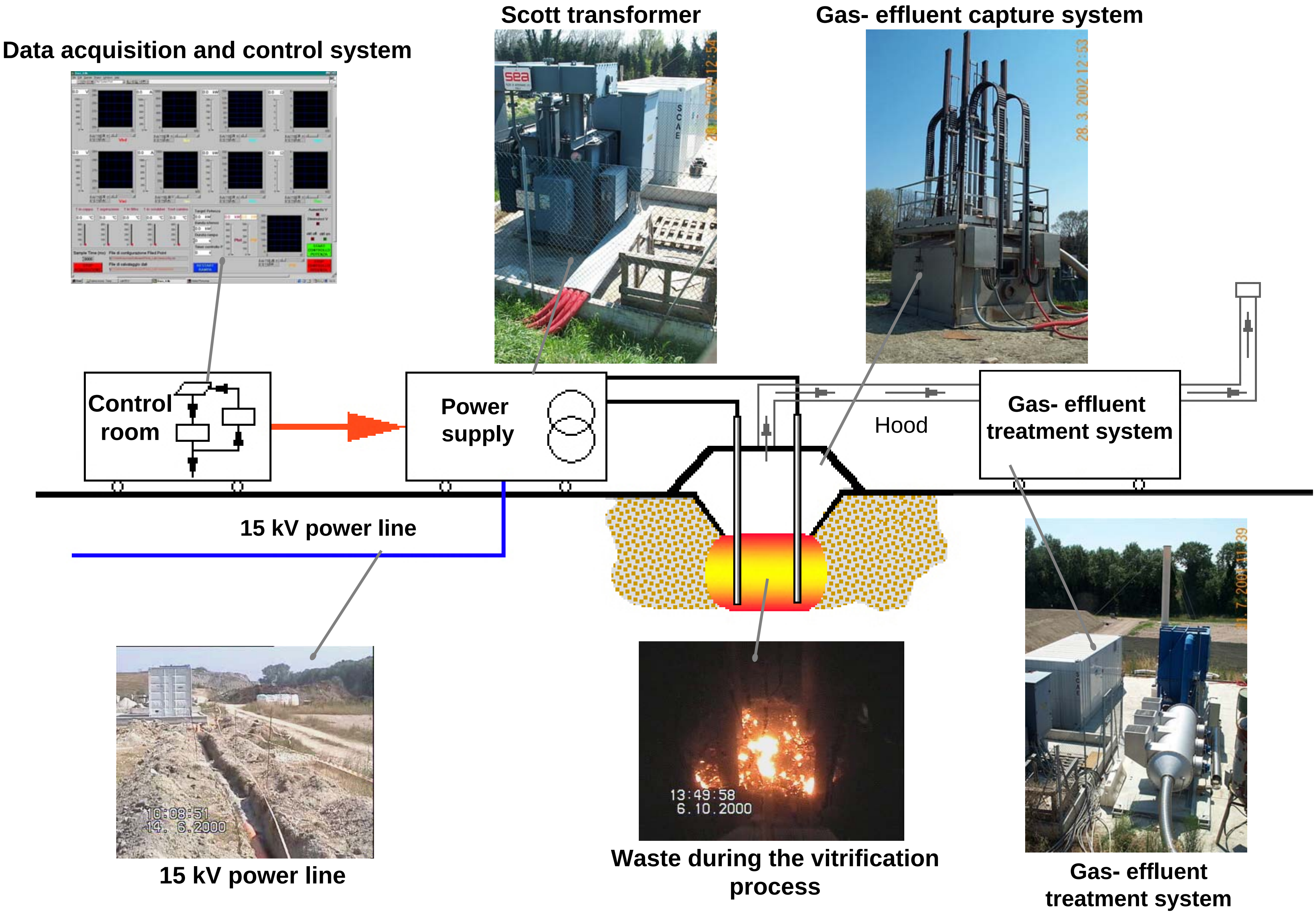
Process of the in-situ vitrification (ISV)

