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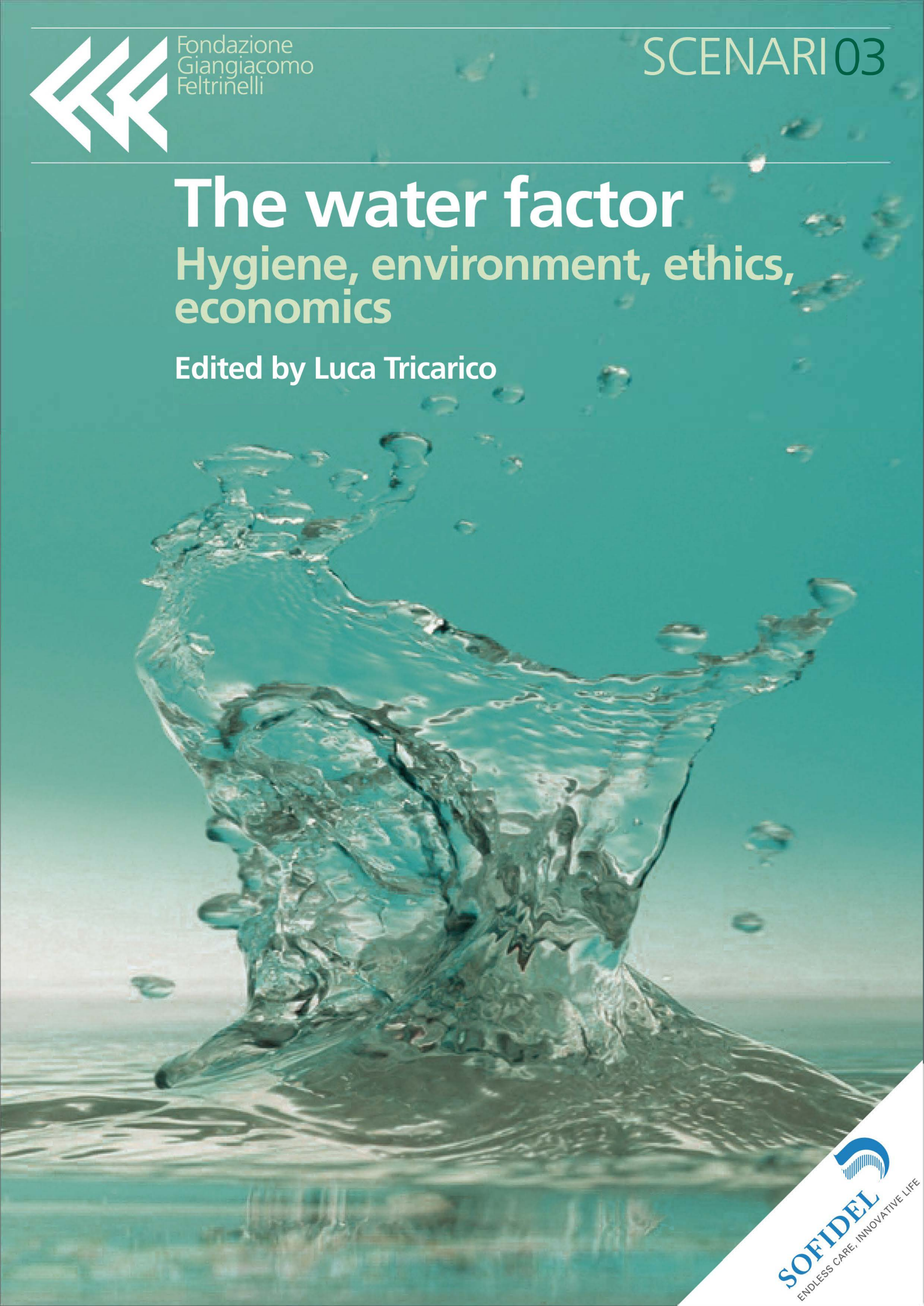
SCENARI 03

# The water factor

## Hygiene, environment, ethics, economics

Edited by Luca Tricarico



# SCENARI

# The water factor

## Hygiene, environment, ethics, economics

*Edited by*

Luca Tricarico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# The text

Water does many things: it questions our idea of sustainability; it forces us to rethink the word *economics* and extend its scope to environmental, as well as to all financial, accounting and political issues. Talking about water (in terms of availability, distribution, use...) means trying to focus on certain issues, first and foremost to promote the possibility of *doing* things: raising awareness about the need to act upon water resources to ensure their quality; recognizing water as a critical element which may alterate a delicate natural balance; considering everyday behaviors without underestimating emergencies or necessities.

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# The water factor

## Hygiene, environment, ethics, economics

# Luca Tricarico
## *Introduction*

Talking about water (in terms of availability, distribution, use ...) means trying to focus on certain issues, first and foremost to promote the possibility of taking action: raising awareness about the need to ensure the quality of water resources; recognizing water as a critical element which may alterate a delicate natural balance; considering everyday behaviors without underestimating emergencies or necessities.

Quality and access to water are key factors of hygiene and public health, of virtuous integration of mitigation and adaptation processes, of sustainable resource management (environmental, social and financial), of a proper business development, which should be motivated towards a rational, efficient and responsible use of the resource.

The following contributions aim at exploring all these issues and how they interact with one another, while providing support and food for thought to all those who are interested in the subject.

Water does many things: it questions our idea of sustainability; it forces us to rethink the word *economics* and extend its scope to environmental, as well as financial, accounting and political issues. This wider dimension is clearly evident in Luigi Einaudi's text taken from the magazine "Social Reform" [1], which we have reported below in this brief presentation and which calls on collective interest, ethical issues and public and private responsibilities, by initiating a fascinating political debate of great historical importance.

Water is essentially a public good, and in its use we measure the different

types of cultural awareness of every human future-oriented society. As a public good, it is a resource that needs protection as well as the development of consumers' guidelines. It therefore requires the application of good practices by the active population – the business and financial world as well as the consumers.

As far as the business world is concerned – and more specifically the industry of tissue production – this implies worrying about climate, energy, responsible consumption and access to water. In the business world, this rightfully implies considering its significance, i.e. the cost (in terms of investments, technologies and infrastructures) of making water accessible to everyone. In the consumer's world it is about the right to water access and widespread distribution, which reveals the shared necessity of promoting responsible consumption.

Let us be more precise.

As Laura Achene points out, water is an asset that requires to be developed, and it is becoming increasingly important to invest in it, in order to ensure its quality and safety. It is an essential aspect of human consumption and public health with a management plan that is implemented with the Water Safety Plans (introduced on an international level in 2004 by the WHO) and a global risk assessment approach that includes all the phases of the water supply chain – from collection to consumption. The question here is how quality and access to water are key factors in maintaining hygiene and public health.

At the same time, as Alessandra Goria shows us, water and its use are related to climate policies aimed at achieving the sustainability goals. This is especially true if water is seen as a factor of energy production, as well as of food safety and of attainment of adequate functional health conditions.

It's not just about ensuring water quality, or worrying about its distribution, but also about understanding how water can be related to the goals of sustainable development, both of "mitigation" – those actions that aimed at "tackling" the causes of climate change (e.g. reduction of greenhouse gases in the atmosphere) and that of "adaptation" (e.g. water use and role in sustainability policies to counter climate change). If water, as a

source of renewable energy, can be exploited in climate-reducing emissions policies, then the development of techniques for the most efficient use of water in agriculture and in the most vulnerable sectors of climate variability could play an important role in adapting to climate change within sustainability policies.

In this regard, Antonio Massarutto's contribution emphasizes the problematic nature of water as a resource, disregarding the debate on the alleged scarcity of both fresh and salty water (which can be desalinated). The problem of water, he argues, is not even a consequence of consumption, which in fact is not critical. Because, he notes, "water resources are not finite, as is the case for fossil fuels. Water is constantly renewed through the flow, evaporation and precipitation cycle". The real issue, says Massarutto, is access to water at a reasonable cost. Which does not actually imply the scarcity of water, but the possibility of equal access, because water is not uniformly available on the planet: the rich areas of the world use, abuse, and waste water resources, while many others can only count on very small quantities, in any case unsufficient. Thus, in a planetary perspective, the issue of water lies in its proper management and in intelligent consumption. A "smart consumption", Silvio De Girolamo points out, involving businesses first and foremost, in a type of "water management" that includes both industrial policies and the regulation of water use for consumers. Surely the role of businesses in water resource management is a central issue and sustainability must focus on how technology can support its proper and efficient use, as well as the recycling process of this fundamental resource. However the implementation of best practices to promote the active role and sensibility those consumers should demonstrate is no less relevant.

