

Technical and Environmental Engineering Going Together

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A small hydro plant (6,7 MW)

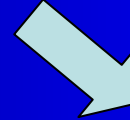


Another small hydro plant (600 W)

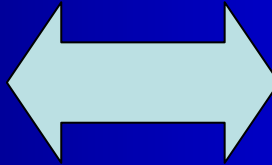


BASIC PRINCIPLE

INTEGRATED APPROACH



TURNING THE
ENVIRONMENTAL
CONSTRAINTS IN
TECHNICAL DESIGN
PRINCIPLES



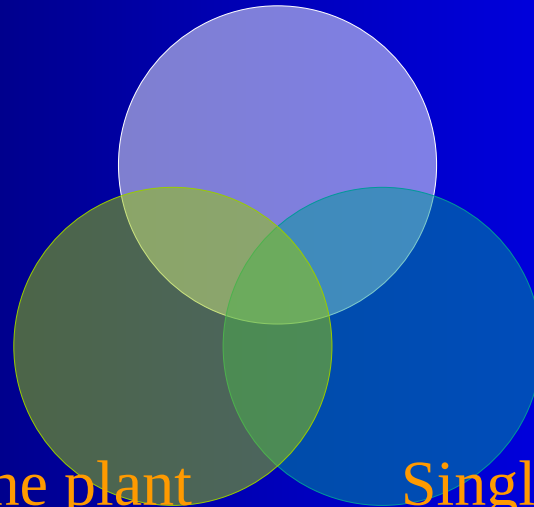
INTEGRATE THE
ENVIRONMENTAL
ISSUES IN THE
EARLIEST STAGE OF
DESIGN



ACTIONS ON

ACTIONS ON

Single environmental impacts



General layout of the plant

Single parts of the plant

MULTIPLE USE OF THE WATER RESOURCES

Schemes where the small hydropower plant is an ancillary part and the energy production is not the main scope of the use of water

New small hydropower plants realised along existing irrigation schemes

New small hydropower plants along water cooling systems

New small hydropower plants along drinking water supply systems

New small hydropower plants at shiplocks and weirs

Small hydropower plants at the toe of a dam realised for other purposes

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MULTIPLE USE OF THE WATER RESOURCES

EXAMPLES

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← Before



After →

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Schemes where the small hydropower plant is an ancillary part and the energy production is not the main scope of the use of water

Small hydropower plants at the toe of a dam realised for other purposes



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New small hydropower plants along water cooling systems



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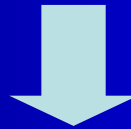


MULTIPLE USE OF THE WATER RESOURCES

EXAMPLES

MULTIPLE USE OF THE WATER RESOURCES

Schemes where the small hydropower plant is the main part and scope of the use of water and the other purposes are secondary and mainly achieved to optimise water exploitation



Small hydropower plants with pondage basin used for recreation scopes

EXAMPLES



Slopes consolidation by means of bio-engineering techniques



Uncovered anchoring blocks



← Yes!

No! →



Interred penstock

Can you see it?

No, but



Can you inspect and maintain it?



Possible solution...

EXAMPLES: Single parts of the plant

“Maintenance free” Glass Reinforced Plastics Pipes



River Continuum preservation: Coanda screens



River Continuum preservation: Fish passes



Yes! ←



No! →

Rubber dams or inflatable flap gates

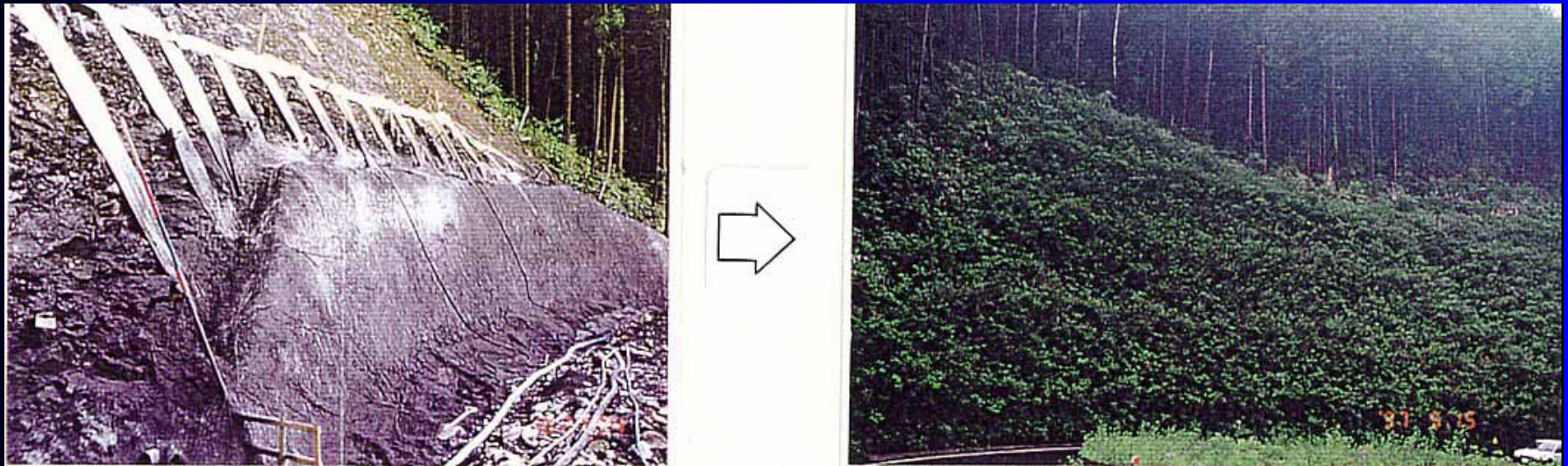


← New concept

Old concept →



Tree planting and grass sowing at the plant vicinities



Creation of low water river-bed



SOME HINTS

Penstocks without expansion joints *No paths for maintenance*

Underground powerhouses *No visual impact, high cost, must we hide?*

Building coating with local stone *Better integration in the landscape,
But is it a value?*

Restructuring of regulated embankment

Creation of inundation areas

BASIC CONCLUSION

MITIGATION AND COMPENSATION MEASURES ARE TOO EXPENSIVE FOR SMALL HYDRO DUE TO STRONG NEGATIVE SCALE EFFECTS



IF YOU CAN'T FIGHT THEM, TURN THEM INTO FRIENDS



INTEGRATE THEM IN THE DESIGN



THE END