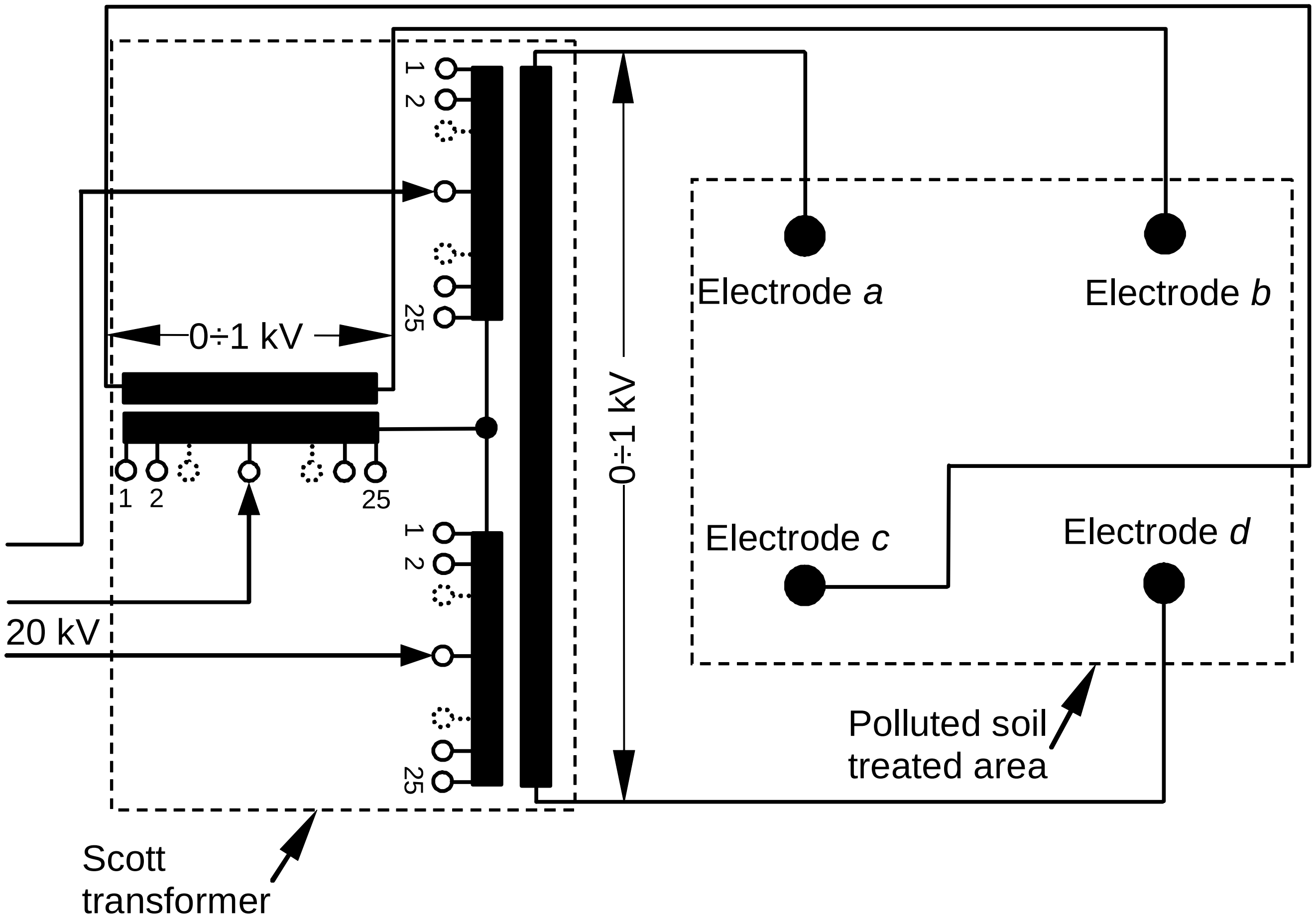


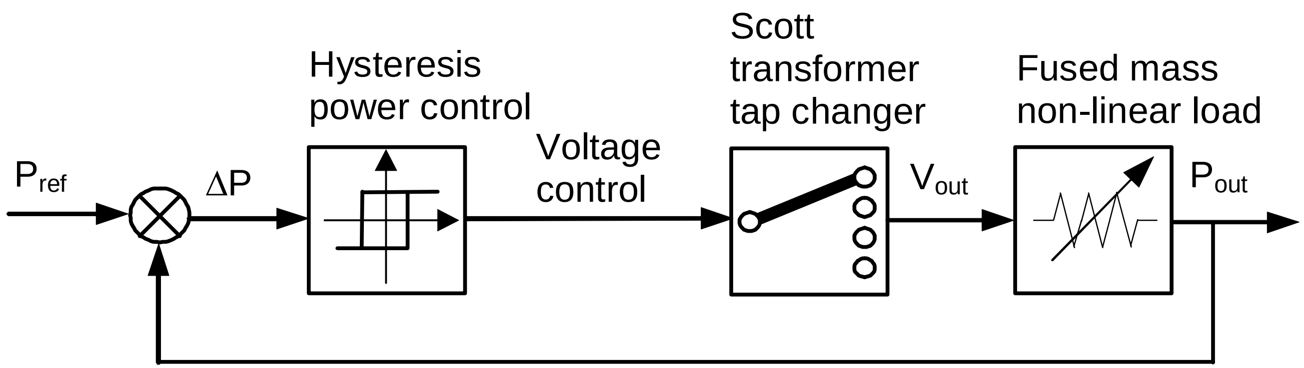
Italian ISV project stages

Stage number	Stage name	Phase description	Rated power	Vitrified mass
1	Laboratory-scale	Engineering feasibility of the vitrification process	10 kW	1÷10 kg
2	pre-pilot-scale	Development of the first power supply prototype, of its control and of the prototype gas-effluent treatment system	30 kW	50÷100 kg
3	pilot-scale	Development of a combined power supply plant including its control and the final gas-effluent treatment system	0.5 MW	0.5÷1 t
4	prototype-scale	Design and optimization of the ISV plant components in view of the real-scale application	0.5 MW	1÷5 t
5	real-scale (*)	ISV plant design aimed at a reclamation intervention on a polluted site	0.5 MW	>10 t *