By reading this overall outline, we realize how many-sided the considerations on the water factor are, and how intertwined both within the individual sphere and in social, industrial and political organizations. This study provides us with a depiction of the articulated interests that lay behind water management, as well as opening up the debate over a fundamental right for human life.

1 The publication is kept at the Fondazione Giangiacomo Feltrinelli.

# Luigi Einaudi [*]

## *The government of resources*

In recent years, the use of hydraulic forces has made huge progress, mostly because of its ability to transmit energy at a distance. Many waterfalls, which had been forgotten in the gorges of our Alps, suddenly became exploitable with profit.

The number of applications for concessions grew and the legislation of 1888 proved to be inadequate and imperfect. The recent circular of the Minister of Public Works, Afan de Rivera, rules that the State should be the sole user of most important hydraulic forces. The controversies sustained by Afan de Rivera against the Southern Railway Direction on *Nuova Antologia* are well known, as well as the vigorous protests that have arisen from industrialists and public authorities against a norm which – with the pretext of reserving water forces to the benefit of future electric traction – prohibited industrial enthusiasts from exploiting a driving force of national economy which had been neglected up until today. The Minister of Public Works appointed a commission to study the modifications to be made to existing laws and regulations. Hopefully the Commission's work will lead to good results.

In the meantime, I think it is appropriate to briefly summarize the fundamental concepts of the new legislation on hydraulic forces adopted by a state that, in this respect, has some resemblance to Italy.

The Province of Ontario in the dominion of Canada, just like Italy, cannot rely on any coal resources. Up until today, it has therefore found itself in a manifest state of inferiority, compared to other Canadian Provinces and the United States, who can count on great mining and industrial resources.

Ontario has many waterfalls and rivers that can now be exploited by remote transmission. Raw materials for many industries are available at close proximity: sawmills as well as furniture, paper, wood and matches factories could rise and combine the abundance of raw material with the cheap energy market. This also applies to the mines that lie intact at present because the slightness of pure mineral wealth only allows a limited investment for processing; these mines could ultimately be exploited with great profit. The huge low-grade iron ore deposits that lie to the north of Lake Superior and the Seine are often located near waterfalls which could provide hundreds and thousands of horsepower at a relatively low cost.

Other industries, such as wool and cotton mills, other mills and chemical factories could spring up in the most convenient places to easily sell the goods as well as obtaining the necessary power with the electric transmission.

The extraordinary importance of hydropower for the industrial and economic future of Ontario after the recent discoveries in long-distance transmission has led the Government to look into new provisions in accordance with the principles established in all Anglo-Saxon colonies, regarding the concession of those resources that can be considered as natural monopolies, such as mines, forces, water, forests and land.

It is Henry George who has inspired the principles of this new legislation: individuals must not monopolize natural wealth: it should belong to the nation. When mines, water, forests and land are granted to private citizens, very soon a class of landlords forms itself with the sole purpose of extorting the greatest possible profit (through monopoly rent as well as differential rent) from the actual entrepreneurs and workers who wish to invest capital and labor in the gifts of nature. Since it is not possible to prevent annuities – and the monopolist of a natural resource will always demand the highest possible price – the property of natural wealth should be assigned to the nation as a whole. As the sole monopolist, it will temporarily hand over the use of the resource to entrepreneurs and workers in exchange of a fee corresponding to the utility of the resource. Thus the nation will benefit from the monopoly and differential incomes it is entitled to receive. Because

the nation alone – and not individuals – is the rightful representative of the human communities that, generation after generation, are entitled to benefiting from the gifts of nature. This system will allow the entrepreneurial class to better express their energies than under the system of private property ownership. They will pay the nation a fee for the temporary use of natural resources; however this fee will not exceed the amount they would pay to the landlords; furthermore taxation on industries and businesses will be reduced, because part of public expenditures will be covered by the royalties. And there are many other advantages in nationalizing natural assets. Private owners grant the use of their monopolistic wealth only if business is convenient, and are often driven to keep them away from the market in order to increase their value, which explains the speculation spreading in all new countries, and in Italy especially, with respect to hydraulic forces. Huge private monopolies are created and become a perennial threat to national prosperity and independence of public powers. Whereas the nation, as the sole owner and monopolist of all natural resources, can temporarily offer a very good price to the actual entrepreneurs in order to create numerous and flourishing industries, and increase the fee to the maximum possible extent when, at the expiration of the first lease period, the businesses have reached a solid structure. The capitals, once they've grown stronger, should be content with a small fee, and the growing population entitled to claim an enlargement of the state functions, which should correspond to an increase in public revenue.[1]

These fundamental principles – preventing speculation, granting quick and easy use of the hydraulic forces to the actual entrepreneurs and industrialists, reserving the state's property and the yield of public waters – have inspired the act approved on January 17, 1898 by the Parliament of Ontario (*An Act respecting Water Powers* , 61 Vict. Chap. 8) as well as the regulation adopted by an *Order in Council* of the Lieutenant Governor on June 21, 1898. [2]

The act is extremely short; with a single article it gives the Commissioner

of the lands of the Crown faculty to reserve the concession of all water resources – along with an adjoining area to erect buildings and facilities – to the state, as well as the right to open and use the necessary access routes to exploit them. The Commissioner will be able to fill in a regulation form in which terms of sale, lease and use of hydraulic forces are indicated. Based on this act, a regulation was issued, which applies to those hydraulic forces, that have at least a potential horsepower of 150 under normal and medium water conditions. The hydraulic force together with the bordering land necessary for the construction of canals, tunnels, tanks, industrial buildings, etc., for the use of water, constitutes an autonomous and separate property from the surrounding lands and is governed by the provisions as follows:

Those wishing to obtain a hydraulic power concession must submit the plan filled in by an *Ontario Land Surveyor* to the *Department Of Crown Lands* with the following indications:

Situation of the required hydraulic forces, and description of the bordering land needed for the development of the exploitation;

Height of the fall or rapid, water volume in average conditions between strong and weak water flow; estimated horsepower; height of dams or shelters that are intended to be built; increase in the water level likely to be caused by the above-mentioned shelters or dams;

Nature and situation of the industry, plant or manufactury for which water exploitation is sought, and horsepower the applicant intends to use within two and within five years;

Plan for the use of hydraulic power, with the indication of the shelters, dams, tunnels, siphons, aqueducts, wells and other constructions or installations; estimated cost, and ways of using or transmitting power with direct energy, electricity or compressed air, etc.

The areas that risk being flooded or otherwise damaged by rising water levels or by the construction of sanitation, dams, aqueducts, siphons or any other constructions.

The Commissioner of the Crown Lands has the right to request measures, plans, descriptions, levels, sketches and any other information that he/she believes necessary to properly assess the application. All costs are borne by

the applicant. Similarily, the construction of sanctuaries, dams, tunnels, aqueducts, siphons, canals, wells and other works cannot be carried out without approval of the plans by the Commissioner.

The applicant will have to provide evidence of his financial situation and his ability to exploit the required resource; this information must be valid and persuasive.

All these provisions, along with others, are intended to ensure the State, owner of the water resources, that they will be granted to an actual entrepreneur and not to a speculator planning to sub-sell the obtained concession.

Then come the rules regarding the concession, which is always temporary. The lease has duration of ten years, with the right to renew for a further period of ten years, and, provided the agreed obligations have been met, further renewal for twenty years. The annuity must be paid each year in advance in the amount decided by the Commissioner. The concessionaire's right may not exceed the duration of forty years. The whole period is then divided into several parts, allowing the contract to be solved; additionally, the fee may be increased in proportion to a possible increase of the value of the hydraulic force or to more prosperous economic conditions in the country.

Detailed rules regulate the operation of the water concession.

If an applicant wishes to use no more than half of the force requested, the Commissioner can grant it, retaining the right to grant the other half along with its bordering land. The concession of water resources cannot diminish or damage the legal right of forest owners to let down their wood along rivers or streams. The tenant shall not prevent or obstruct the navigation of any river, stream or waterway, and shall provide for the construction of canals, crossings, etc. to keep ensuring a clear passage.

