DOI 10.7343/AS-084-14-0111

A preliminary assessment of the Normative Framework regulating MAR schemes in Europe: the EU Directives and their Implementation in nine National Legislations

Una preliminare analisi del quadro normativo regolante i programmi di ricarica degli acquiferi in condizioni controllate in Europa: le Direttive Europee e la loro implementazione in nove legislazioni nazionali

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Riassunto: La ricarica degli acquiferi in condizioni controllate rappresenta una practica che, in Europa, risale all'inizio del XIX secolo. Ad oggi, programmi di ricarica degli acquiferi vengono diffusamente attuati da numerosi Stati Europei e costituiscono oggetto di numerosi studi e progetti di ricerca. A questa situazione de facto non corrisponde però sul piano normativo, sia a livello regionale che nazionale, un'adeguata regolamentazione delle modalità secondo le quali i suddetti programmi di ricarica possano essere avviati e implementati. Anche i numerosi progetti di ricerca riguardanti la ricarica degli acquiferi in condizioni controllate sembrano aver dedicato scarsa attenzione all'argomento. Il presente contributo è invece specificamente dedicato ai profili di diritto riguardanti le ricariche acquifere in condizioni controllate. Esso si basa sui risultati presentati in un Report realizzato nell'ambito del progetto Marsol che è stato finanziato dalla Commissione Europea attraverso il Settimo Programma Quadro e che mira a dimostrare l'utilità dell'attuazione e sviluppo di programmi di ricarica per ovviare alle crescenti problematiche derivanti dalla mancanza e la scarsità di risorse acquifere. Attraverso l'utilizzo di un questionario inviato a diversi esperti nazionali, i ricercatori coinvolti in Marsol hanno raccolto una serie di dati relativi al quadro normativo regolante le ricariche in nove Stati dell'Unione Europea. I dati raccolti sono stati elaborati con metodo qualitativo, integrati dove necessario e hanno costituito oggetto di un'analisi comparata volta anche a determinare il livello di implementazione nei Paesi considerati delle due direttive Europee che regolano la gestione delle acque superficiali e sotterranee, ovvero: la Direttiva Quadro sulle Acque e la Direttiva Quadro sulle Acque Sotterranee. Il presente contributo riguarda un numero limitato di Paesi dell'Unione Europa è, tuttavia, in programma un ampliamento dell'ambito dello studio, ovvero l'inclusione di un numero maggiore di Paesi Europei nonché di Stati extra-Europei.

Parole chiave: Acquifero, Ricarica, Legislazione, Europa, Ricarica degli acquiferi in condizioni controllate.

Keywords: Aquifer, Groundwater Recharge, Legislation, Europe, Managed Aquifer Recharge.

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Abstract: *The use of MAR schemes within the European Union is not a new phenomenon, on the contrary it dates back to the beginning of the XIX century. Despite being widely adopted and currently the object of extensive studies, this tool is not soundly regulated and so far very little research has been conducted on the normative framework regulating MAR at the regional and at the national level. This paper draws upon the findings of a Report which represents one of the deliverables identified by MARSOL, a EU FP7 project launched in December 2013 that aims at demonstrating that MAR shall be regarded as a viable approach to address the predicted water shortages over the long term. Through a survey which involved a number of national experts, the researchers involved in the drafting of the Report have collected relevant data concerning the national legal frameworks of nine EU countries that adopt MAR schemes. The results of the questionnaire have been processed using a qualitative and comparative approach and have been duly included in the legal analysis, which covers the implementation at the national level of the two EU Directives relevant for MAR Schemes, i.e. the Water Framework Directive and its "daughter", the Groundwater Directive. This paper shall be considered as the outcome of a preliminary investigation which covered only a limited number of European countries, it is expected that the research will be carried out as to include a larger number of EU Member States (MSs), alongside the most relevant extra EU countries.*

Ricevuto: 01 agosto 2014 / Accettato: 05 settembre 2014
Pubblicato online: 30 settembre 2014

