Tyrol-Adriatic Project
C
"River Basin Management" – "River Room Recreation"
Renewable Energy Sources
Electric Mobility

0 GENERAL

The expected consequences of climatic change, the economic and financial crisis and the employment market situation demand extending the Tyrol-Adriatic Project to the sectors of flood prevention, renewable energies, environment, traffic and others.

RIVERS IN NORTH-EASTERN ITALY

The shallow sections of River Adige – North-East Italy's longest stream – come very close to the main ridge of the Alps. The river thus makes a possible waterway between the Adriatic region and Danube. Project B presents the connections between European inland waterways and the Adriatic Sea. In order to make rivers navigable, it is crucial to regulate their high and low tides.

During the snow melt and autumn rain periods, the rivers Isonzo, Torre, Natisone, Tagliamento, Degano, But, Fella, Meduna, Cellina, Livenza, Piave, and Brenta are usually in flood and thus feature very broad riverbeds (partly of several kilometers width). However, in dry periods the respective rivers carry only little water (also as a result of draining for power stations and irrigation purposes) and are in parts even dry due to water loss caused by leaching. Riverside communities as well as the partly densely populated regions in the lowlands suffer from being permanently exposed to this flood hazard. Therefore, projects that aim at banning the respective risk are given priority.

The extraordinarily wide river areas require comprehensive river basin management. In this course, areas becoming available may be deployed for new utilization purposes. The use of hydro power and solar energy for power generation is potential to be exploited within the course of the river basin area's restructuring.

1 RIVER BASIN MANAGEMENT CONCEPT – "RIVER-ROOM-RECREATION"

1.1 Flood Control

1.1.1 Quick water evacuation in the event of flood threatens communities located at the lower reaches and additionally impedes shipping. On some upper reaches (e.g. on River Cellina) storage reservoirs that have the potential to retain water were built. Within the river courses, up to 6 meter high inflatable weirs serve to dam the water to a number of impounding reservoirs, edged by embankments. The width of new river beds depends on the respective river's profile at the lower reaches.

1.1.2 The respective top impoundment is to be designed as retention and collecting basin that serves to retain larger water volumes as well as sand, gravel and flotsam and thus reduce the water's destructive powers. In order to realize this, a deep ditch running transversally through the impoundment ids continuously cleared by a wire rope conveyor mechanism. Additionally, the bottom basin is also designed for larger water quantities in order to be able to stop the turbine/generator units installed at the respective weirs or to allow their function as reversely running pumps that transport the water back to next top basin in the event of excess power supply.

1.1.3 At suitable places, areas for flood control will be used as so-called polders. In order to facilitate this flood control system, the respective areas will be structured as terraces. In the event of flood hazards, a controlled amount of water can be directed to respectively designated spots and – by partially elevating the water level – flow into the polders.

1.2 Expanding River Sections to Waterways

1.2.1 By equipping weirs with ship locks, electrically operated ships can also navigate rivers used as waterways all the way to important business locations in the valley. This applies e.g. to Merano at the River Adige, Goerz at Isonzo River, Ponte al Tagliamento, Nervese della Battaglia at Piave River or Bassano del Grappa at Brenta River.

1.2.2 Ship locks: the ship lock of 112 m or 224 m length and 12 m width will be erected right in the river's bed with as sealed sheet pile walls, which are horizontally supported in direction of the respective river bank's crest. The support structure's watertight sheathing creates an air cushion, which – being covered by floor slabs – turns into a walkable and trafficable surface floating on the headwater. Each ship lock provides the option for a bridge to the other side that allows for crossing the river. The ship lock's locking components will be opened in the event of flood in order to allow the water's unimpeded drain via the lock, which does thus not constitute any obstacle or constriction to the river's profile.

1.2.3 Inside the lock, the water level is lifted or lowerred by means of pump turbines that pump retained headwater in or out through the channels flowing in at the sides.

1.2.4 Padova-Mare Waterway: in this context, it is intended to intergrate currently incomplete Padova-Mare Waterway with the inland waterway of Brenta River, equip it with a PV cover for power generation and open it for ship traffic.

1.3 Aquacultures

1.3.1 Within the respective impoundments, the volume of water will be – compared to the current level – increased many times over especially with respect to residual water ways. Given the present water quality, this will create good conditions for aquacultures, in particular for pisciculture. Since different species and sizes of fish will be kept in separate impoundments, fish migration is undesirable; a fish pass is thus not required. If necessary, the system facilitates a practicable crossing.