Within the period indicated in the lease agreement, the concessionaire shall use at least half of the obtained power and will have to use the remaining part within a further period as indicated in the contract. He or she will have to allow others to use the part of the hydraulic force that is unused because it is unnecessary for his industry or manufacturing. The

tenant and the subsequent applicant will agree upon the sub-concession conditions; should the parties not agree, the governor would set the mandatory conditions for the parties with an *Order in Council*. Once again, this rule has the purpose of preventing the buying-up of hydraulic forces by a class of landlords to the detriment of the industrialists truly wishing to exploit them. To make the buying-up even more difficult, the dealer who cannot or does not want to fulfil his obligations or is late in the payment of the annuity of over ninety days past due, will certainly have his or her right revoked. Similarily, after the exploitation process of the hydraulic power has begun, be it just partially – should the concessionary neglect to exploit the resource for the benefit of both his customers and his own for over a year, the governor may declare the lease contract as null and terminated, unless the concessionary finds the negligence to be due to force majeure.

Clearly the above rules provide sufficient guarantee for industrialists to obtain the use of hydraulic forces at a fair fee without having to overcome the obstacles of the hoarders, for a period of time (40 years) sufficient to write off the entire capital of the plant.

Thus the state succeeds in rapidly developing the resources of the country confident that the competitive mechanism will give it the full value of public water monopoly. If there is only one applicant, the annual rent is fairly determined by the Commissioner of the Crown, based on the available scientific data regarding the relevance of the requested resource; if there are several, the Commissioner has the faculty – not the obligation – of setting up an auction in order to assign the exploitation of the site to the best bidder. This system lies half way through the system of the right of the first petitioner (or inventor) and the auction system. The great freedom given to the Commissioner and the great power he may exert could be potentially dangerous in countries ruled by omnipotent and corrupt bureaucracy, but no disadvantages may derive from it in countries in which accusations of immorality to public officials are unknown and where public opinion puts pressure on morality.

The concessionary, as the whole context of the law clarifies, is not the sole owner of the waterpower, but only a temporary usufructuary and must

therefore return the obtained resource in good conditions at the end of the rental period.

A clause in the contract requires the tenant to keep all sanitation, dams, tunnels, aqueducts, siphons, canals and wells in good condition during the whole rental period, as well as any other construction built for the exploitation of the hydropower; it prohibits him or her from damaging or destroying them, be it just partially. At the expiration of the lease, the hydropower will be returned to the State, becoming its absolute property again – just as if the rent had never been granted –, along with all shelters, dams, tunnels, aqueducts, siphons, canals, wells and other constructions or works erected by the dealer and all the buildings and lands included in the rent. The concessionary will only have the right to remove the machinery he has used within a reasonable period of time, which is determined by the Commissionary of the Crown. After this deadline, all the machinery that will not have been removed will become property of the State.

Mostly, people will find it sensible for the renter to lose the right to use the hydraulic force after termination of the contract; but the confiscation without compensation of all constructions carried out with the tenant's investment will appear excessive and unfair. Yet with this rule, and rightly so, the State conforms to the system adopted in all Anglo-Saxon countries by all private owners, who see no infringement of the law and feel that no legitimate interest is damaged when the tenant is warned from the very beginning of the fact that after the lease period the State will go back to owning not just the bare soil – the mines or the waterfall – but all the improvements made by the tenants with his intelligence and with his capitals as well. The only consequence is that the tenant will have to redeem all the capital of the plant during the period of lease and will pay the State a lower fee to compensate the costs deriving from the obligation of amortisation.

Returning the improvements made by the tenant to the State will cause no financial loss for the tenant, and at the same time the provision eliminates the possibility of controversies over whether or not it is possible to conciliate the rights of the owner of the hydraulic force and those of the

private owner of the improvements. The confiscation of the improvements may be problematic if the rental period is too short to allow the amortisation of the capital, but if we exclude this exception it is not only a rule of good and wise management of public assets but also a powerful incentive to redeem the capitals in the shortest possible period of time, which represents a necessary condition of success in a time where science continually renewes the technical processes of all major progressive industries.

The standards currently under consideration in Ontario's hydropower legislation may not, unless precise modifications are made, apply to all countries where there is a need to properly adjust the use of such a precious natural resource; but the key concepts that govern the legislation of a new territory such as Ontario should definetly serve as the foundation of Italy's legislation, which is also a new country with respect to the exploitation of waterfalls.

The protection of hydraulic forces in the national interest may perhaps be the first sign in Italy of trend reversal against the infamous politics that – as the italian State was forming itself – have squandered our magnificent public territory by encouraging individual initiatives and protecting indolent landowners to the severe detriment of those populations deprived of any rights of expolitation on public and ecclesiastic land. Populations which, up until now, have in vain been lured by the illusion of buying and preserving the property of the land which has been fertilized by the sweat of their fathers and ancestors.

[*] Originally published under the title *Un esempio di legislazione nazionalizzatrice sulle forze* in "La Riforma Sociale", vol., Vol. VIII, Fasc. 10, October 15, 1898, pp. 967-973. The legislation and regulation of energy sources for the industry began in the second half of the nineteenth century. The first intervention field is water. Starting with the legislation implemented in Canada in the 1980s, Luigi Einaudi suggests to consider the need to properly regulate the use of water resources. He is persuaded that this policy is of paramount importance for all industrialized countries, but above all for those, like Italy, who are lagging behind the process of industrialization. This consideration represents for Luigi Einaudi the first act of reparation against a policy that until that moment had squandered the State property land for the sole benefit of the landowner and the detriment of the countryside population. [Ndc]

[1] See Henry George's writings and the vast American and Australian literature on the subject. Among Italian researchers, the unfinished work of Ugo Rabbeno is definitely noteworthy, in *La quesione fondiaria nei paesi nuovi*, Torino, Bocca, 1898. With regards to the nationalization of mines, I wrote a chapter in a study on the mining industry which will soon be published in Volume IV of the fourth *Serie della Biblioteca dell'Economista* in which the ways and difficulties of implementing the nationalization idea are also discussed. [cfr. Luigi Einaudi, *La rendita mineraria* , in *Biblioteca dell'Economista*, S. IV, P.te 1, UTET, Torino 1900, pp. 371-816]

[2] See the text of the law and the regulation in *Seventh Report of the Bureau of Mines of Ontario*, Third Part (Thomas W.

Gibson Water, Power of Ontario pp. 251-56). Toronto, Warwick Bro's and Rutter, 1898. The reports of the Mining Office (that have now reached Volume VII) and of the Office of Industries (of which fifteen of them have already been published) of the Canadian province of Ontario represent a precious source of economic facts about that most interesting region of the Canadian dominion, thanks to the intelligent work of the directors Archibald Blue and CC James.

Laura Achene [*]

# *Quality control methods and criteria of Italian waters: Current issues and perspectives*

**Introduction**

Access to drinking water is essential for individual and collective health. A symbol of ethical value for ancient civilizations, today it has become, along with sanitation, a human rights issue in UN, WHO and EU programs. It has become a fundamental principle of the social and economic well being in every community.

The European policy decisions, expressed in rules, regulations and domestic legislation, aim to ensure that safe water be available, in sufficient quantity and in any environment, household or business, continuously and at sustainable cost. In Europe, the EC Legislation 98/83 is intended to protect public health from the negative effects of contamination of water intended for human consumption, ensuring its health and hygiene. In Italy, the main legislative reference is the Legislative Decree of February 2, 2001, No.31, which implements the European Directive with the precise aim of protecting human health from the negative effects of water contamination.

In its formulation, the EC Legislation 98/83 provides that the legislation itself be subject to a regular reassessment process to ensure the adequacy to the scientific and technological advances in the industry, as stated in Art. 11 and 12 [concerning state and autonomous and provincial powers respectively].

After a long debate between within the competent bodies, the Directive (EU) 2015/1787 amending Annexes II and III to the EC Council Directive 98/83

regarding the quality of water intended for Human consumption was adopted, with a special focus on the principles of risk analysis issued by WHO several years ago.

#### European and Italian legislation on water intended for human consumption

The first European Water Directive for human consumption dates back to 1970 [EEC Directive 75/440]: it is therefore only since 1976 that rules on drinking water have been laid down on a modern and shared basis at State Community level. Subsequently, there were several updates to follow the scientific and technological developments of knowledge, taking WHO guidelines into account. The current legislation on the protection of water intended for human consumption, EC Directive 98/83 – which was developed at European level and implemented nationally with Legislative Decree no. 31/2001 and subsequent amendments and addenda – prescribes minimum salubrity, physical, chemical and microbiological requirements (parameter values) wherever water is available for consumption. As far as radioactive substances are concerned, a specific regulatory framework was issued by the Euratom (Euratom Council Directive 2013/51), with specific requirements regarding radioactivity in drinking water, thus removing the monitoring from the CE Directive 98/83 and, at the same time, updating the list of parameters for inspections, ensuring uniformity, consistency and completeness of the legislation.

