

WP4.4 Pilot Case Studies indicators database for MCA

Structure of Var decisional tree

09/04/2012

version 4.0

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SHARE - Sustainable Hydropower in Alpine Rivers Ecosystems
<http://www.sharealpinerivers.eu>

Project reference number: 5-2-3-IT

Priority 3 – Environment and Risk Prevention

Project duration: 36 months – 1/08/2009 – 31/07/2012



Summary

SHORT DESCRIPTION

This document contains the description of the MCA application to the river Var. The lower valley of the Var river had 16 dams, built in the 1980's. Several recently collapsed, for hydromorphological reasons apparently. Should the local authority decide to dismantle all of the remaining dams?

Document Control

Project	SHARE - Sustainable Hydropower in Alpine Rivers Ecosystems (ref. 5-2-3-IT)
Action	Action 7.3-A
Deliverable	
Due date	
Delivery date	
Dissemination	Public
Origin	PP10 – GERES
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VERSION	DATE	AUTHOR	AUTHOR'S ORGANIZATION	DESCRIPTION/CHANGES
v01.00	19/12/2011			1st version
v02	26/01/12			2nd version
v03	05/03/12			Final version
v04	09/04/12			Final version completed
V05	27/04/12			Final version completed
V05.01	14/05/12			Final version completed

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Introduction

The SAGE¹ from the Alpes-Maritimes French department and GERES co-drive the working group "consultation and hydropower."

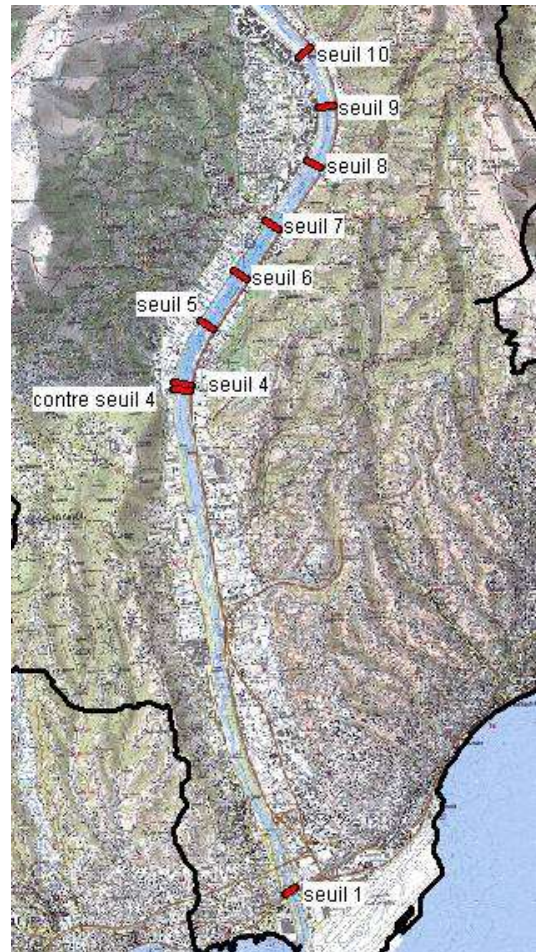
On the river Var, in the part of the plain, a series of sills originally built to moderate the effects of floods, is equipped with micro-hydropower plants (built in the years 1983, 1984).

Over the years, these small dams (high 50 cm to 4 m) slowed the transport of sediments. Upstream dams, silts deposited tend to limit water exchange between the aquifer and the river and to increase the flooding risks. Also, some old working plants are threatened in case of flooding (such as 1994) as they may collapse. Therefore one of the main objectives is to diminish the risk of flood. These sills will be lowered in the goal that the river returns to its natural functioning and flood transports sediments unhindered.

Three stations on the sill 8th, 9th and 10th have been or are going to be removed (the station from sill 10th is inoperative due to silting).

The hydropower plants operator, Varenergy, German group, had an operating permit that ends by the prefecture. This operator is seeking, with the SAGE hydropower group, another hydropower alternative that does not unhindered sediments transport.