1.3.2 In a time of the seas suffering from overfishing, this new industrial sector (pisciculture in ecological river systems) globally faces a promising future. It is thus promoted by both, the Italian Republic as well as the EU. The Act No. 57 as from 03/05/2001 aims at supporting rural development and employment in the sectors of farming and pisciculture (aquaculture) and enhancing environmental protection and landscape conservation.

1.4 Development of Living, Recreational and Leisure Space at the Waterside

1.4.1 In the river basin, larger areas of water will be created to improve the scenery and – due to the increased evaporation rate – additionally ensure more pleasant climatic conditions. In the cities and other communities located at the waterside, the river will be given a new appearance: while the river bed was previously nearly empty due to draining or – depending on peak power generation - at times and certain sections nearly empty or filled with roaring masses of water, the river will now spread a peaceful atmosphere.

1.4.2 This newly found situation as waterside city or community will ensure the emergence of aquatic facilities for water sports, fishing spots at the riverside and recreational areas at suitable places. At the inflatable weirs, passages (slides) for boats might be set up.

1.4.3 Both, the aquacultures as well as the river basin's development into living, recreational and leisure waterside space will open new perspectives for the inhabitants' lives, activities and economic situation.

1.5 Redevelopment of New Available Areas in the Abandoned River Basin

Areas formerly occupied by the river and now becoming available – located outside the newly created river bed – will be used for new purposes such as for instance:

1.5.1 Transport Routes

It is intended to build traffic lanes for motor traffic, bikeways and footpaths on the embankments at both sides of the river. These will be connected to the traffic routes existing in the communities located at the waterside. One lane into each direction might be adapted for the use of electric powered vehicles.

1.5.2 Cultivated Agricultural Areas

More than 10,000 ha of abandoned areas in the river basin will be used for agricultural purposes such as rice growing. Depending on respective cultures grown thereon (tomatoes), they might also be roofed and used for PV power generation. The respective areas' irrigation should be realized by installing efficient and yet water-saving systems.

1.5.3 Theme and Recreational Parks, Sports Facilities, Tourist Facilities

1.5.4 Animal Reserves

1.5.5 Green Pastures

This allows for transforming the rocky and sandy deserts in said North-East Italian river valleys (that can even be seen from outer space) to **"green pastures"** – in order to quote former German chancellor Kohl's comment on the fall of the Berlin Wall.

In times of agricultural land shortage, desert landscapes along riversides are nonsense.

The presented concept for river basin management can be appropriately summarized by using the term **"River-Room-Recreation"** ("RRR" in short).

1.5.6 The restructuring and cultivation of respective riverside areas also includes the utilization of renewable energy sources.

2 ELECTRICITY GENERATED FROM RENEWABLE ENERGIES

2.1 Photovoltaic – PV

2.1.1 Canopy-Shaped PV Roofing for Rivers and Channels

Rivers and shipping channels are supposed to be covered with solar film that is affixed to span roof-shaped steel framework structures. The bearer frame's supports will be piled in on both riversides and – with rather broad rivers – additionally in the river bed. The membrane roof is intended to feature a slope of 45 degrees and laterally stop at a height of 5 meters in order to ensure the snow's safe skidding into the river and unhindered view onto the water.

Rivers are continuous spaces (corridors), which makes perfectly suitable for pipeline routes.

The membrane covering's bearer frame might accommodate

- power lines for various voltage levels;
- supply and overhead lines for inland vessels powered by electricity; and
- lanes for overhead tracks.

■ **Danube-Tyrol-Adriatic Waterway – Project B –**

If the waterways on the Rivers Inn and Adige, from Passau at River Danube all the way to Venice, were roofed with film on a length of Adige 620 km (in the open), this would result in a film-covered surface of 62,000,000 m² (620,000 m length x 100 m width).
Assuming from a rate of 100 kWh/m², this will result in a nuclear power station's annual output of 6,200,000,000 kWh or

■ **an annual output of 10,000,000 kWh per km of waterway.**

2.1.2 PV Roofing for Roads and Freeways

It is furthermore intended to also cover roads and freeways with PV film in order generated solar energy. Suchlike roofing would be realized in the form described above.

■ **per each kilometer of road 1,200,000 kWh and**

■ **per each kilometer of freeway 4,400,000 kWh of electricity could thus be generated per year.**

2.1.2.1 Power Lines

Underneath said covering, power lines for various voltage levels as well as one overhead line for electric vehicles per each direction could run.