In Italy, 85% of water intended for human consumption is provided by groundwater, which is naturally protected. Water service providers and local authorities, with the help of advanced technologies, carry out a comprehensive system of inspections. The systematic monitoring carried out in the area shows the overall efficiency of hydro potables as far as the quality of provided water is concerned: as a whole, only a small number of non-compliances in certain areas of the territory is found. The non-compliance to regulatory standards of quality requirements in water intended for human consumption – which is in any case handled with appropriate criteria to monitor the risks for involved populations – proves

the efficiency of monitoring systems as well as providing substantial knowledge to strengthen risk prevention actions. Figures 1 and 2 show non-compliance data to parameters subject to ordinary inspections for hydro-potable supply for over 5,000 inhabitants between 2011 and 2013.

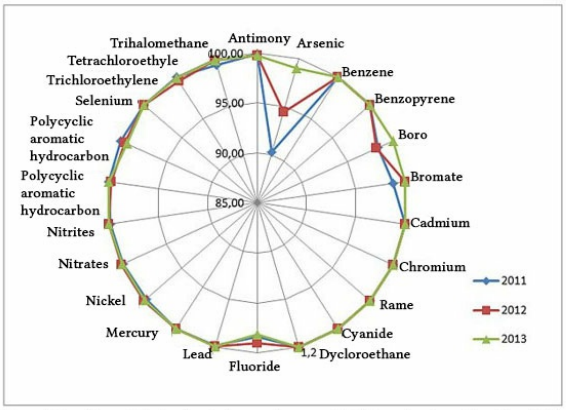


**Figure 1** Compliance data for chemical parameters are subject to routine inspection (about 80% of the national coverage) for hydro-potable drinking water more than 5,000 inhabitants in 2011-2013.

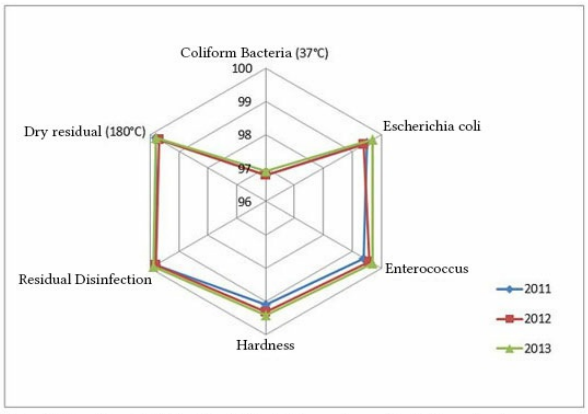


**Figure 2** Compliance Data for Microbiological Parameters and Indicators of routine inspections (approximately 80% of national coverage) for hydro-potable supplies over 5,000 inhabitants in 2011-2013 (Source: Regions and Autonomous Provinces).

The assessment of suitability for consumption of drinking water is therefore based on conformity of inspections according to a number of microbiological, physical and chemical parameters, which are to be performed only downstream the distribution chain, with a retrospective approach. This approach however suffers from reduced accuracy in relation to:

1) Parameters sought with respect to the many potential chemical, physical, biological and radiological agents that could be found in the waters due to contamination at the source and possible interactions with materials and products used for treatment and distribution,

2) A monitoring system that, though frequent and strategically distributed in water systems, represents a small number of inspections over the spatial and temporal extension of the water distribution.

A key response to this prevention-based control mode is the adoption of a new holistic approach based on the Water Safety Plans (WSP) model promoted by the WHO. The EC Directive 98/83 provides, as set out in Articles 11 and 12, a periodic assessment to ensure the method is up to scientific and technological standards. In this respect, after a long discussion among the various competent bodies, the European Commission has come to the adoption of Directive 2015/1787 in 2015 amending Annexes II and III to the EC Directive 98/83. This directive is an important turning point, and it marks the transition to the implementation of concepts and practices of the Water Safety Plans in European Union countries.

**Water Safety Plans**

The Water Safety Plans were introduced in 2004[1] on an international level by the WHO and implemented by national guidelines [2] after specific application experiences. They define the necessary criteria, methods, activities and responsibilities as well as the needed time and resources to ensure the safety of water intended for human consumption by means of an approach for evaluation and global risk management encompassing all stages of the water supply chain, from collection to consumption.

The risk analysis introduced in EU Directive 2015/1787 presides over the introduction of a flexible inspection system; in certain circumstances it may require the fulfilment of specific parameters for the aqueduct system (e.g., not ordinarily included parameters such as thallium, perfluoroalkyl compounds, uranium, etc.). On the other hand, in other circumstances and conditions, it may limit the sampling and eliminate not-significant parameters, thus reducing costs without affecting public health or other benefits.

Therefore, according to the results of the risk assessment of a hydro-

potable supply chain, and after a transitional check-period of the new system, the list of monitored parameters can be expanded or reduced, and the frequency of sampling increased or decreased, according to conditions laid down in the directive.

This represents a shift from a retrospective approach – exclusively based on supervision – to a proactive approach, based on risk assessment and management, i.e. on prevention and control. In this context, it is also important to implement systems and strategies of Early Warning System which – among other things, where technically feasible – can exploit the use of adequate monitoring networks in continuous use, to allow optimization of the number and types of laboratory analysis. The WSP approach is applicable to all water supply systems, regardless of their size and complexity.

Difficulties in designing and implementing the plan can be found mainly for Small Water Supplies (SWS), which represent important and critical situations in the Italian aqueduct scenario.

The development and application of a WSP approach to a hydro potable system is an important and challenging process in terms of intellectual and time resources for the various experts involved, not only at the level of the hydro potable system but also for all those who, one way or another, have an influence over or are interested in water quality. The working group, coordinated by a team leader, should be made up of experts who have a thorough knowledge of each segment of the water supply chain. This means involving managers, engineers in various sectors (management, maintenance, design, investment), experts in water quality assurance (microbiologists, chemists, physicists) and other technical personnel, all with deep knowledge of routine operations.

The WSP implementation also represents an opportunity for growth and development for water managers, thanks to the knowledge of the critical features of their hydro potable system, the promotion and circulation of more efficient operating procedures, providing tools to cope faster and more efficiently with possible dangerous events. In this context – as the new directive requires – the inspection of the WSP at local level is an essential

element to ensure that the plans are complete, properly implemented, effective and constantly improved, in order to receive approval for them by the competent national health authority.

A multidisciplinary team that represents various institutions and types of expertise – put together by the Istituto Superiore di Sanità and the Public Health Ministry – is currently developing guidelines for WSP auditing and approval, based on recent WHO guidelines [3].

**Conclusion**

Access to clean and safe drinking water is a fundamental human right and one of the key determinants of human health. The quality parameters to be observed for drinking water in Italy are defined in the Legislative Decree 31/2001 and subsequent amendments and addenda, transposing EC Directive 98/83 which sets out the conformity compliance criteria and indicates the responsible institutions for the inspections as well as the procedures by which they are to be carried out. The World Health Organization has been introducing for several years a new approach towards water inspection; this model, the Water Safety Plan, has been transposed at EU level in the new EU Directive 1787 and regulates risk assessment and management across the entire water supply chain. This approach aims to ensure a significant strengthening of all prevention and control strategies.

* Istituto Superiore di Sanità, Department of Environment and Health - Department of Hygiene of the Inner Waters.

1 World Health Organization. *Guidelines for drinking-water qualitu. Volume 1. Recomendations*, 3rd Edition. Geneva: WHO; 2004.

2 Lucentini L., Achene L., Fuscoletti V., Nigro Di Gregorio F., Pettine P. (eds.), *Linee guida per la valutazione e gestione del rischio nella filiera delle acque destinate al consume umano secondo il modello dei Water Safety Plans*, Roma, Istituto Superiore di Sanità, 2014, Rapporti Istan 14/21.

3 Drury D, Rinehold A. *A practical guide to auditing water safety plans.* World Health Organization (WHO), Switzerland, and International Water Association (IWA), United Kingdom; 2015.

