

**FINAL REPORT ON THE INVESTIGATION INTO THE METHODS AIMED
AT SELECTING PLANNING STRATEGIES ADOPTED IN INTEGRATED
WATER SERVICE PROGRAMS FOR INVESTMENTS**

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1. Introduction

- 1.1 With Resolution 595/2015/R/IDR of 4 December 2015, the Italian Regulatory Authority for Electricity Gas and Water (hereinafter the Regulatory Authority) launched an investigation into the methods aimed at identifying the planning strategies adopted in the Program for investments (“Programma degli interventi”, hereinafter: PdI) of the integrated water services (hereinafter SII). The aim is to guarantee that the realised investments - which are covered by tariff - are planned according to appropriate and efficient criteria.
- 1.2 The investigation was aimed at assessing planning strategy compliance, as a binding condition for future tariff approvals. In the short run, the aim was twofold:
 - i. verifying consistency between critical issues locally identified and the proposed investments;
 - ii. identifying both criteria to gauge the gap from the optimal resources allocation and criteria to compare a range of different planning strategies.
- 1.3 Such investigation forms part of the OS13 strategic objective of ‘Regulating and Enforcing PdIs and financing water infrastructures.

2. AEEGSI Roadmap for PdIs

MTI Stage

- 2.1 Legislative Decree 152/06, in Article 149, calls for, among other documents, the water infrastructure analysis and the PdI, establishing that:
 - i. the survey identifies the condition and operational status of the infrastructures to be assigned to the integrated water services operator (Par. 2);
 - ii. the PdI specifies “the extraordinary maintenance and the new works to be undertaken, including interventions to adapt already existing infrastructures, necessary to achieve at least minimum levels of service, as well as to satisfy the overall water demand of users”; it defines the objectives to be achieved, the investments planned for this purpose and the implementation periods for the full management (Par. 3).
- 2.2 The legal framework in order to safeguard and manage water resources, outlined in Legislative Decree 152/2006, provides for higher-level planning as compared to levels of the so called Optimal Territorial Area (hereinafter ATO, in particular, regional and district catchment area levels), with the subsequent need to verify

the consistency of planning strategies with the objectives identified at higher level.

- 2.3 The regulation as defined by the Regulatory Authority establishes that each Local Authority (hereinafter EGA) must include the PdI as part of the documents that make up the specific regulatory procedure to be compulsorily submitted for tariff approval. This PdI represents the designated EGA planning tool for investments concerning SII, pursuant to Article 149 of Legislative Decree 152/06.
- 2.4 More specifically, the PdI specifies the objectives to be achieved through the investments implementation for the period 2014-2017, including, for any residual period until maturity of the concession, all the information necessary to achieve at least minimum levels of service, as well as to satisfy the overall water demand of users.
- 2.5 In order both to implement the comprehensive *survey* of the state of local services and critical issues, as well as to standardize the information throughout the whole national territory, the Regulatory Authority has recommended methodological guidelines and the minimum information content to update the PdIs.
- 2.6 In addition, in order to ensure increased *simplification* and *standardisation* of the documents to be presented, with positive effects in terms of both verification of the completeness of information and improved usability, and to enable the *comparable* and *uniform assessment* of the investment needs of the different local districts, the Regulatory Authority made then available a ‘PdI format’ with the Directorate for Water (DSID) Determination 3/2014 of 7 March 2014.
- 2.7 Finally, as part of the same DSID Determination 3/2014, the Regulatory Authority clearly established the information representation criteria, in terms of:
 - i. survey of the critical issues as arisen in the relevant SII activities, classified into seven areas, each one divided into specific sub-areas, identified by an alphanumeric code, to be gauged by means of suitable performance indicators (hereafter KPIs);
 - ii. target service levels, for each performance indicator to be reached in order to overcome the identified critical issues, with the related timeframe;
 - iii. for each identified critical issue, evidence of the process implemented by the EGA to select the most appropriate and efficient intervention strategy, aimed at achieving the expected target service levels, with related timeframe for each selected investment.