DOI 10.7343/AS-084-14-0111

Introduzione

Water is the essence of life. Safe drinking water and sanitation are indispensable to sustain life and health, and fundamental to the dignity of all (United Nations High Commissioner for Human Rights, 2010). Therefore, more diligent management is needed to secure adequate supplies of suitable water for human and environmental needs as stressed by the World Health Organization which over the past 50 years has provided an authoritative basis for the setting of national regulations and standards for water safety in support of public health (WHO Guidelines for drinking Water Standards, 2011). Consistently with the wide need to increase water resources managed aquifer recharge (MAR) provides ways to generate water supplies and protect the environment using water that may otherwise be wasted (Dillon et al., 2009). A number of benefits have been associated with the use of MAR, *in primis* low capital costs, potential location close to new water sources (and where demand for water is high), improved reliability of existing supplies and improved environmental flows in water supply catchments for urban areas. Despite the large number of benefits that may derive from the establishment of MAR, the research conducted has shown that there are also risks associated with it, for instance changes in water quality within the aquifer may occur as a result of recharging an aquifer with a source of water that has a different chemical composition or physical attributes to the native groundwater. Hence, factors beyond water supply costs must be considered when determining the viability of MAR projects. Concerning the adoption of MAR schemes within the European Union, where the first use of this tool dates back at least to 1810 (Ray et al., 2003) and many ancient experiences are documented, it should be noted that the studies conducted so far have not shed light on all the key issues involved. In particular with regard to the normative framework governing MAR, it is worthwhile to mention that the present paper is relevant as very little analysis has been carried out on this specific and crucial aspect. Therefore the goal of the present contribution is to provide an overview of the domestic legal frameworks in place in nine European Member States (MSs) and reflect on their compliance with the European framework established through the adoption of the Water Framework Directive (WFD) 2000/60/EC and the Groundwater Directive (GWD) 2006/118/EC. The analysis will help shedding light on the shortcomings of the existing normative approach and pointing out possible ways to improve it.

Methodology

The paper draws upon the findings of a Report (Bonfanti and Capone, 2014) which represents one of the deliverables identified by MARSOL, an EU FP7 project launched in December 2013 that aims at demonstrating that MAR shall be regarded as a viable approach to address the predicted water shortages over the long term. The researchers involved in the drafting of the Report have collected relevant data concerning the national legal frameworks of nine EU countries (Fig.1) that adopt MAR schemes through a questionnaire that has been submitted to a number of national experts, bot practitioners and academics, with relevant knowledge of the topic at stake. From the outset an important caveat is needed: this paper is the outcome of a preliminary investigation which covered only a limited number of European countries, i.e. nine, it is expected that the research will be carried out as to include a larger number of EU Member States, alongside Israel, which hosts one of the demonstration sites relevant to the Marsol project, the US and Australia, two of the countries where MAR schemes are most widely adopted. For the time being and with regard to the Report and the present contribution, the results of the questionnaire have been processed using a qualitative approach and have been duly included in the legal analysis, which also covers implementation at the national level of the two EU Directives relevant for MAR Schemes, i.e. the Water Framework Directive 2000/60/EC and the Groundwater Directive 2006/118/EC, the "daughter" Directive that has been developed in response to the requirements of Article 17 of the WFD. Both Directives pursue the harmonization of the national legal frameworks governing water management, to this end they lay down certain goals that must be achieved by every Member State through the integration or modification of existing provisions established by their national, regional or local laws or other instruments. The WFD's primary objectives are to promote the sustainable use of water, reduce water pollution, particularly by 'priority' and 'priority hazardous' substances, lessen the effects of floods and droughts, while introducing a co-ordinated approach to water management based on the river basin as the appropriate scale for planning (Kallis and Butler, 2001). According to Article 4 of the Directive, "surface waters" are required to meet "good ecological and chemical status" and groundwater bodies to meet "good chemical and quantitative status" by 2015. According to Article 11(4), artificial recharge of aquifers is mentioned as a possible supplementary measure in part B