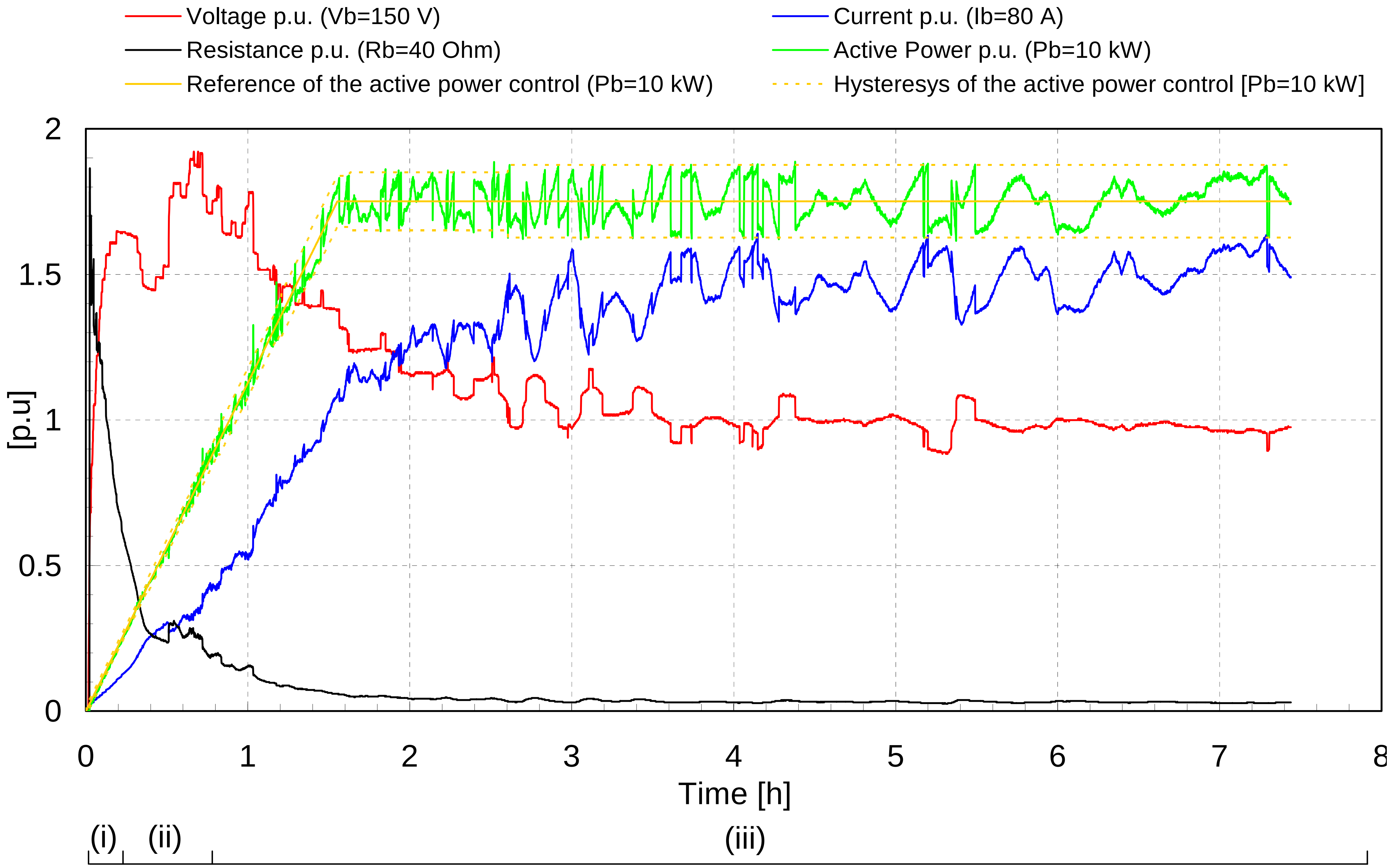
(*) Target, within the framework of this project

General scheme of the Scott transformer and of the active power control implemented into the ISV real-scale plant