Main evidence

- 2.8 The received PdIs, compliant with the Water Tariff Method (MTI), has allowed the Regulatory Authority to carry out a first extensive mapping of critical issues

and activities linked to the SII, bringing to light investment needs previously overlooked or not rendered explicit.

- 2.9 In addition, a first set of KPIs has been identified as a primary attempt at the unequivocal and uniform representation on a national level of critical issues locally identified
- 2.10 This first survey and systematisation of data has also contributed to the necessary publication and dissemination of information on the status of SII infrastructures on a national level and of the conditions of water and wastewater service provision, in order to guarantee, primarily, maximum transparency towards users and all stakeholders.
- 2.11 However, noncompliance in the drafted PdIs have also been identified, particularly relating to:
 - i. ambiguity in attributing critical issues to the specific established codes, partly determined by overlapping and/or redundancy of critical areas identified and also due to an excessive generality in the definition of individual critical items;
 - ii. the absence of indicators aimed at measuring the critical issues identified for the district or, in the case of their identification, poor uniformity in the choice of indicators to measure these critical issues, or the discretionary attribution of current levels;
 - iii. inconsistencies between the critical issues for the district and their proposed measurement indicators, with the use of both indicators aimed at detecting the effect of the investments and/or 'binary' type indicators, unable, in both cases, to highlight the actual conditions and the progress in the resolution of the relative critical issues;
 - iv. the lack of uniformity and/or consistency in the assignment of individual planned investments to the corresponding areas of critical issues to be resolved and/or mitigated, with resulting classification difficulties and limited significance levels of analysis aimed at comparing the demands for investments at national level.
- 2.12 In summary, an unambiguous relationship between critical issues and KPIs is not a feature usually and/or immediately identifiable in the received PdIs, sometimes giving the only impression of a formal, not essential, requirement to the methodological guidelines outlined in the referred DSID Determination 3/2014.
- 2.13 On the other hand, the poor inclination to implement a rigorous measurement system, with the use of standardized KPIs prevents from adopting methods aimed at comparing technical feasibility and environmental sustainability, as well as economic and financial analysis and risk assessment for each of the identified planning strategies.

- 2.14 Indeed, the set of PdIs issued as part of the tariff proposals according to the MTI, lack indications on the assessment of investment alternatives and, as a result, it is impossible to establish whether the ex-ante selected strategies correspond to the most efficient options in terms of the allocation of economic resources.

MTI-2 Stage

- 2.15 In the light of the analysis of the PdIs received in the first regulatory period, as briefly described in the previous paragraph, first of all, this investigation was specifically launched to investigate the methods to identify the planning strategies adopted in the PdI; then the Regulatory Authority introduced, for the second regulatory period 2016-2019 (MTI-2 stage) , new requirements for updating PdIs.
- 2.16 In detail, as set out in Articles 3 and 4 of Annex A of Resolution 664/2015/R/IDR, the Regulatory Authority illustrated the criteria and minimum content essential to updating the PdIs as part of MTI-2, requiring, in addition to that already requested in MTI:
- i. an indication of the population affected by individual critical issues, with the aim of obtaining the relative weights;
 - ii. an indication of the population affected by each specific investment, as identified to solve a critical issue, with the aim of obtaining the impact of single planned investments and first information on their effectiveness;
 - iii. due motivation in the case of any discrepancies between the predicted investments detailed in the new planning for 2016 and 2017 and those reported for the same years as part of the MTI, with the aim of enforcing and fully monitoring the planned investments adopted to solve critical issues identified in the EGA district.
- 2.17 In addition, again with the aim of adequately monitoring, Article 11 of Annex A of Resolution 664/2015/R/IDR has introduced the specific control (already part of the MTI) of the realisation of planned investments, which requires the EGA to justify any discrepancies between the total amount of investments planned for 2014 and 2015 and the actual investments realised for the same years.
- 2.18 Furthermore, from one hand, an increased correlation between the individual identified critical issues and the investments assessed and subsequently planned by the EGA to solve these issues and, on the other hand, the systematisation of the requested data and information to be provided by EGA were both reiterated under MTI-2; such evidence is also expected to be useful to achieve the aforementioned completeness and usability information aims by the Regulatory Authority Offices during the verification and analysis of PdIs. To this end, with DSID Determination 2/2016 of 30 March 2016, the Regulatory Authority has established:

- i. a new version of the PdI format;
- ii. dedicated tools for reporting and systematisation of PdI data and information,

with the additional requirement for the EGAs to communicate online PdI updates compliant with the formats described above.