Alessandra Goria [*]

# *Water: a precious resource for mitigation and adaptation policies for climate change*

**Climate change**

On World Water Day, educational and emotional videos about water and its value for our planet and for humanity as a whole are shown everywhere. The messages are *water is the world*, *water is food*, *water is health*, *water is energy*.

Water really is all of this: an essential, extremely precious resource for life on Earth. And it is mainly through water that climate change affects the ecosystem – and consequently, the development and well-being of societies.

It is therefore important to understand the extent to which the climate is changing, and the effects on water, the whole ecosystem and on economies and society[1].

During the last 10,000 years the Earth has had a relatively stable climate, characterized by changes in global temperatures below 1 °C over a century, and by societies that have evolved adapting themselves easily to the natural variability of climate; but the situation today is quite different. In an increasingly overcrowded and energy-hungry world, mankind is responsible for the uncontrolled growth of greenhouse gas emissions that are affecting the climate system and it is forced to adapt to climate change in a context of strong pressures and scarce resources.

The scientific community now agrees in acknowledging that global warming is a fact, and it is most likely that human activity is the main cause of the global warming, which has been registered since the mid-twentieth

century, with the exceptional increase of the so-called greenhouse gases emission into the atmosphere (mainly $CO_2$, methane and nitrous oxide.

The concentration of $CO_2$ in the atmosphere in 2013 has exceeded 400 parts per million (ppm. Today it reaches 406 ppm: values like these have never been reached before – not in the past 800,000 years, at least – and should be compared with the estimation of stable concentrations around the level of 280 ppm in the pre-industrial era. The increase in $CO_2$ emissions, which has characterized the growth of developed countries from the "industrial revolution" to today, has literally exploded in recent years.

This is also true in emerging economies: in 2006, China overtook the United States in the country's $CO_2$ emissions ranking. Today, China continues to account for about 25% of the emissions[2], followed by the US, with 14% of global emissions, and then by the EU, India and Russia - although in per capita terms, the United States and major developed countries still hold the bitter record.

The analysis of the emission sources shows that almost 40% of global emissions come from the production of electricity, heat and transportation. Other responsible industries are land exploitation, agriculture, forests, and waste production.

Along with the global temperature of the atmosphere and the oceans, climate records show that melting of snow and ice has considerably spread in the last few decades, and that seawater levels have risen like never before in history at global level – with a continuous trend of growth.

The recent findings of the Fifth IPCC[3] Report on the physical science of climate showed an overall average increase in the surface temperature of the Earth over the years 1880 to 2012 by as much as 0.85 °C, based on measurements both on continents and oceans.

The IPCC also points out the fact that the period of thirty years going from 1983 to 2012, when continuous data on temperatures were available thanks to the satellites, was probably the hottest in the Northern Hemisphere in at least 1,400 years.

There was an increase of the level of marine waters of 19 cm on a global

scale between 1901 and 2010, with accelerated growth in recent years, due to both the melting of ice and the thermal expansion of the waters, which have become warmer and warmer in the last 40 years, absorbing over 90% of the extra energy accumulated in the climate system.

The warming of the atmosphere and the reversal of glaciation are certainly no new phenomena for our planet: the novelty is the role of mankind in these processes.

The warming trend will be irreversible for many decades in the near future, and higher temperature increases will also occur if greenhouse gases continue to accumulate into the atmosphere. To avoid this, a severe reduction of greenhouse gas emissions must be implemented.

Global warming will inevitably increase risks and create pressures on society, on the economy, on ecosystems, and on nature as a whole throughout the 21$^{st}$ century and beyond, forcing society to respond to a changing climate. The impact will result in huge and in some cases irreversible damage, which will most likely affect the poorest and most vulnerable countries. Furthermore, if no action is undertaken, we will have to face outrageous additional costs.

Sea level rise, droughts, losses in agriculture, spreading of new diseases, mass migratory movements and conflicts are just a few of the many consequences of climate change we must expect in the near future, along with a series of 'chain reactions' that will multiply the damages and the costs.

Estimated damages range between 1 and 5 percent of the average global annual GDP, for a temperature increase of 4 °C, and can reach up to 10 per cent – or even more, if we take a series of risks and potential effects into account – in case of a higher temperature increase and zero-discount rates policy.

The impact is higher in the poorest areas of the world, those more vulnerable to climate change from an environmental, economic and social point of view. Paradoxically, the poorest and less emitting countries are the ones that are already undergoing and will suffer the greatest damage. And

emerging economies, who have always scarcely contributed to the accumulation of greenhouse gases in the atmosphere, are asked today to reduce their emissions, while they are going through a phase of energy-consuming, fast economic growth, and to face costs of up to trillions of dollars each year, primarily to support energy efficiency and new technologies.

Climate and energy policies must therefore meet development policies, addressing the needs of development – or sustainable growth – in poor and emerging countries. Let us consider that in the Global South, 1.3 billion people still have no access to electricity today, and 2.6 billion people use fossil fuels cookers and heaters that are harmful to health. More than 95% of these populations live in Sub-Saharan Africa and the less developed regions of Asia.

At the Paris Conference of Parties (COP21 in December 2015, the International Community adopted the first global and legally binding climate agreement, in which 195 countries committed themselves to submit a National Action Plan by 2020 to maintain the average global temperature below 2 °C. The International Community also recognized the need to help the poorest and most vulnerable countries in implementing appropriate mitigation and adaptation policies, confirming their commitment to mobilizing huge resources – i.e. US 100 billion dollars per year by 2020 - through The Green Climate Fund.

#### The impact of climate change on water resources

The foreseen increase in temperatures and in the frequency of extreme events expected for the coming future will have an impact on the availability of water resources, in particular on the size and distribution of rainfall, on ice melting, on river and aquifer capacity, as well as on the quality of water – with effects that will vary in different regions of the world – resulting in severe impacts on the economy and the society.

**How the world will change.** The recent World Bank Report on future

scenarios in a + 4 °C[4] world advances that the melting of glaciers and snow in the regions of the main mountain ranges – the Hindu-Kush, the Himalayas and the Andes – throughout the century will reduce the availability of water and the hydroelectric potential in areas populated by over one sixth of the world's population.

Changes in rainfall and temperature will also affect the outflow and availability of water, with consequences that will vary in the different geographic areas of the planet.

Before the end of the century, more frequent and extreme rainfalls will also increase the risk of flooding in areas inhabited by 20% of the world's population.

As far as agriculture is concerned, global crop yields are expected to decrease as temperatures rise above 3 °C. At these temperatures it is estimated that some African countries may lose up to 50% of their crops on non-irrigated land, generating price increases for agricultural products as well as widespread poverty.

The coasts will be exposed to increasing risks of erosion and rising sealevels; the most vulnerable areas will be the small islands of the Pacific and the most densely populated Asian and African regions.

Our planet's population will suffer from growing malnutrition, increased cardio-respiratory problems, infectious diseases, and dysentery – largely caused by poor water quality.

**How Europe will change.** According to a study by the European Environment Agency[5], the most vulnerable regions to climate change in Europe are Southern Europe, the Mediterranean basin, the most remote regions of the continent as well as the Arctic.

Let us look at some figures: the impact of climate change on rainfall and on retreat of glaciers in the second half of the century will lead to an increase of at least 5% of hydroelectric production in Northern Europe and a decrease of at least 25% in Southern Europe. Moreover, climate change will have severe impacts on the quality and availability of water resources,

affecting many industries among which agricultural production, given that over 80% of farming land is irrigated by rains alone.

The areas suffering high water stress in Europe will increase from the current 19% to 35% in 2070, with financial as well as social consequences leading to new dynamics of migration flows, especially in the Mediterranean region.

The results of the recent Peseta project[6] confirm these predictions, estimating that, with a temperature increase of about 5.4 °C by the end of the century, the of Southern regions will be the ones suffering the largest loss in agriculture, with harvests falling by about 25%.

By 2080, the population suffering damage caused by the flooding of rivers and floods, mainly in the regions of central Europe and the British Isles will double, compared to the end of last century.

The most pessimistic forecasts for the population affected by rising sealevels in the absence of adaptation measures at the end of the century are even more impressive: estimates reach up to 5.5 million people, mostly resident in the British Isles, Southern Europe, and the northern coasts of Central Europe.

#### Water as a resource for mitigation and adaptation

We can think of mitigation as the series of actions aimed at tackling the causes of climate change. Mitigation is defined by the United Nations as all the human efforts to reduce the emission, or increase absorbtion of greenhouse gases in order to reduce their concentrations in the atmosphere.