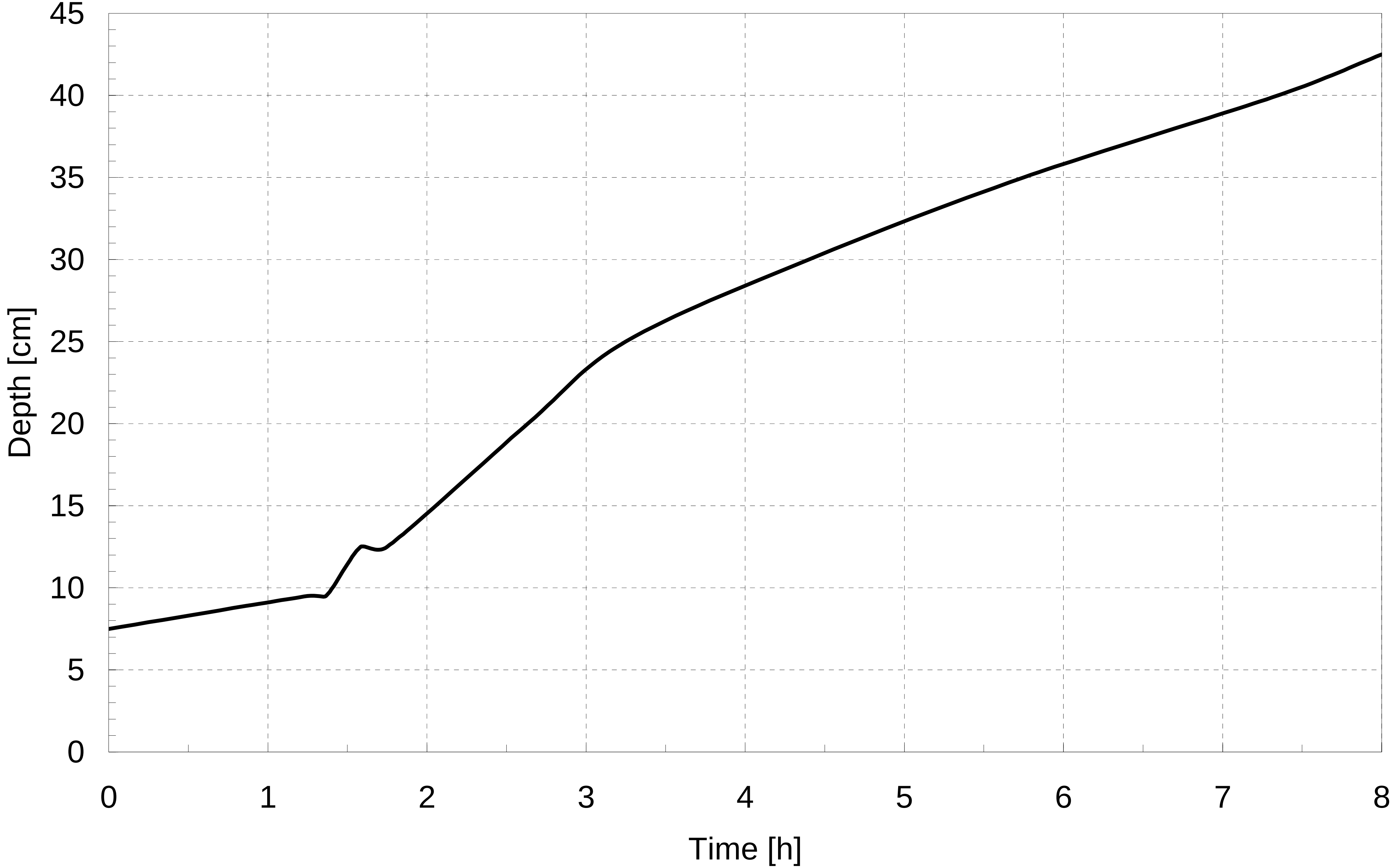




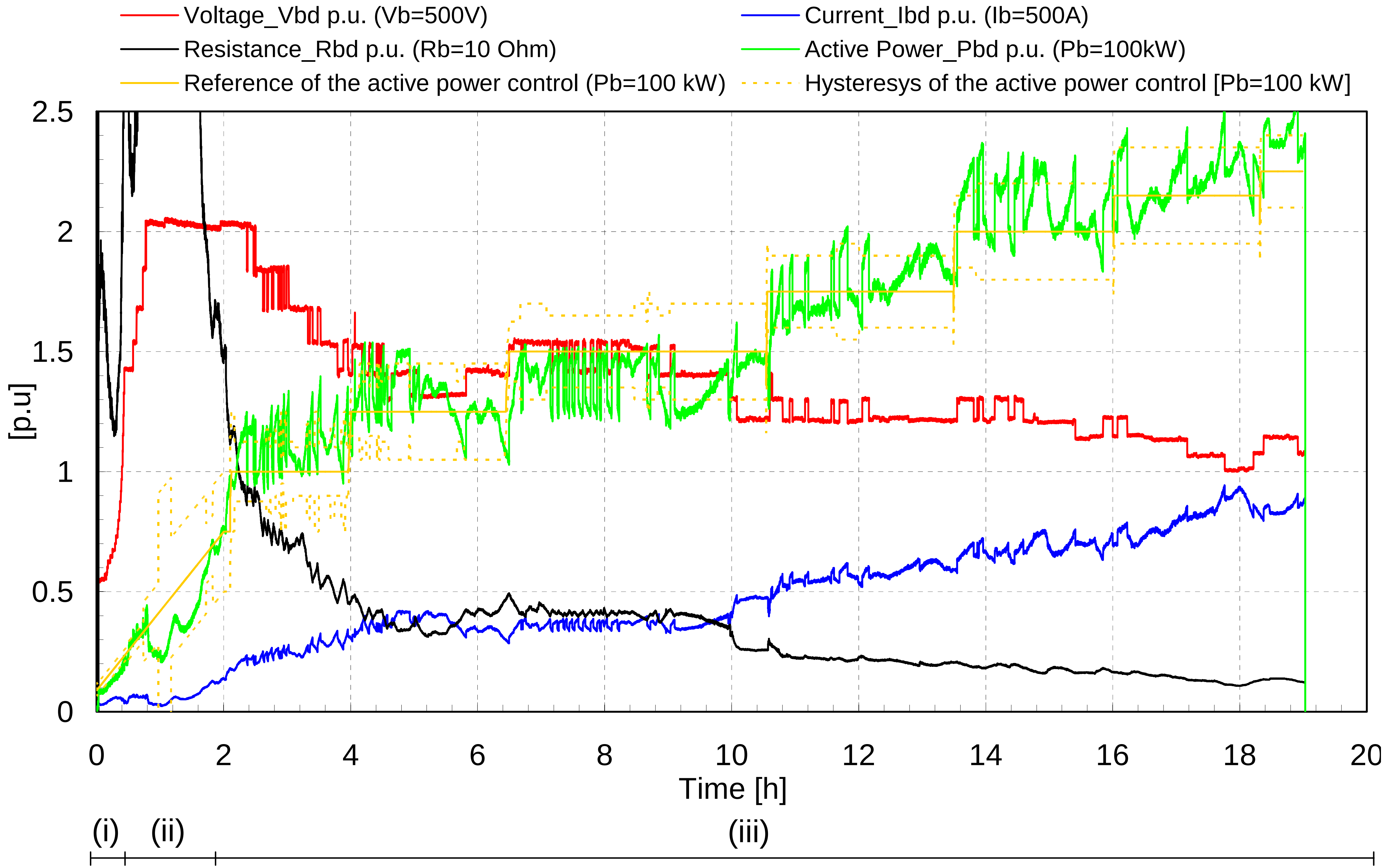
Time variation of electrical quantities during a typical ISV process in Pre-Pilot-scale