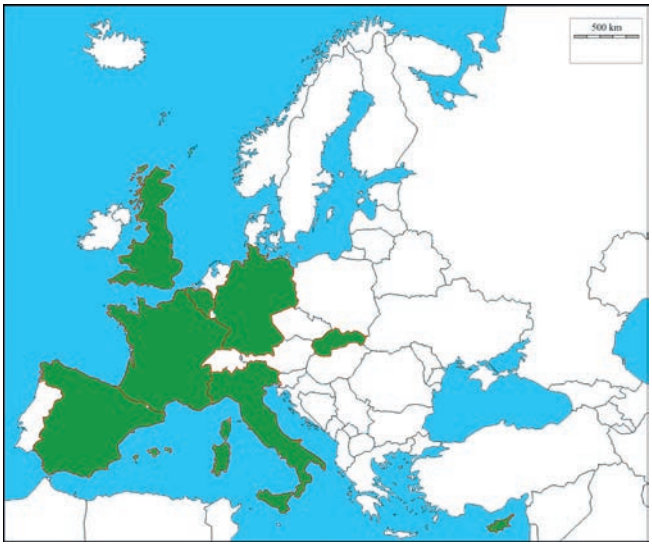

Fig. 1 - Ordinamenti giuridici degli Stati Membri dell'UE che adottano schemi MAR e che sono oggetto del presente studio.

Fig. 1 - EU Member States's Legal Frameworks governing MAR schemes put under investigation.

of Annex VI. The GWD, adopted pursuant to Article 17 of the WFD, seeks to establish specific measures to prevent and control groundwater pollution. As far as MAR schemes are concerned, they may be adopted and implemented by Member States as long as an authorization or permit, control and monitoring regime(s) is (are) established within their jurisdictions (T. Wintgens et al., 2012). At the moment, this is the minimum (and rather broad) requirement in order to make the promotion and running of MAR schemes in compliance with the Directives' established provisions.

Results: MAR schemes' Regulation within the Surveyed Member States

This section examines the national legal frameworks governing or applicable to MAR schemes in 9 EU Member States, namely: The United Kingdom, France, Italy, Germany, Spain, Belgium, Slovakia, Cyprus and Austria (the "surveyed MSs"). Among the cited Member States, Germany, France, Cyprus and Spain have established more than 15 MAR schemes, while there are less than 10 in the UK, Italy, Austria and Belgium (Bonfanti and Capone, 2014). The most common type of MAR scheme is the "Infiltration Pond" that is adopted in all the surveyed MSs except for Belgium, where dune filtration is used. Different water sources are used for MAR schemes, but the most common is surface water (streams and lakes): all the surveyed MSs' MAR schemes employ water coming from these natural sources, some of them, e.g. Germany, also use water coming from treated sewage effluents and from drinking water distribution systems (Bonfanti and Capone, 2014).

In the United Kingdom, MAR schemes are regulated by provisions established by different legal instruments having regional scope. The relevant regulations in force in England and Wales are respectively the *Environmental Permitting Regulations* 2010 and the *Water Resources Act* 1991. Schedule 22 of the *Environmental Permitting* deals with "Groundwater Activities" and applies to MAR schemes. It transposes relevant rules established by the Groundwater Directive and the Water Framework Directive into domestic (English) law. Pursuant to Article 11(3)(f) and Article 11(3)(j) of WFD, Schedule 22 makes artificial recharge or augmentation of a body of groundwater for the purposes of groundwater management contingent upon the granting of an environmental permit from the "regulator", *i.e.* the Environmental Agency. The *Water Resources Act* 1991 deals with water resources management and, in particular, regulates the granting of permits/licenses to operators in order to extract water (Part II), and establishes a mechanism for monitoring pollution of water resources (Part III). According to the Act, the Natural Resources Wales is the authority in charge of issuing licenses for controlled activities impacting the water and groundwater status, registering operators benefitting from a licenses/authorisations, and monitoring the activities subject to licenses/authorizations. With regard to Scotland, MAR schemes are regulated by the *Water Environment (Controlled Activities) (Scotland) Regulations* 2011. In general, these Regulations strengthen the permitting and control regime for abstraction, impoundment and building, engineering and other works that impact on the physical quality of aquatic habitats, and improve transparency and effectiveness in administrative procedures. Finally, in Northern Ireland MAR schemes are subject to prescriptions provided by the *Groundwater Regulations (Northern Ireland)* 2011. These Regulations aim at preventing the entry into groundwater of hazardous substances and the pollution of groundwater by non-hazardous pollutants. In a nutshell the establishment and implementation of MAR schemes in the UK is subject to authorizations issued by specific agencies. These agencies grant permits only under certain conditions. The beneficiaries of the permits have the duties to control the volumes and the quality of water recharged, and to provide periodic reports to the relevant agency about their activity. Furthermore, in order to carry out specific activities which may be related to the implementation of MAR schemes like building and drilling, beneficiaries need to ask for a supplementary permit/authorisation. In spite of the abovementioned regulations and the actual transposition of the relevant EU directives, MAR schemes are neither part of any national integrated groundwater and water resource management strategy nor expressly envisaged by any River Basin Management Plans.