- 2.19 Furthermore, the Regulatory Authority carefully reviewed the organisation criteria, proposing eight classification categories, eliminating those that were the potential cause of attribution ambiguity, and introducing new crosscutting and/or intangible areas, for the main purpose of making it clear the widespread shortcomings that are not only infrastructural but also related to poor knowledge and operation of water and wastewater system.
- 2.20 Moreover, the Regulatory Authority adapted and refined the specific alphanumeric criticality codes, currently standing at 137, in order to capture the extreme complexity and heterogeneity of the SII sector in the multiple and varied geographical contexts.
- 2.21 Finally, it is worth underlining that through the revision of the PdI format, as briefly described above, an in-depth review of the EGA planning process has been performed :
- i. periodical survey of the characteristics and status of SII infrastructures, by means of suitable KPIs, in order to extract relative current values to identify extensively and exhaustively the status of SII in the pertinent area;
 - ii. comparison between the current indicator levels and the general objectives of higher-level planning, in order to detect possible discrepancies and therefore providing evidence of the critical issues of the area;
 - iii. identification, as part of possible higher-level strategies, of alternative investment options, aimed at resolving the identified critical issues;
 - iv. the selection, for every critical issue, of the optimal investment strategy and the identification of the specific target level of the relative indicator, which should come out of the overall figure of merit of the selected strategy; a potentially different or more detailed level as compared to that outlined by the general objectives of higher-level planning;
 - v. adoption of the implementation programme for the whole set of selected interventions;
 - vi. periodical revision of activities undertaken, with a view towards the continuous monitoring and progressive improvement of the service.

Main evidence

- 2.22 The provision of digital formats, according to the DSID Determination 2/2016, enabled the first accurate analysis of a sample of PdIs, issued for the tariff proposals ex MTI-2, carried out by the Regulatory Authority Offices, with a 60.6% coverage in terms of national population¹.
- 2.23 With reference to the analysis of the frequency of critical issues indicated by the EGAs, despite the previously described attempts to substantiate and further detail the list of envisaged individual critical issue codes, difficulties seem to persist in capturing the extreme heterogeneity and specificity of the different local districts, given that the rankings of the top 15 most frequently occurring critical issues, in terms of both number of operators and served population, include the generic code ‘Other Critical Issues’ (indicated by 59% of the population sample), which should have been a marginal code.
- 2.24 In addition, the distribution of investments for the four-year period 2016-2019, with regard to interventions identified to resolve specific critical issues, acknowledges the destination of an overall share of just over 14% to overcome these ‘Other Critical Issues’ in each of the eight areas of classification established by the DSID Determination 2/2016.
- 2.25 A 14% investment share of the total investments planned over the four-year period 2016-2019 relates to crosscutting and/or intangible critical issues, thus highlighting the significant and widespread need for investments aimed at increasing the efficiency and know-how of SII operations, an essential requirement for optimal investment choices.
- 2.26 In terms of more qualitative investigation, some methodological shortcomings have been disclosed by the analysis of the alternative investment options, as summarised by the EGAs in the received PdIs :
- i. frequently, where present, the analysis of investment options resulted to be only qualitative and presented in a descriptive manner, thus highlighting poor adoption of rigorous and consolidated methods that comply with international guidelines, also promoted by the European Union²;
 - ii. at times, analysis is misunderstood to be a demonstration of consistency between the intervention strategies already identified and the higher-level objectives, leaving EGAs to suppose that higher-level planning can be used as unquestioning justification of investments choices;
 - iii. at times, the description reveals in reality the adoption of an “inverse” rationale in the planning process, in which efforts are directed towards

¹ Reference: ISTAT Italian population as of 1 January 2016.