Few decisions, as lowering sills, have been already taken by the prefecture. Therefore, various alternatives need to be tested to take in consideration all stakeholders issues and opinions.



Plant 3, after destruction of sill number 3 by the 1994's flood, Var, France

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¹ SAGE is in French: « Schéma de Gestion et d'Aménagement des Eaux »

Alternatives description

The territory administration leads a SAGE with environmental requirements on the one hand, and on the other a situation in which the energy peninsula development solutions for green electricity produced locally are encouraged.

SESAMO is used to show the balance between economic and ecological components in various scenarios / options:

1. **Alternative 1:** Maintenance of sills equipped with power plants (current case and not maintainable)
2. **Alternative 2:** Removal of all sills and power plants (desired solution by the objectives of SAGE) – except n° 16.
3. **Alternative 3:** Development of new facilities - new power plants technology: airbag sill on the total width of the river (solution studied by the operator).
4. **Alternative 4:** Development of new facilities – new power plants technology: airbag sill on a partial width of the river (solution studied by the operator)



Sill 4th, Var, France

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MCA tree

Unlike using a SESAMO in the assumption of the creation of a single power plant, where it seeks what is the flow taken the most appropriate with the environment balance, the *Var* itself has specific aspects:

There're several power plants installed. Therefore, to run the software we add the heights and flow rates to rationalize as if we had only one power plant.

The SESAMO tree in the case of the *Var* has been built similarly to other trees - but also has some specific features.

Criteria and indicators

The criteria and indicators considered in the *Var*MCA are as follows:

- Criteria **Energy production** with 3 indicators:
 1. **Annual energy produced** (G€) ;
 2. **Production in Lower Var valley compared with local consumption** (in all the Alpes Maritimes territory) (%)
 3. **Production in Lower Var valley compared with hydropower departmental production** (%)

- Criteria **Economy related to HP production** with 2 indicators:
 1. **Financial outcomes** HP producer level (*direct incomes from the sale of hydroelectricity*) (G€)
 2. **Economy regional level** (*indirect incomes, taxes from the sale of hydroelectricity*) (G€)

- Criteria **River ecosystem** is divided into **3 sub criteria** (qualitative):
 1. Sub criteria **Hydro morphology** with 2 indicators: **Continuity in solid transports** and **Possibility for the river to move trough its all width**
 2. Sub criteria **Ecological continuity** with 4 indicators : **“Eels upstream migration ”**, **“Eels downstream migration ”**, **“Fish upstream migration”** and **“Fish downstream migration”**
 3. Sub criteria **Avifauna** with 1 indicator **Natura 2000 objectives**
NB Indicator *“benthic macro invertebrate”* does not seem pertinent.

- Criteria **Tourism** with 1 indicator (qualitative): **Scientific tourism** (school, university...)

- Criteria **Other uses** with 1 indicator (qualitative): **Drinkable Water** intake upstream of the sill. If the sill is removed, the drinking water intake must be ensured deeper or further upstream, although the use of that water intake is exceptional.

- Criteria **Security of the river bed**, with 2 indicators
 1. **Maintenance cost** (G€)
 2. Issues **impacted during an exceptional event (flood risk)**