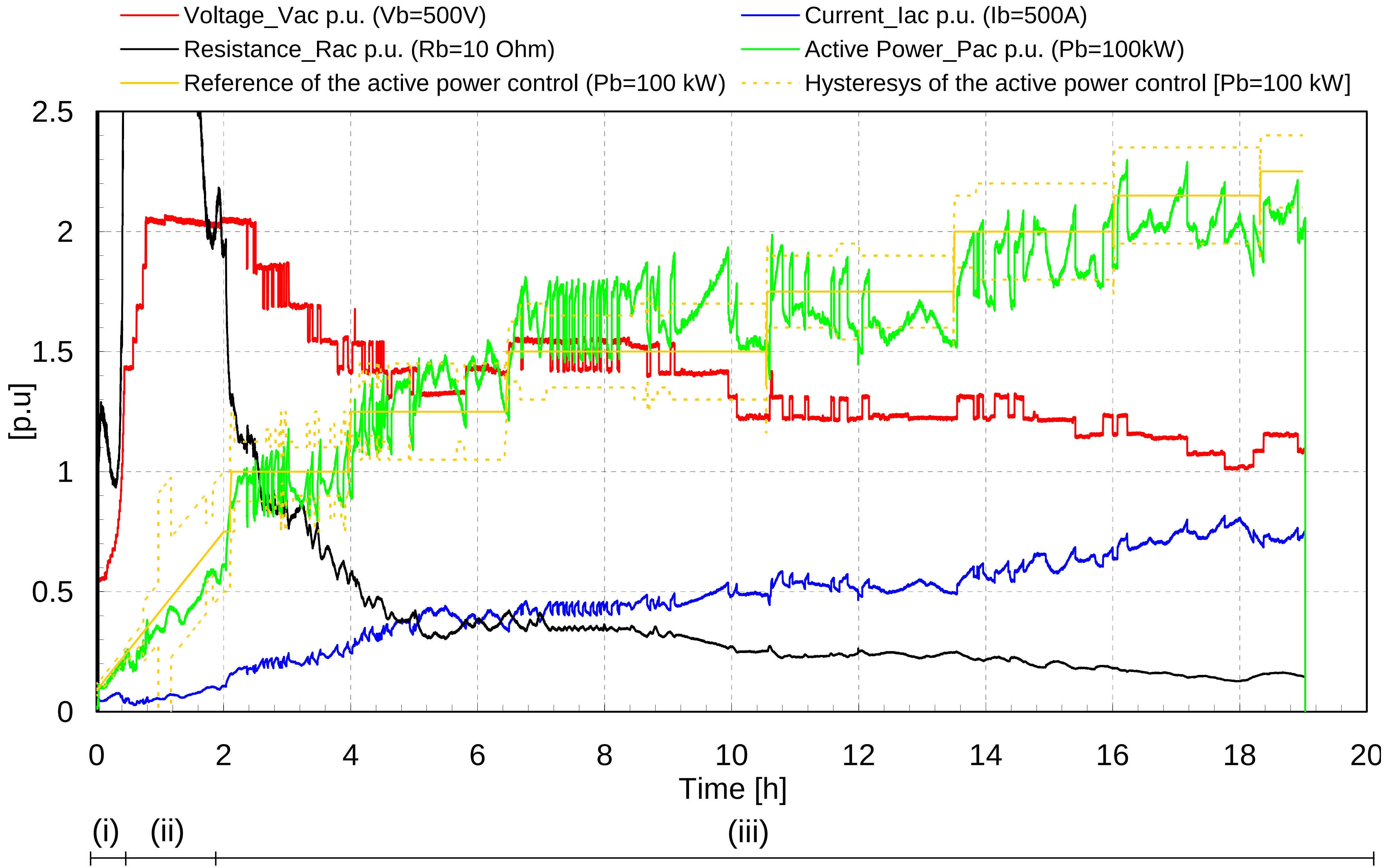
Time variation of electrode depth during a typical ISV process in Pre-Pilot-scale