² For example, see the report of the European Commission (2015). Guide to Cost-Benefit Analysis of Investment Projects, Brussels, doi:10.2776/97516, available at http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf

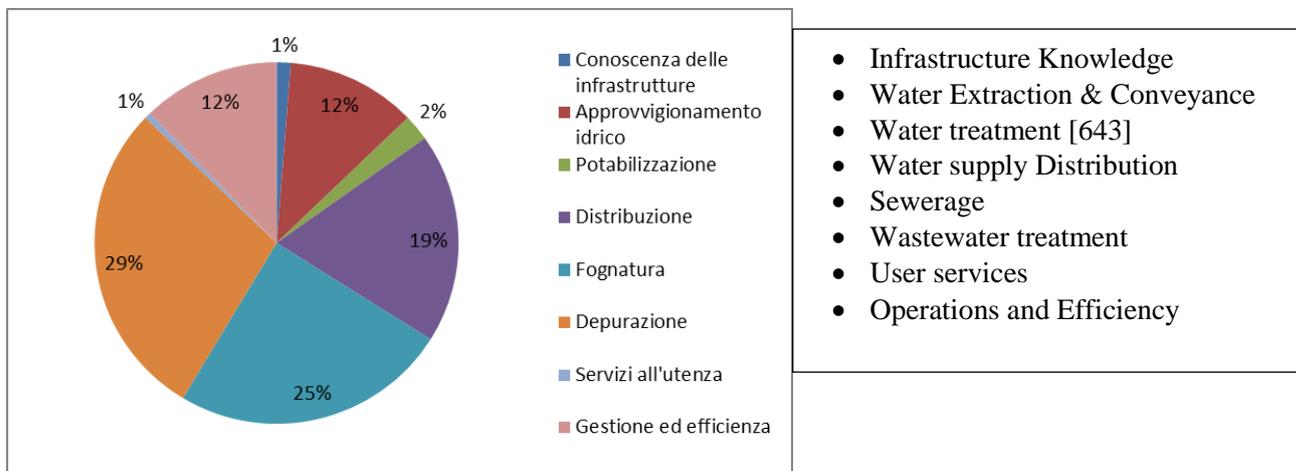
attributing *ex post* investments – already identified – to the detected critical issues;

- iv. often, the adopted of this “inverse” rationale in the planning process causes and justifies the frequent use of KPIs of ‘intervention monitoring’, rather than those of critical issue assessment, with a *project management* point of view rather than a *planning* point of view.

- 2.27 Alongside the justified adoption by some EGAs of relevant and suitable indicators, accompanied by evidence of detailed measurement procedures, certain examples are observed in which indicator levels, both quantitative and qualitative, are attributed in a discretionary manner, with no clear indication of the adopted criteria and/or the used calculation methods.
- 2.28 In summary, often a clear, obvious, shared correspondence between critical issues and KPIs cannot be found, nor are the methods for calculating the indicators that would make unequivocal their meaning and generalizable their use .
- 2.29 On the other hand, the selection, from a range of alternative planning options, of programmed investments to overcome critical issues is unlikely to be achieved without carrying out an accurate quantitative analysis of the status of the SII. As a matter of fact, such a quantitative analysis may only be implemented through the use of specific KPIs as an objective tool to quantify and to connect critical issues with investments identified during the planning process.

3. Infrastructures survey

- 3.1 Lacking a homogeneous system of indicators an objective and comparable identification of the status of the SII infrastructures throughout the entire national area is unlikely to be carried out, yet the analysis of the PdIs, arranged according to MTI-2 guidelines, enabled the Regulatory Authority offices to in depth survey the most common critical issues as indicated by EGAs. The following analysis is therefore focused on the identification of the most recurrent critical issues on the national area.
- 3.2 Based on the planned investments, the critical areas that require greater investments – calculated over the four year period 2016-2019 – are mainly concentrated around wastewater treatment and sewerage activities – which are subject to European infringements – followed by the activity of water supply.