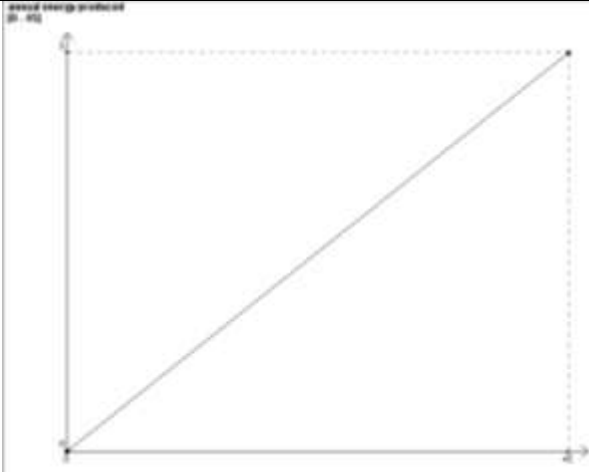
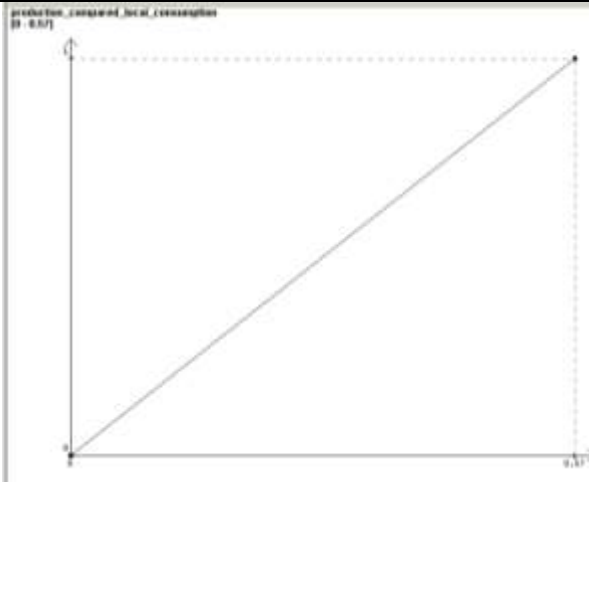
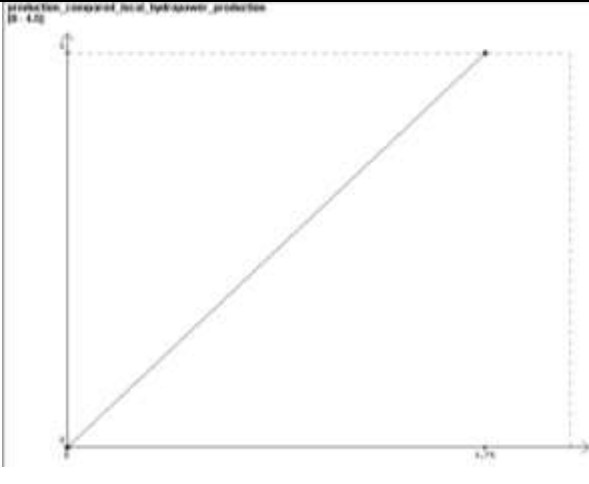
Fish ladder sill 4th, Var, France
 ©Philippe Belleudy - Université Joseph Fourier Grenoble

Structure of Var decisional tree

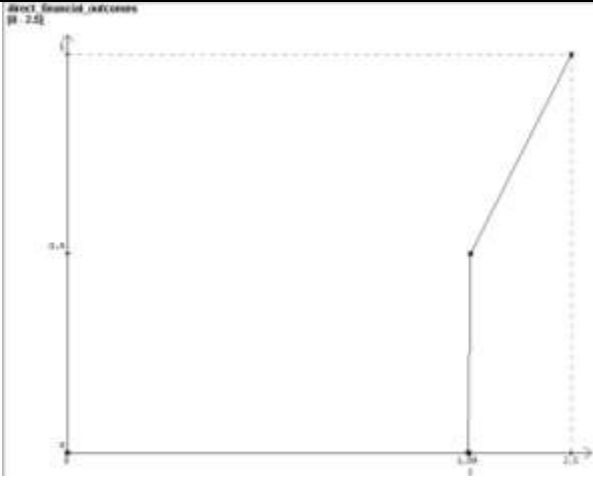
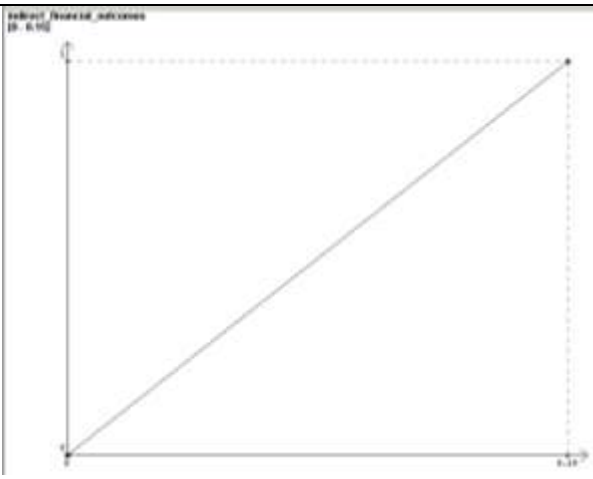
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 - [-] annual_production_GWh (F)
 - [-] production_compared_local_consumption_% (F)
 - [-] production_compared_local_hydropower_production_% (F)
 - [-] hydropower_economy
 - [-] direct_financial_outcomes_M*€ (F)
 - [-] indirect_financial_outcomes_M*€ (F)
 - [-] river_ecosystem
 - [-] hydromorphology
 - [-] solid_transport_continuity_qual (F)
 - [-] bed_mobility_qual (F)
 - [-] ecological_continuity
 - [-] eels_upstream_qual (F)
 - [-] fish_upstream_qual (F)
 - [-] fish_downstream_qual (F)
 - [-] eels_downstream_qual (F)
 - [-] Avifauna_natura_2000_qual (F)
 - [-] tourism
 - [-] educational_tourism_qual (F)
 - [-] other_uses
 - [-] drinkable_water_qual (F)
 - [-] river_bed_security
 - [-] maintenance_cost_M*€ (F)
 - [-] flood_risk_qual (F)