Adaptation is defined by the IPCC as “adjustment to ecological, social or economic systems in response to current or expected climatic stimuli and their effects and refers to changes in processes, practices or structures to reduce or counteract potential damage or to seize those opportunities associated with climate change.”

Just like mitigation, adaptation is also necessary, because the effects of climate change are already real and they are bound to amplify.

**Water as a mitigation tool**. Water is a key resource for renewable, clean energy sources that can play a crucial role in countering climate change. Water is one of the most common renewable energy sources, along with solar, wind and geothermal energy and biomass. In Europe, the increase in energy production from renewable sources is one of the three objectives of the EU 20-20-20 goals to be achieved by 2020, bringing the share of energy from renewable sources to 20%. Renewable energy comes from natural sources and processes that regenerate faster than consumption.

Water is one of the oldest sources of energy production. Currently, hydroelectric power covers just over 2% of the world energy demand; 800,000 dams generate 14% of electricity worldwide approximately. Rainwater basins occupy about 300,000 $km^2$ globally, an area as large as Italy.

For many countries, hydroelectric power is an important source for electricity generation: in Norway it covers 96.7% of power generation, 75.2% in Brazil, 64.8% in Venezuela and 60% in Canada.

In Italy, the use of new and promising renewable sources has significantly developed in solar and biomass power production in the last decade – the latest data provided by the Electrical Services Manager show that in 2016, renewable sources covered about one third of total power consumption – whereas hydroelectric energy has lost ground.

After having been the main source of electricity until the sixties – 82% of total production – the share of hydropower has gradually decreased, while the produced quantity remained unchanged. In the eighties, the share of hydropower had already decreased to 25%, while thermal electric power had grown from 14% to 70% in the same period. Hydropower today covers about 16.5% percent of total electricity consumption.

The potential of hydroelectric resources in our country – estimated at about 65 TW – is exploited at almost 90% of its potential, and does not seem to offer expansion opportunities. The potential which may be exploited consists in the realization of micro-hydro, low power systems – less than 10 megawatts – demanding less technical and financial investments and

causing low environmental impacts.

Hydropower is not the only possible exploitation method of water as a clean energy source. Energy production from waves, streams, tides, as well as thermal gradients between surface and deep water is being studied by the scientific community, which aims at developing new sources of energy for green and sustainable growth

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**Water and adaptation**. In addition to the water mitigation potential, the development of techniques for the most efficient use of water in agriculture and the most vulnerable sectors of climate variability may also play an important role in adapting to climate change within sustainability policies. Efficiency in the use of water resources will be crucial to maintaining productivity in agriculture and ensuring food security in a changing climate.

Among the relevant measures for adaptation in agriculture we can point out the introduction of practices to improve an efficient management of water and soil in order to avoid repercussions on crops.[7]

There are several techniques for preserving water in the soil or managing the resource more efficiently, taking into account local ground and climate conditions such as:

1) The most possible responsible choice of soil processing techniques (laser-controlled leveling system of the fields, minimal processing, mulching, etc.) and use of alternative cultivation techniques (inter-cultivation, multicultivation, etc.) depending on the specific environmental conditions and the available new technologies;

2) Innovating through infrastructure investments at corporate level; for example, structures and protection systems against frost and hail or high efficiency irrigation systems, capable of ensuring the prevention of soil salinization risks in arid areas;

3) Planning irrigation according to actual requirements as estimated by special technical assistance services;

4) Investing in human capital for the improvement of water management in the interregional districts that are responsible for water suplly infrastrctures;

5) Recovering, restructuring and maintaining hydraulic systems used in agriculture, especially in the hilly areas, through participatory planning at micro basin level;

6) Modifying soil exploitation and diversifying crop replacement on farms;

7) Innovating in mechanization, with, among other actions, the introduction of forms of sharing that facilitate the use of low cost modern technologies, tailored to the specific characteristics of local production systems. As far as the relationship between changes in climate and water is concerned, margins of action can be identified in both adaptation measures – to be implemented immediately, at local level, by planning actions in preventive adaptation in the most vulnerable areas – and mitigation measures, which will have global long-term benefits, to the advantage of future generations. Creating synergies between water management and climatic policies will be crucial to achieving sustainability goals, with a special focus on food security and the achievement of adequate hygiene and health conditions for development.

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[1] Some of the passages that follow are taken from: A. Goria and L. Mercalli, *Clima bene comune*, Mondadori-Pearson, Milano 2013

[2] Edgar database, *EU and Netherlands Environmental Assessment Agency*, 2015.

[3] IPCC, *Intergovernmental Panel on Climate Change*, 5AR- Fifth Assessment Report, The Physical Science Basis, 2013. [4] World Bank, *Turn down the heat: why a +4° world must be avoided,* 2014.

[5] *EEA-JRC-WHO, Impacts of Europe's Changing Climate, 2008 Indicator-based assessment Report*, 4/2008.

[6] The Peseta project, 2007-2011, funded by the European Commission, studied the future effects of climate change in Europe. Results are available at: peseta.jrc.ec.europa.eu.

[7] A.Bordin and A.Goria, *Cambiamenti climatici e agricoltura, in Agricoltura e ambiente ai tempi dell'EXPO 2015*, IPSOA, 2015.

Antonio Massarutto *

# *Water as an economic issue*

According to the OECD, if current trends do not change, 4 billion of human beings will experience "water stress" problems in 2030. As the figure shows, North Africa, the Middle East, Central Asia, and the Pacific side of North America will be the areas suffering the most.

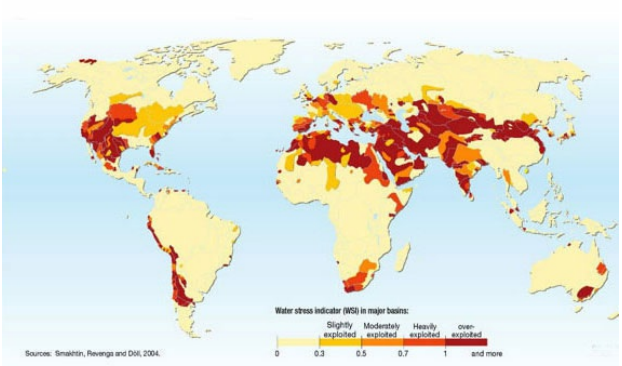


**Figure 1** Water Stress Indicator on a global scale
Source: Ocse

The water stress index is a combination of natural resources (per capita precipitation and intensity of use (per capita water use. This does not necessarily mean that we will die of thirst; however the trend does set out a growing conflict caused by differences in use. Economists use the term "trade-off": either I do one thing or I do the other. The two alternatives exclude one another, and something is bound to be lost.

In the media debate, however, the terms of the question are often misunderstood. In the dominant narrative, the shortage of water is perceived as a problem of physical scarcity. There is less and less water, because we are squandering its "reserves", and because humanity keeps growing – having now exceeded seven billions. Therefore, there will be conflicts in order to put the hands on the "blue gold", the oil of the 21st century. The

big corporations, who understood this well ahead, are trying to gain access rights, to then sell them at a high price and make profit. Groups of citizens rebelled against this attempt, claiming their "right to water". Today this right is defended by a common front that goes from the UN to Pope Francis, and it is being increasingly explicited even in Constitutions; reaffirming with equal force the ownership of water by citizens (the "common good"), with the corollary of a necessarily public, non-lucrative management of water.

The above described position is so deeply rooted in our minds that it has become a kind of conditioned reflex – a mantra. Yet, one would only have to look a little bit closer to realize that it is fundamentally wrong. Not that it doesn't contain any element of truth: but it is the random linking, the way of approaching concepts and data that contains something blurry and ultimately misleading.

To begin with, water is not scarce in the physical sense. The availability of fresh water is accounted for in $km^3$ (billions of cubic meters), the uses in $hm^3$ (millions of cubic meters): there is a 1000 factor of difference. This figure is confirmed not only on the global scale, but also on the continental and sub-continental scale. Surely there are areas of the planet in which water is actually scarce in the physical sense (the American Deserts, North Africa, some parts of Central Asia and Northern China, South East Australia), although it should be considered that scarcity is due to the high concentration of population in areas poor in resources.