In France MAR schemes are regulated by the national law in force. Namely, the *Environmental Cod*e deals with water recharging.1 The Code – in its Legislative Part L.214-1-L.214-6 –, requires operators to ask for authorization in order to set up MAR schemes, as well as forces them to declare and report their activities periodically. In its Regulatory Part, Art. R.214.1, the Code specifies those installations, structures, works and activities which are subject to the abovementioned authorization. As far as MAR is concerned, the authorization required is called "*arreté préféctoral d'autorisation*" delivered by the "*préfet de département*". The authorization obliges the beneficiaries to perform specific duties concerning the monitoring and reporting of quantitative and qualitative environmental impacts of MAR.

In Germany, MAR schemes are disciplined by regulations adopted both at the central (federal) and regional level. At the federal level, the main legal instrument concerning water management is the *Federal Water Act* ("*Wasserhaushaltsgesetz" or WHG*) 2009 that transposes and implements the binding EU provisions into domestic legislation. The Act contains specific Articles on both quality and quantity metrics of water resources. It also regulates the usage of water resources on the basis of administrative permission granted to operators by the competent water authority. Chapter 2 of *WHG* contains common provisions on permits and authorization conditions and procedures concerning the management of water resources (Section 1), as well as special provisions concerning surface waters (Section 2), coastal waters (Section 3) and groundwater (Section 4). Each type of authorization sets out specific duties and rights for its beneficiary. According to the common dispositions of *WHG* (par. 10), the authorization entails monitor-

1 *The French Environmental Code is divided in two parts: the Legislative Part and the Regulatory Part.*

ing and reporting duties concerning the quantity and quality requirements of the treated water. It has to be noted that there are other legal instruments that apply to MAR schemes in Germany. These instruments, that generally regulate the discharges to groundwater and the use of treated sewage effluent, are: the *Waste Water Ordinance* (*AbwV*) that specifies the standards set out in the *WHG* (par. 57) for both direct and indirect discharge of waste water, and implements the technical requirements established by the EU directives; the *Groundwater Ordinance* (*GrwV*) that details measures to prevent the entry of pollutants into groundwater and, generally, the deterioration of groundwater quality and quantity.

In Belgium, the establishment and implementation of MAR falls generally within national legislation on environmental protection. Furthermore, they fall within the competence of the three regions in which Belgium is administratively divided (Walloon, Flemish and Brussels Metropolitan Region). In particular, the three regions have defined the requirements and the procedures for issuing environmental permits to operators requiring them in order to carry out activities that may potentially impact the environment. As far as the Flemish region is concerned, the Flemish Council (*i.e.* the Regional Parliament) adopted the *Decree on Environmental Permits* 1985. This Decree was implemented by two regulations adopted by the Flemish Government: *VLAREM I* and *VLAREM II*. With regard to the latter, its Chapter 5.54 regulates the establishment and implementation of any new installation for artificial replenishment of groundwater. Once granted a permit by the competent authority (in general the Province after consultation with relevant local administrations), the operator/beneficiary that is responsible for running the MAR scheme has to monitor the groundwater quantity and quality periodically, keep records of monitoring activities and make data available to the supervisory authority (the Province), and report specific information to the Division of the Flemish Environment Company – that is competent for activities related to management of groundwater. It is worth noting that no legislation regulating the use of treated sewage effluent is in force in Belgium.