Utility functions

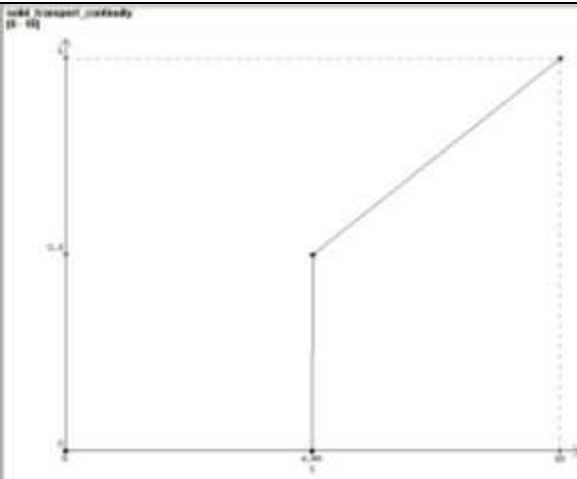
“Energy production” criteria > 3 indicators

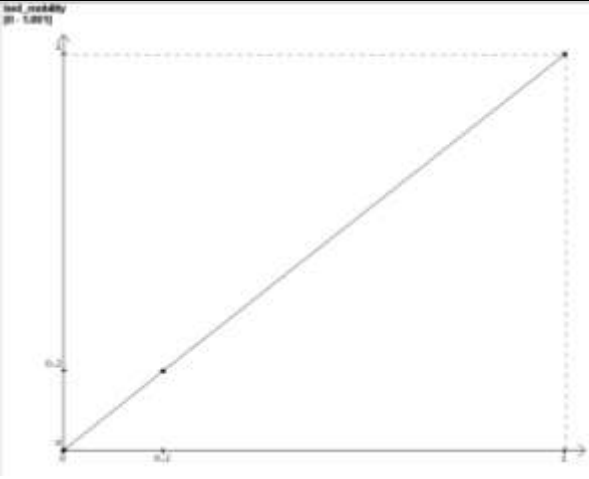
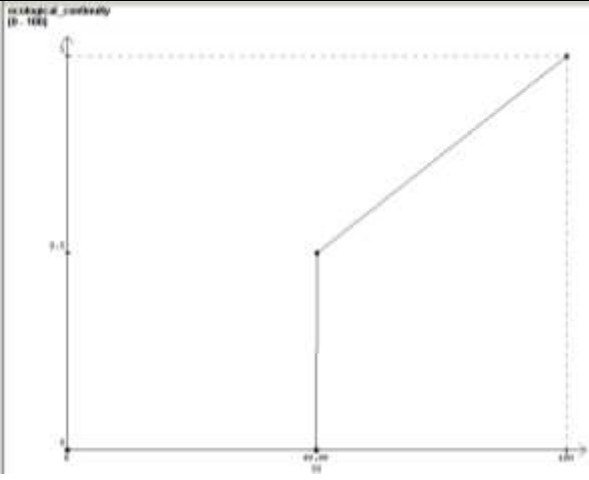
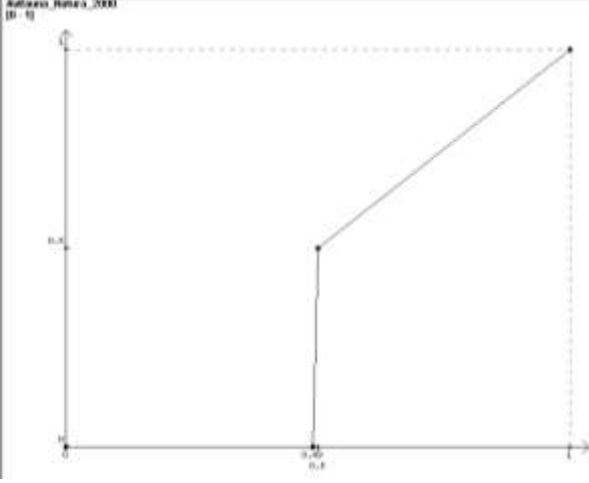
<p>Annual energy produced (G€)</p> <p>stakeholder : PTP</p>		<p>For all the stakeholders (this indicator does not concern only the operator), the most satisfactory is the alternative with the most important production.</p> <p>There isn't in this case a minimum of production requested for the stakeholders > the UF is linear.</p>
<p>Production in Lower Var valley compared with local consumption (in all the Alpes Maritimes territory) (%)</p> <p>stakeholder : public administration department (Conseil Général)</p>		<p>The public administration department does not have any production target concerning the river basin of lower Var valley, in comparison with the energy consumption in the department. > the UF is linear</p>