2.1.2.2 Positive Side Effects of PV Roofing or PV Canopy:

- snow-free traffic lanes;
- no formation of ice or hoarfrost;
- no snow clearance, no use of de-icing salt or winter road sand required;
- longer pavement life;
- possible noise reduction;
- unhindered view to both sides of the road.

2.1.3 PV Roofing for Sports Stadiums, Intensely-Used Agricultural Land or Wherever Roofing Facilitates Multiple Use

2.1.4 PV Elements Floating on Water Surfaces e.g. Uncovered Reservoirs.

2.2 Wind Turbines

In order to utilize the updraft created by the air heated underneath the roofing, wind turbines will be installed horizontally in the roofing's gables. However, since respective empirical values are not available, their output cannot be estimated.

2.3 Hydropower Stations at the Weirs

2.3.1 At the individual weirs, sub-aqueous turbine generator units will be installed to generate electricity by using the available water and differential. Running reversely (thrust reversal), these units serve to pump to the respectively next higher basin and – in the event of excess supply – take electricity from the mains and save it as renewable energy.

2.3.2 In order to compensate production and consumption capacities, high-pressure pump storage hydro power stations will additionally be built in order to especially compensate output peaks and to optimize the electric current's transport through the power line network.

2.4 Electricity for the Use of Electric Powered Vehicles

The plants for power generation and transport are positioned alongside said main traffic routes (waterways, railway, freeway, national and federal roads, bikeways) and are thus ideal to:

2.4.1 feed the grid for electrified lanes on freeways, roads and waterways;

2.4.2 directly operate high-performance quick charging stations for electric powered vehicles, provided at roadhouses and parking areas **(Park & Charge)**.

2.4.3 Furthermore, the electricity might be fed into the railway supply system since the power station will be built in its direct proximity.

3 ELECTROMOBILITY

3.1 On Freeways, Roads and Waterways

3.1.1 At least one traffic lane per each direction will be equipped with overhead lines for electric powered vehicles. The respective line will consist of two respective DC conducting wires of 700-1200 V voltage.

3.1.2 Without any drive unit or differential, the electric drive will be directly realized onto vehicles' wheels.

3.1.3 On non-electrified roads, rather heavy-weight electric powered vehicles will be supplied by integrated power generators, which might in future be partly replaced by high-performance batteries.

3.2 Traffic Guidance and Control System, Power Control System

It is furthermore intended to equip the power lines running above the traffic lanes (overhead lines) with a traffic guidance and control system.

3.2.1 The guidance system facilitates automated driving for higher road safety.

3.2.2 The integrated control system allows for integrating the electric powered vehicles with a highly efficient local and trans-European power control system.

Each electric powered vehicle (bus, truck), which is supplied from overhead lines on electrified lanes, can employ its integrated power generator with an output of approx. J 200 kWel within just seconds, feed any possibly oversupply back into the same overhead line and thus turn from power consumer to power producer. 10,000 trucks (for comparison: 6,000 trucks cross the Brenner Pass every day) can generate the power of 2 nuclear power stations - i.e. 2,000,000 kW – to support the power grid. Possible local grid overload could thus e.g. be addressed by engaging the auxiliary power units installed in electric powered vehicles traveling the respective region.

3.3 Overhead Railway (Aerobus)

3.3.1 The bearer frame of the roofing of rivers, channels or freeways might accommodate tracks for a **suspension light-weight cable railway** (Wuppertal suspension railway, which runs above the River Wupper, alternatively the model overhead monorail Aerobus). The railway might consist of a basic vehicle (carriage), which a car for the transportation of passengers or a container for the transportation of goods is mounted to from below.

3.3.2 The **channel tunnel's arch** (78 km) provides space that can't be used by respective ships and is thus available for an overhead railway.

3.3.3 Course of the route: up from the north portal east of Innsbruck, the line will pass via train station Hall in Tyrol (where the entire rail traffic in the directions north-south and east-west will be made accessible) and then run through the River Inn valley all the way to Passau at the Inn underneath the waterway's roofing. In Rosenheim, the traffic lanes might be continued inside the freeway's roofing all the way to **Munich** interchange located further in the north. Up from the channel tunnel's southern portal, the traffic lane might follow the roofing of River Adige via Verona all the way to Venice.