As far as Spain is concerned, the Spanish Parliament adopted the *Water Law No. 29/1985* aimed at regulating the public hydraulic domain and water use. The Spanish Law provides for measures to increase control over waste water, improve water quality, its efficient use, and users' responsibility for water management (Title IV). The Law has undergone several reforms, in particular the WFD has led to the adoption of the 2001 national hydrological plan and its subsequent amendment in 2004 (Garrido and Llamas, 2009). Particularly relevant for MAR schemes is the Royal Decree 1620/2007, which establishes the legal framework for the reuse of treated wastewater, pursuant to Article 109.1 of the amended Water Act, passed by Royal Legislative Decree 1/2001, of 20 July. The Royal Decree sets the quality standard for the use of reclaimed water, as spelled out in Article 5: Reclaimed water must comply with the quality criteria established for different intended uses in Appendix 1.A. at the point of delivery. Moreover, the Royal Decree explains in details the procedures to be followed in order to obtain water reuse concessions and permits (Article 8 and 9), where the first one refers to the holder of a concession on a primary use of water and the second one to the holder of an effluent disposal permit.

In Austria, the Federal Ministry of Agriculture, Forestry, Environment and Water Management is in charge of integrated groundwater and water resource management at the national central level. The Ministry is responsible for protecting Austrian water resources and keeping their use/exploitation sustainable. It is in charge of implementing the Austrian water management strategy and, in particular, it contributes to the monitoring of water usage. The main legal instrument regulating groundwater and water resource management in Austria is the *Water Act 1991* - further implemented by the following ordinances. The Act defines uniform procedures and criteria for the control and monitoring of groundwater, rivers and lakes. Monitoring is carried out by the Ministry in cooperation with the offices of the nine Austrian Provincial Governments. The mentioned cooperation is set out by the *Ordinance on the Monitoring of the Quality of Water Bodies* that indicates the measures to be adopted in order to prevent and limit inputs of pollutants into groundwater. Technical support is provided by the Austrian Federal Environment Agency. The Act also defines a regime for granting authorisations/licenses to operators. Authorisations are required for any use of a public water body outside the scope of common use as well as the construction or alteration of a facility for the use of the water body. Applications must be directed to the relevant water authority. It regulates both discharges to groundwater and the use of treated sewage effluent.

In Italy, there is no *ad hoc* legislation on MAR schemes. Presently, relevant provisions on water management may be found in the *Legislative Decree No. 152/2006* ('Environmental Code'). Articles 104 and 105 of the Decree aim at protecting the quality level of water sources and establishing specific measures to manage the discharge to superficial water and groundwater. Other relevant provisions can be found in the Regional Water Protection Plans adopted by Italian Regions in compliance with the *Legislative Decree No. 152/2006*. These Plans provide for measures to protect the quality and the quantity of the water sources. At the national level the recent amendment of Article 104 of the Environmental Code has led to the adoption of paragraph 4 bis according to which the competent authority can authorise the augmentation under controlled conditions of groundwater bodies in accordance with the criteria set by the Ministry of the Environment. To this end the Ministry has established a working group of experts that is currently laying down the basis for drafting a new regulation that will implement the new provision enshrined in Article 104.

In Cyprus, water management is regulated by the *Government Waterworks Law* (Chapter 341). According to the Law, the Council of Ministers is in charge of identifying the areas where waterworks are to be established, building the necessary infrastructure, regulating the use, distribution and man-

agement of the water resources. In particular, the District Officer is responsible for granting administrative permits to water operators or users. The permits establish duties upon the beneficiaries. Among these duties there are obligations to monitor and report the implemented activities to the District Officer, especially those activities concerning recharge with tertiary treated wastewater effluent.

As far as Slovakia is concerned, the main legal instrument regulating water management at the national central level is the *Water Act* 2004. The Act sets out general measures concerning the use of surface waters and groundwater (Section 2), water planning (Section 3), the protection of water resources (Section 5), water installations (Section 8). Among the implementing laws that followed the adoption of the *Water Act* 2004, it is worth mentioning Regulation No. 279/2011 that provides for measures to prevent or limit inputs of pollutants into groundwater (Section B). In addition, Regulation No. 418/2010 details the performing criteria for the surface and groundwater monitoring activity. Following the implementation of the Groundwater Directive, two River Basin District Plans (RBDP) have been adopted and implemented in Slovakia: the Danube RBDP and the Vistula RBDP, both managed by the Ministry of Environment.