<p>Production in Lower Var valley compared with hydropower departmental production (%)</p> <p>stakeholder : public administration department (Conseil Général)</p>		<p>The public administration department does not have any production target concerning the river basin of lower Var valley, in comparison with the global hydropower production in the department. > the UF is linear</p>

“Economy related to the HP production” criteria > 2 indicators

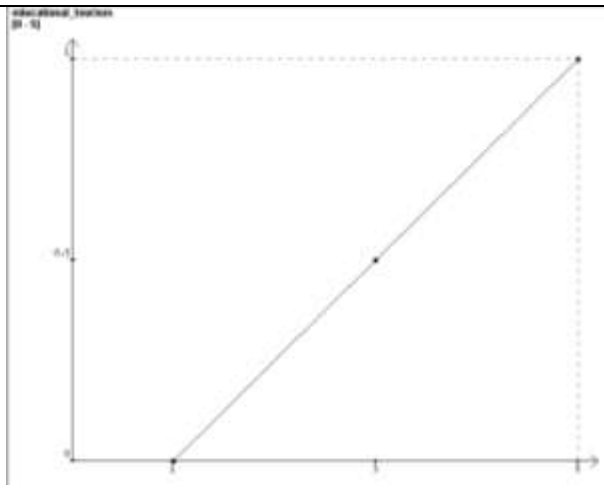
<p>Financial outcomes HP producer level (direct incomes from the sale of hydroelectricity) (G€)</p> <p>stakeholder : operator</p>		<p>The operator is satisfied when the financial outcomes are above 2 (profitability of the powerplants)</p>
<p>Economy at a regional level (indirect incomes, taxes from the sale of hydroelectricity) (G€)</p> <p>stakeholder : public administration department (Conseil Général)</p>		<p>The most satisfactory is the alternative with the most important incomes.</p> <p>There isn't in this case a minimum of incomes requested > the UF is linear.</p>