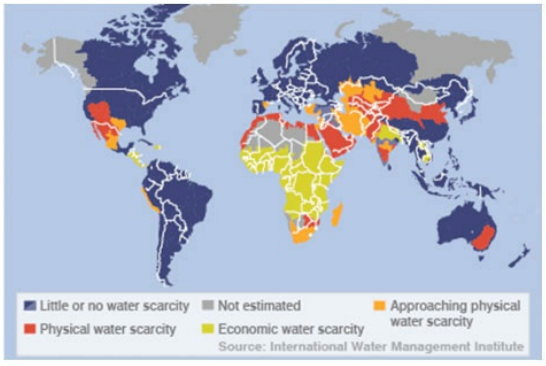


**Figure 2** Physical water scarcity, Economic water scarcity

Furthermore, it must be considered that, at a certain finished cost, high but not *extremely* high, water can be available anywhere, in any quantity.

The cost of seawater desalination using plants of adequate size is around $ 0.5/$m^3$, and today this technology is widely used from California to Spain, Greece and Israel. It must be noted that water resources are not finite like fossil fuels. Water is a stream that is constantly renewed with the evaporation and precipitation cycle. More than the total precipitation, therefore, it is the outflows that count, with a result that depends on the capacity of "natural tanks" (snow, ice, lakes, groundwater). On the other hand, because of this characteristic water use does not necessarily imply its consumption, nor the impediment to other possible uses. In other words, even the very intensive use of water where it is available in abundance does not necessarily mean it is being wasted (the used water would have otherwise been thrown at sea, certainly not increasing the availability of those who suffer water scarcity).

So where does the problem lie?

First of all, what counts is not the absolute availability of water resources, but what is accessible and usable at a reasonable cost. The fact that, at a certain cost, we can have all the water we want can still mean that the cost is higher than the theoretical availability to pay these uses, in particular those for irrigation. Secondly, that cost may be out of reach of potential users, because they are too poor to afford them.

If we look at figure 2 again, we can see that, for a significant portion of humanity, the actual problem lies in the "economic shortfall" rather than in the physical one. That is, where the purchasing power is too weak, even drilling a well to access groundwater may be prohibitive. And it must be understood that, with particular reference to agriculture, the problem of scarcity particularily concerns those populations whose livelihood depends on self-consumption of agricultural products, not just the ones whose agriculture is fully integrated in a market mechanism.

We can say that water is not insufficient: it's heavy. To be useful to man it must be available where and when it is needed, in the required quality. This is possible, but it implies a lot of technology and financial means. Water isn't scarce, money is, Bernard Barraqué warns us.

Therefore some form of organization is needed, a management system, a system of rules that establish who and how manages and governs it, who and how accesses to it, who and how will bear the economic cost that is needed to make it available.

With a closer look, "water wars" are almost never about the appropriation of this or that controversial resource: they concern much more subtle conflicts. They are a *governance* issue in that they are about the need to cope with stressful situations (there is less water than needed) with the evolution of services and rules. Archaic rules and management systems were good for governance.

It is the great megacities that grow at sight, especially in the poor countries of the planet, that represent the most obvious symptom of "water stress": not because water is scarce, but because we have not been able to accompany such a tumultuous urban development with that of the service networks they required. In the endless suburban areas, people have no water because they lack an adequate infrastructure system, both for supply and for the equally important health and hygiene functions. "There is enough water for everyone" and "Water insufficiency is often due to mismanagement, corruption, lack of appropriate institutions, bureaucratic inertia and a shortage of investment in both human capacity and physical infrastructure", the United Nations wrote in 2006.

Secondly, saying that water is a cyclically renewed resource does not mean that human use cannot negatively interfere with this cycle, as is the case, for example, when an aquifer is permanently deteriorated due to excessive exploitation.

In addition to being heavy, water is vulnerable. And if we want to use it for all of our needs (both in the civil and in the production sphere), we cannot forget its ecological functions

.

In terms of actions to be taken, this means that not only is it necessary to invest huge resources in water infrastructures; but also even more will have to be spent to make sure that the water we return to the environment does not affect the essential functions of the water ecosystem. If we look at the

Italian case, we realize that the actual "water emergency" is not represented by drought or by the fact that somebody dies of thirst. Rather, our emergency is a consequence of the inadequacy of our sewerage and purification system, for the incompleteness of which the EU has already sanctioned us. But even in poor countries, the most disadvantaged situation concerns sewerage systems. Good or bad, the Millennium goals related to drinking water (halving the population without access to a guaranteed and controlled source) have been achieved in time; while those related to purification are still very remote (Figure 3).

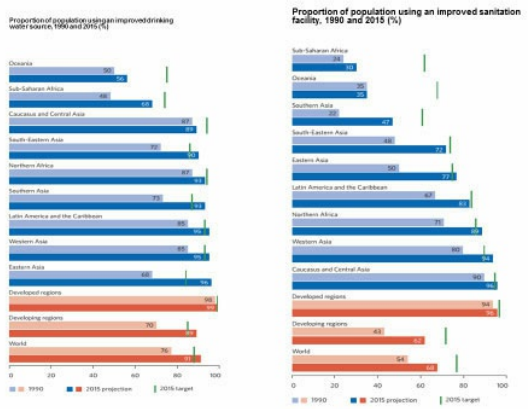


**Figure 3** Millenium goals on drinking water and sanitation facilities, 1990-2015


**Figure 4** Sustainability in 4 objectives

The consequence of this is that when we talk about sustainability, with reference to water, we must refer to at least four different dimensions (figure 4):

A first dimension is *ecological*: water should be used interfering as little as possible with its ecosystem functions, ensuring their integrity.

The second is *ethical*: water is a fundamental human right, which means

the cost should not exclude those who can not pay.

The third is *financial*: infrastructure and management services costs must be covered, to allow the system to mobilize adequate human, technical and financial resources.

Finally, the fourth dimension is *economic*: water resources must be allocated efficiently (i.e., favoring the uses for which is associated with the majority value creation); But also economic resources need to be efficiently allocated (i.e.: investing in infrastructure only makes sense if the value of the water made available exceeds its cost).

All four are equally important, but they contradict each other. And if it is true that the economics consist precisely in the application of the scientific method to trade-offs, that is, to the mutually exclusive choices, then the issue of water scarcity and the related conflict is revealed in its essentially economic nature.

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# *Companies' Sustainable water management: the need for cultural awareness*

The world keeps changing. It is pointless to deny it, but maybe is it still difficult to understand it? Everybody speaks about sustainability, sometimes inappropriately, as if it were just the "in" thing to do. But how can we encourage the community to perceive sustainability for water resources as a fundamental issue for present and future generations?

The starting point lies in a cultural awareness that should acknowledge water as an essential element for sustainable development, consistently with the United Nations Agenda 2030 and the stand-alone target SDG 6: "Ensure access to water and sanitation for all". In fact much of the environmental, economic and social challenges that our society faces in the 21st century depends from a sustainable and responsible use of water. Water resources and the variety of services that they make possible are the foundation for poverty reduction, economic growth and environmental sustainability; they contribute to food and energy security, to a healthier planet populated by healthier people, to improving our wellbeing and to the livelihood of billions of people.

In these terms, water takes on the role of a primary social asset, as it is functional and necessary for the livelihood, protection and progress of our society. As Salvatore Veca points out, a primary asset involves issues of efficiency, effectiveness and justice. It involves a fundamental human right for the people on this planet, without any distinction. It involves the issue of global equity, because everyone should have the same right to access that

resource, with the freedom every human being should have to decide upon his or her life.

Thus, if water is a fundamental right and the denial of access to it is a violation of human dignity, who is in charge of ensuring the efficiency of water production, consumption and management systems and reducing the water footprint as well as of promoting a fairer distribution of this resource? Surely all players within our society (institutions, enterprises, non-profit organizations, and the civil society) should work together in a joint action throughout the supply chain, to ensure the fundamental right of access to water for every human being and encourage the development of sustainable production and consumption models, both in industrialized and developing countries.

Among the many involved players, companies definitely play a leading role in reducing the water footprint. Most production processes – be it in the primary, secondary, or tertiary industries – largely depend on massive use of water. Starting with full awareness and acknowledgement of their role in active citizenship, businesses are called upon to innovate and create an integrated business model in which sustainability is part of every business activity. Top managements must take on this responsibility, first of all by being aware of the benefits of sustainable action, and then by spreading sustainability as a value within the organizational structure and across the entire value chain, vertically and horizontally. Major benefits of sustainable business models include reducing environmental impact, improving business performance, and responding to increasing market expectations.