Concluding Remarks

In light of the above overview of the normative data gathered through the questionnaire submitted to national experts it is possible to conclude that all the EU Member States surveyed, to different extents, have implemented the two EU Directives relevant to the regulation of MAR schemes. In more detail, mechanisms for granting authorizations/permits to operators exploiting water resources and operating MAR schemes, as well as for monitoring their activities are established in most of the surveyed MSs. With regard to the monitoring, the operator/beneficiary of the permit/authorisation and the relevant national, regional or local authority are equally responsible for this activity. Of course it should be noted that there are differences between the surveyed Member States because of the specific provisions that each of them has adopted. For example, in France responsibilities for monitoring are shared between different entities depending on the specific type of monitoring at stake: the entity carrying out a preliminary study of impact is responsible for baseline monitoring; the entity that implements the pilot system is responsible for validation monitoring; the operator/beneficiary of the permit/authorisation is responsible for operational monitoring; and the competent public authority is responsible for verification monitoring. Moreover the content and scope of the permit/authorization, granted by the relevant authority to a beneficiary operating MAR schemes, are paramount for determining the latter's duties and rights concerning water management. In general, the content and scope of the permits affect the way these schemes may be established and implemented. For example, in the some of the surveyed MSs, like the UK and Belgium, the permits require the beneficiary to adopt detailed preemptive measures to prevent hazards chemicals in recycled water. Furthermore, they establish specific requirements concerning the quality of the effluent and its treatment before this is employed for recharge purposes. The permits may also require a compulsory training program to be taken by those subjects operating MAR schemes. In a few cases, the permits require the beneficiary to define clear rules and procedures to be applied in case of incidents or emergencies affecting its water installation. For example, in both the UK and France, operators granted the permits must provide the relevant authority with plans for dealing with incidents that might damage the water environment. However, it should be noted that in most of the surveyed MSs the definition of *ad hoc* procedures for emergency or incident management of water installations are not dealt with either in the authorisation/permit or by the law (*e.g.* Austria, Spain, Cyprus, Slovak Republic, Italy). Only in Germany, the response to emergencies for water installations or infrastructures (those adopted for MAR schemes included) is guided by specific warning and alarm plans implemented at the regional level. In a nutshell, what emerged from the research is that, despite being adopted in several EU countries, MAR schemes are not soundly regulated. Both of the EU Directives consider MAR as a possible measure to achieve the "good status" objectives, however the Directives refrain from providing sufficient guidance with regard to their implementation. As described above, at the horizontal level, there are substantial differences among the surveyed Member States concerning the requirements for the authorizations/permits necessary to establish and run artificial recharge schemes; the procedures for their monitoring and also the type of authority in charge of awarding the authorisation and conducting the monitoring phase (e.g. environmental agencies, water authorities, central regional or provincial administrative bodies). Despite their marginal place in the EU Directives, the need to harmonise the way MAR is governed at the national level stems from a number of considerations. *In primis* having a clear and sound approach throughout Europe could improve the cooperation and the exchange of knowledge among different Member States and non-state actors; secondly investments in this sector could benefit from a more consistent approach as well as the environmental policy pursued at the EU level. The need to improve the normative framework governing the key aspects related to the establishment, implementation and monitoring of MAR schemes stems from the importance to have a coherent approach across the European Union. However, it is note worthy that technical and scientific considerations should then be tailored on the specific site in order to preserve its chemical and biological characteristics. In fact enhancing the overall discipline of MAR schemes will imply the development of a more sound institutional and legal framework at the EU and at the national level, as well as leaving a margin of appreciation at the decentralised/local level to allow the best use of each site.

To further, and better, steer the Member States' efforts to regulate MAR schemes, measures such as guidelines and declarations could represent a useful and less challenging

solution in comparison with the adoption of a new and *ad hoc* Directive. It is thus important to further underline that the present contribution, which represents only a preliminary output of the ongoing legal research envisaged within the Marsol project, will be followed by a wider and deeper analysis encompassing more EU MSs and relevant extra EU countries. Upon completion of the analysis the authors will eventually formulate a set of recommendations to assist the drafting of the guidance document.

Acknowledgements: The authors are grateful to Professor Andrea M. T. de Guttry, full Professor of International Law at the Sant' Anna School of Advanced Studies in Pisa, for his guidance throughout the project. They also wish to thank Dr Rudy Rossetto for the opportunity to contribute to this special issue and the kind assistance and help provided. Finally, their gratitude goes to all the partners involved in the Marsol project, in particular those participating in WP 17, and to all the national experts who replied to the questionnaire and generously shared their knowledge.

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