3.3 The following section illustrates the main evidence for each of the activities of the water supply chain.

Water supply system

3.4 as far as water supply activities are concerned, with reference to water extraction and conveyance, drinking water treatment and distribution, strong shortcomings have been arisen in the pipelines physical conditions (critical issue mentioned by 62% operators, covering 67% of the Italian population). Similar problem is significantly highlighted on both distribution and conveyance networks, mainly due to the ageing of the pipes and the low rate of renewal. In turn, this issue strongly affects the extent of network water losses, with poor performance in the leakage reduction target. In fact, also the high level of water leakage throughout distribution networks is one of the most frequently mentioned, which affects 46% operators which cover 44% of the population.

3.5 A second, very widespread problem is related to the lack of sources to ensure the security of provision, which affects 54% operators, covering 69% of the population. This issue along with the other connected to the vulnerability of procurement sources, mentioned by 25% of operators (36% of the population), makes a picture of general weakness in the water supply system throughout the national area.

3.6 A further issue, very frequently identified, relates to the poor functioning or the ageing of user meters, which is indicated by 48% operators, which cover 54% of the population. This issue tends to undo the efforts aimed at achieving the national and European objectives of saving water.

- 3.7 Finally, among the most frequently mentioned issues, the inadequacy of the physical conditions of the civil works along the entire water supply chain is also highlighted, which is mentioned by 39% operators that provide the service to 31% of the population.

Sewerage

- 3.8 The need to achieve total coverage of the population is still today the most significant critical issue in the sewerage system. In fact, out of all the analysed plans, for a significant portion of operators (around 68% of the total³) existing limited areas of local districts – individual municipalities or agglomerations – are still reported as not adequately covered with collecting system for urban wastewater, in compliance with relevant provisions as per Directive 91/271/EEC concerning wastewater treatment .
- 3.9 Secondly, most of the existing sewerage system is lagging behind, thus underlining the need to renovate networks and the related systems. In particular, cases of ageing and physical inadequacy of the sewerage infrastructure have been identified by 67% of the sample analysed with reference to pipelines, by 44% as regards plants and 28% for storm-overflow sewage, which often require to be adapted to current standards. The dimensional inadequacy of the infrastructure – for example in terms of excessive or insufficient speed and excessive filling levels – concerns 22% operators.
- 3.10 Closely related to the problems discussed above are the high inflow and infiltration problems and the frequency of flooding in sewer systems, which are indicated, respectively, by 25% and 23% of the panel.

Wastewater treatment

- 3.11 Deep and widespread shortcomings in terms of absence and inadequacy of the service are confirmed as critical aspects of the wastewater treatment sector. Almost half of the surveyed operators– which serve 66% of the sample population – have indicated as prevalent issues the absence of the service in some areas of the served territory, followed by the proven inadequacy of wastewater treatment plants, where they exist, in terms of plant obsolescence and incompleteness of the treatments to ensure full compliance with the discharge limits envisaged by current environmental standards.
- 3.12 Where the wastewater treatment service is active, situations of non-compliance are identified in terms of absence of appropriate treatments in accordance with

³ The operators in question cover 75% of the population of the sample, but the data provided are not sufficient for extrapolating the incidence of the problem in terms of population served.

article 7 of the previously mentioned 91/271/EEC (indicated by 20% operators, for a served population equal to a third of the sample), as well as absence of the required more stringent treatments in the areas classified as “sensitive areas” (article 5 of the same directive), for 18% operators which cover 31% of the sample population.

- 3.13 Furthermore the critical issue related to excessive service fragmentation is also frequently mentioned, with the presence of inefficiently sized plants (30% operators, which cover 55% of the population), which is often tackled with decommissioning them and simultaneous centralising the service towards plants with greater potential. In turn, this causes consequent problems related to the adjustment for the increased load placed on the latter (a critical issue identified by 25% of operators, serving 37% population).
- 3.14 Finally, another frequent problem is represented by managing sludge, both in terms of the need to reduce landfill usage, an option going to disappear but still largely widespread (critical issue indicated by 18% operators, covering a population equal to 18% of the sample), and in terms of inadequacy of the sludge treatment phase within the wastewater treatment plants, which hampers correct downstream recovery (critical issue indicated by 10% operators, for a population served equal to 18% of the sample).