The good news is that some progress is already evident: many businesses, especially the ones relying on water in their production process, are now aware of the issue of water management, as shown by an international survey[1] on 1,907 professionals from different businesses in Europe, North America, Central and South America and Asia. The report shows that 70% of the interviewed companies consider water management issues relevant to their business strategies, reaching 85% in the case of companies using water in their production processes. In the last 5 years, half of the surveyed

companies have undertaken sustainable water management initiatives, driven by economic needs and compliance with current legislation.

Water management, however, still is a major challenge for many companies, both in terms of environmental impact and business performance. Luca Crisciotti, administrator of DNV-GL, points out the importance of the issue of water resources, due to the fact that the world's population has doubled during the twentieth century, and the demand for water expanded six-fold, which definitely is one of the main global development issues at stake, as the Director of UNIDO pointed out.

To acknowledge the critical aspects associated with water resources is therefore the first step to sustainable water management, and, as it seems, companies are beginning to realize it. However, much more could be done if companies took the social pressures, as well as those of consumers and stakeholders into account in their strategies, and if they aimed at consistently taking on the principle of effectiveness and efficiency for the management of a primary social asset such as water.

#### Water Management in Autogrill

*Autogrill* acknowledges the importance of accurate water management.

In Italian outlets, it is the public aqueduct that supplies water, which is used in sanitation, cooking activities and fire protection facilities. In areas far from the public distribution network, water supply is provided by wells, while waste water management complies with the relevant national and local directives. Drawing water from wells is regulated by authorizations issued by competent Public Administration offices, which allow use for specific purposes of groundwater replacing water from aqueducts. In particular, consumption of drinking water for sanitation purposes is hence avoided.

In 2016, over 440,000 $m^3$ of water were taken from 22 regularly licensed wells, located on as many local Autogrill sites, with the result of saving equivalent volumes of water not taken from the aqueducts.

In the outlets in which sanitation is left to Autogrill, water consumption

is largely concentrated in the restrooms.

Having said this, clearly the trend of water consumption on the premises of the Autogrill Group is not strictly related to the business management, but rather to consumers' behaviour. Therefore, Autogrill can only drive the reduction of water consumption partially, by adopting technologies that minimize its use.

The company is strongly engaged in meeting this challenge.

In all major countries of activity, it is progressively adopting a self-cleaning mechanical system to replace the traditional water-based system.

As with energy, solutions for consumption reduction are accompanied by control and prevention systems at major retail outlets. Over the last few years, waste detectors, dual flow taps and air to water mixing valves have been installed, as well as presence detectors for water dispensing.

For example, a new monitoring procedure was introduced in France, which calculates the monthly water consumption for each site, aiming to detect and reduce any form of waste.

The European project for the review of cleaning processes, which involves the use of more concentrated detergent solutions and the installation of automatic dispensers and/or mechanical equipment also aims at reducing water consumption.

At Amsterdam Schiphol Airport, the installation of AquaFox taps with flow regulators is estimated to have reduced water and soap consumption by 70%.

HMSHost International (the Group's subsidiary managing catering activities at North Europe, Middle East and Asia airports) supports Made Blue, a fundraising program based on the company's water footprint wich aims to ensure access to water in developing countries. The consumption of fresh water used by the company to carry out its activities will be offset by the implementation of initiatives that will return the same amount of water in the world, for a total of approximately 175.000 $m^2$ in 2016.

**VILLORESI EST**

*Villoresi Est is the international best practice of the Autogrill Group in sustainable innovation. It puts into practice a set of on-site virtuous solutions that can be individually repeated in other locations of the Group's global network. Villoresi Est has been entirely designed and built following the LEED (Leadership in Energy and Environmental Design) Protocol in Energy Efficiency and Environmental Performance Standards; the Protocol has been awarded Gold Certification, in addition to EMAS and ISO 14001 and ISO 50001 certifications. The building stretches over an area of approximately 2,500 $m^2$ with a structure entirely made of certified PEFC laminated wood from indipendent certified sources with forest certification schemes.*

*As required by the LEED standard, the project only used environmentally friendly and recyclable building materials. Its characteristic volcano shape (reaching 27.5 m high) facilitates excessive heat flow and optimum utilization of outdoor temperature conditions, thus decreasing the use of electricity to heat or cool the air. A "thermal pile" geothermal system was built with 420 deep-dropped drills at a depth of 25 meters approximately, capable of delivering more than 380 kW of heat, covering 85% of the needs during the winter.*

*Furthermore, the 350$m^2$ large capturing roof of the location captures solar or cold energy according to the season and LED lighting has been implemented both for the exterior and interior of the area. As far as water supply is concerned, a system for rainwater and groundwater collection for air conditioning, irrigation, restroom use and fire protection reserve allows zero relying on water supply networks for all industrial use.*

**Figure 1** Villoresi East Autogrill structure

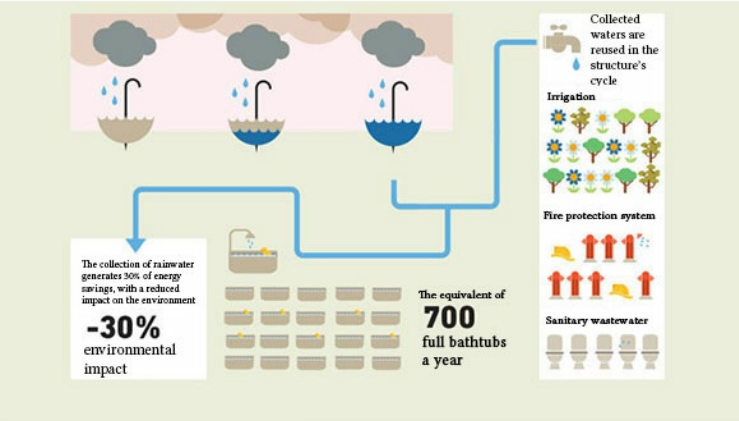


**Figure 2** Water re-use cycle

* - Chief Audit Executive & CSR Officer in Autogrill Group.

1 United Nations Industrial Development Organization, DNV GL (2015), Companies' sustainable water management: New UNIDO report - DNV GL.

# Abstract

Laura Achene, *Criteria and Methods of Water Quality Control in Italy: Current Issues and Perspectives*

The evolution of science progressively transposed at the regulatory level is causing a deep change in the implementation of primary prevention and of water and health inspections, mainly in three directions.

First of all, it has caused the growing advocacy of health in relation to different fields, including environment and infrastructure, in view of the health implications of various criticalities (e.g. widespread inefficiencies in many areas of integrated water service).

Secondly, it has encouraged the development of an approach based on holistic risk analysis with proper consideration of site-specific risk determinants in the safety of water use and reuse.

Furthermore, we see an increase in synergies and complementarity between studies and standards applied to the quality of water resources of different origin, in the research of the transmission of contaminants as well as in the integrated management of prevention and control measures.

In this context, the Istituto Superiore di Sanità, under the aegis of the Ministry of Health, is a key reference at international and national level to coordinate strategies and methods that preserve the new protection and control criteria, oriented to an increasingly holistic vision. Strengthening prevention based on risk analysis is in fact seen as an indispensable condition for ensuring a higher level of water quality in the environment, health protection and sustainability at various levels.

Alessandra Goria, *Water: a precious resource for mitigation and adaptation policies for climate change*

Water is a very precious resource for the planet and extremely vulnerable to climate change. The foreseen increase in temperatures and frequency of extreme climate events will have an impact on the availability of water resources. The poorest populations will be most affected. Health, agricultural production and food security, energy and industry will be the most vulnerable among the affected areas. More efficient management of water resources will therefore be crucial to tackling the challenges of sustainability and countering climate change, both in terms of mitigation and adaptation policies.

Antonio Massarutto, *Water as an Economic issue*

Water is an abundant resource, but not where and when it is needed, and not of the necessary quality. Investment and management systems are needed; however the more you want water to keep the ecosystems intact, the more these management systems become expensive. It is therefore necessary to allocate more and more financial resources: costs must be covered, and cannot be borne by general taxation. But water is also a human right, and it cannot be too expensive to allow access to basic needs. And, in the end, water goes into all production functions and must be strategically managed in order for the community to benefit from it.

Silvio De Girolamo, *Companies' sustainable water management: the need for cultural awareness*

A reflection about the role companies play in water resource management and about technology as a support in water use, efficiency and recycling. Which monitoring and reporting methods can be introduced to engage stakeholders and collaborators? The active role and sensibility that consumers are also able to enact, like some cases of best practices have shown, must also be taken into account.

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