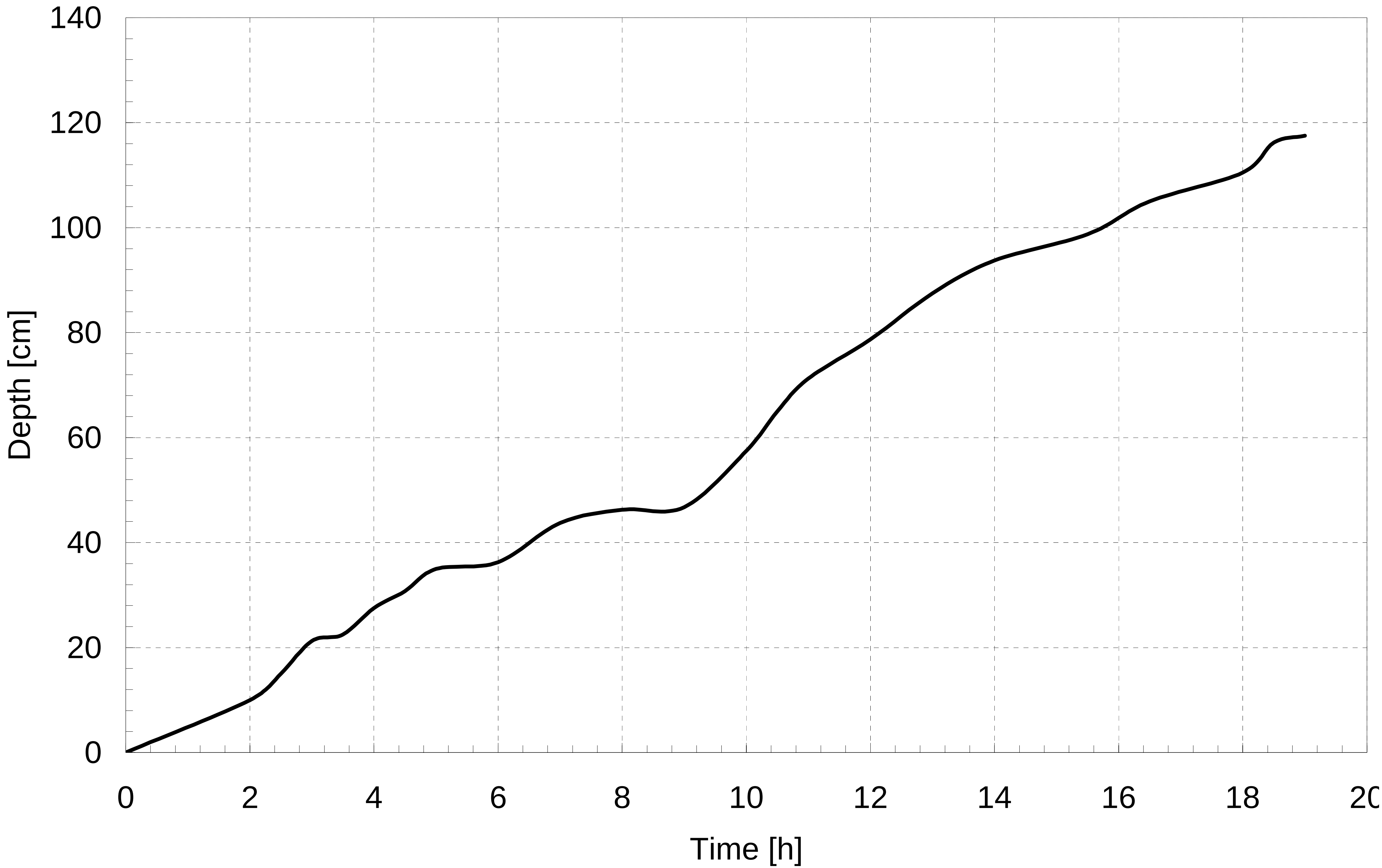
Time variation of electrical quantities during a typical ISV process in Real-scale (electrode couple b-d)



Time variation of electrical quantities during a typical ISV process in Real-scale (electrode couple a-c)



Time variation of electrode depth during a typical ISV process in Real-scale



Comparison between significant electrical quantities obtained with different isv stages

	Distance between electrodes	Total energy (kWh)		Stable phase load resistance (Ω)		Starting voltage (V)		Stable phase active power (kW)		Average active power (kW)		Average current (A)	
		min	max	min	max	min	max	min	max	min	max	min	Max
Pilot scale (*)	**60**	330	812	0,293	0,788	330	445	184	480	114	200	200	358
Prototype scale (*)	**100**	1306	1306	1,042	1,095	860	860	350	350	160	160	249	249
Real scale (*)	**120**	5043	5801	1,14	1,432	1030	1030	450	450	336	348	268	333

Conclusions

The paper deals with the development of the supply power component of an ISV plant. It illustrates the most important results obtained during five years of research activity, involving a multi-discipline research team.

The activity was divided into five different stages corresponding to five different ISV plants each having a different rated power, power system control efficiency and each capable of producing vitrified mass of different increasing weight.

The paper illustrates the ISV power supply system, its main components and the characteristics of the power system control.

Experimental results concerning pre-pilot and real-scale tests are reported and a discussion concerning the behavior of the non-linear electrical load of the melted mass is given. In particular, the tests performed permit to identify three distinct phases of the process namely a primer, unstable and stable phases. The non-linear behavior of the electrical conductivity of the melted mass has been