4. Development of critical issue measurement indicators

- 4.1 Based on the previous findings, fostering a process for developing and sharing a set of measurement indicators for each critical issue, punctually defined and recognised as adequate, has been considered appropriate. Annex B presents a “Survey of performance indicators for measuring infrastructural and operative critical issues of the integrated water service” prepared by the University of Palermo – Department of Civil, Environmental, Aerospace, and Material Engineering – and by the Sapienza University of Rome – Department of Civil, Construction and Environmental Engineering – (hereinafter: Study Group).
- 4.2 The Study Group aimed to associate each critical issue with all indicators taken from literature and/or indicators *ad hoc* formulated which, according to the authors, best could describe and quantify the critical issue. The decision on which and how many of these indicators should be effectively correlated with each critical issue is left to an eventual following procedure by the Regulatory Authority, as well as the detailed indications related to the measurement methodology.
- 4.3 The indicators are identified by an explanatory name, an unequivocal alphanumeric code and are accompanied by the description of: calculation formula, measurement units, measurement procedure description and source from which they were taken or adapted, if any; the *ad hoc* expression is used in

case of own processing or models extracted from the set of PdIs analysed by the Regulatory Authority's Offices.

- 4.4 Furthermore, with reference to the investigation purpose , as previously recalled, and specifically *verifying consistency between critical issues identified by EGAs on their local districts and the proposed planned investments* (point 1.2, letter i.), a series of indications emerged from the survey which are added to the list of indicators developed by the Study Group and provide elements for the development of the Regulatory Authority's regulatory activities.
- 4.5 In particular, in case of a future PdIs revision, a further review of the list of the specific critical issue codes seems to be appropriate in order, on the one hand, to simplify the list, in order to eliminate further residual redundancies, and, on the other hand, to further refine them, in an effort to intercept part of what resulted to be assigned to generic items.
- 4.6 The definition of the critical issue measurement indicators has to take into account certain recommendations taken from the International Water Association⁴, with reference to the design of a system of performance indicators, whose adequacy may be well conveniently extended to the development of critical issue measurement indicators. In particular, the following requirements are mentioned:
 - i. Being clearly and unequivocally defined, easily understood and achievable with reasonable effort;
 - ii. Being objectively quantifiable and verifiable through audits;
 - iii. Being universal, so as to provide a measure independent from specific conditions of the territorial context and/or the involved management;
 - iv. Including information related to the quality of data of any underlying variables;
 - v. In the case of composite indicators, the underlying variables, as well as meeting all the previous requirements, must refer to the same geographic boundary and the same timeframe of the overlying indicators and, in case of using variables external to SII , they must be collected from official sources.
- 4.7 Some other methodological important criteria arose from this investigation aimed at selecting proper indicators:
 - i. Favouring quantitative indicators and the use of shared formal principles for the attribution of the level of qualitative indicators;

⁴Alagre H., Baptista J.M., Cabrera E. Jr., Cubillo F., Duarte P., Hirner W., Merkel W., Parena R. (2016). *Performance Indicators for Water Supply Services*, Third Edition - IWA Publishing, ISBN: 9781780406329.

- ii. Selecting indicators suited to the identification of critical issue at the point on the supply chain where it occurs, thus excluding indicators that measure impacts or effects downstream and/or the progress of the investment, already implicitly identified;
- iii. Favouring the selection of «analogue» indicators rather than binary indicators to gauge the extent of critical issues and quantify the gap in relation to the higher-level objectives, also to monitor the intermediate level of resolution of the critical issue;
- iv. Drawing on the best consolidated foreign experiences and reviewing sources as recognised at the academic and international level, as well as the good practices as highlighted from PdIs analysis.