“River ecosystem” criteria > 3 sub-criteria > 7 indicators

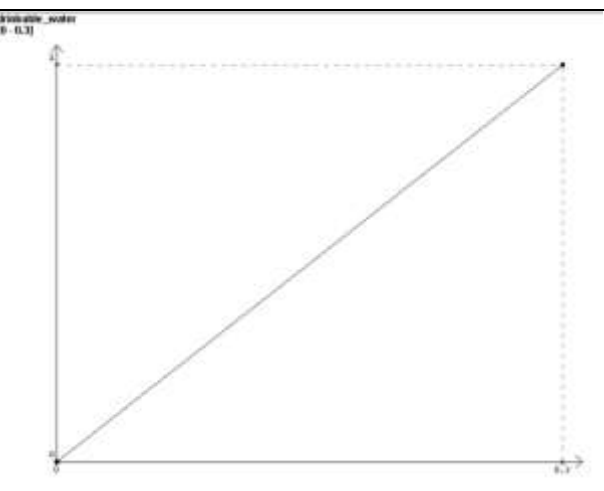
<p>Hydromorphology > continuity in solid transport</p> <p>stakeholder : administration departments (Conseil Général, ONEMA, DDTM)</p>		<p>The data are qualitative.</p> <p>The administration departments are satisfied when the continuity in solid transport is realized by 50%.</p> <p>If all the sills are removed, the score is 10 (any alternative reaching this score or more).</p>
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<p>Hydromorphology > possibility for the river to move along its width</p>		<p>The data are qualitative. The UF is linear because any normative exists.</p>
<p>Ecological continuity > eels upstream migration > eels downstream migration > fish upstream migration > fish downstream migration</p>		<p>For these 4 indicators, the UF is the same. The administration departments are satisfied if the ecological continuity is above 50%.</p>
<p>Avifauna > Natura 2000 objectives</p>		<p>The data are qualitative. The administration departments are satisfied when the Natura 2000 objectives are realized by 50%.</p>

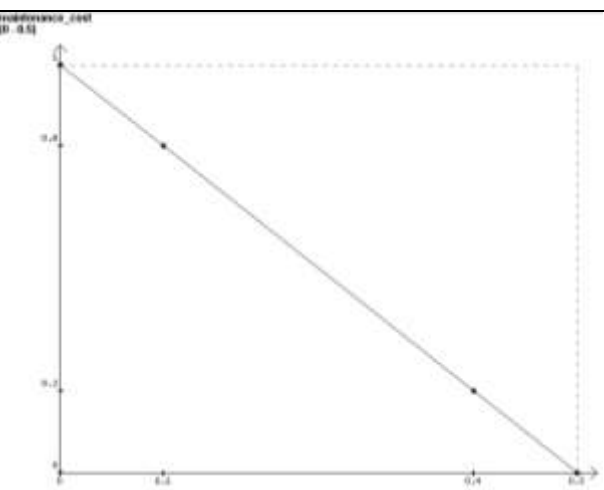
“Tourism” criteria > 1 indicator

<p>Scientific tourism (schools, universities...)</p> <p>stakeholder : operator</p>		<p>The operator is satisfied when he can organize visits (\Leftrightarrow qualitative data is above 1).</p>
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“Other uses” > 1 indicator

<p>Drinkable water</p> <p>stakeholder : Drinkable water intake operator</p>		<p>The studied alternatives impact on the emergency water intake above the 8th sill. The drinkable water intake operator is naturally more satisfied when the development alternative has a lower impact on the water intake.</p>
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“Security of the river bed” > 2 indicators

<p>Maintenance cost</p> <p>Stakeholder : administration departments (Conseil Général, DDTM)</p>		<p>The administration departments are naturally more satisfied when the maintenance cost of the river bed is lower.</p> <p>> The UF is a linear decreasing.</p>
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<p>Issues impacted during an exceptional event</p> <p>Stakeholder : administration departments (Conseil Général, DDTM)</p>		<p>The main goal of the study is to reduce the hydrology risk.</p>
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Sensitive analysis result

With weight chosen by the members of pilot case studies group, the alternative 3 seems the best. However, it means high investments and should be not possible at least.

