



Performance Audit
Smart and RF meters' contribution to more
accurate and timely utilities billing
November 2021



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and timely utilities billing

Report by the Auditor General
November 2021

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List of Abbreviations

AMM	Automated Meter Management
ARMS	Automated Revenue Management Services
CRM	Customer Relationship Management
ERP	Enterprise Resource Planning
EMS	Energy Management System
EU	European Union
HoT	Head of Terms
IBM	International Business Machines
ICT	Information and Communications Technology
ISSAIs	International Standards of Supreme Audit Institutions
IUBS	Integrated Utilities Business Systems
KPI	Key Performance Indicator
kWh	Kilowatt-hour
LVC	Low Voltage Concentrator
NA	Not applicable
NAO	National Audit Office
PLC	Public Limited Company
PDA	Personal Digital Assistant
RF	Radiofrequency
SAP	Systems Analysis Programme
TFEU	Treaty on the Functioning of the European Union
UK	United Kingdom
WSC	Water Services Corporation

Key Facts



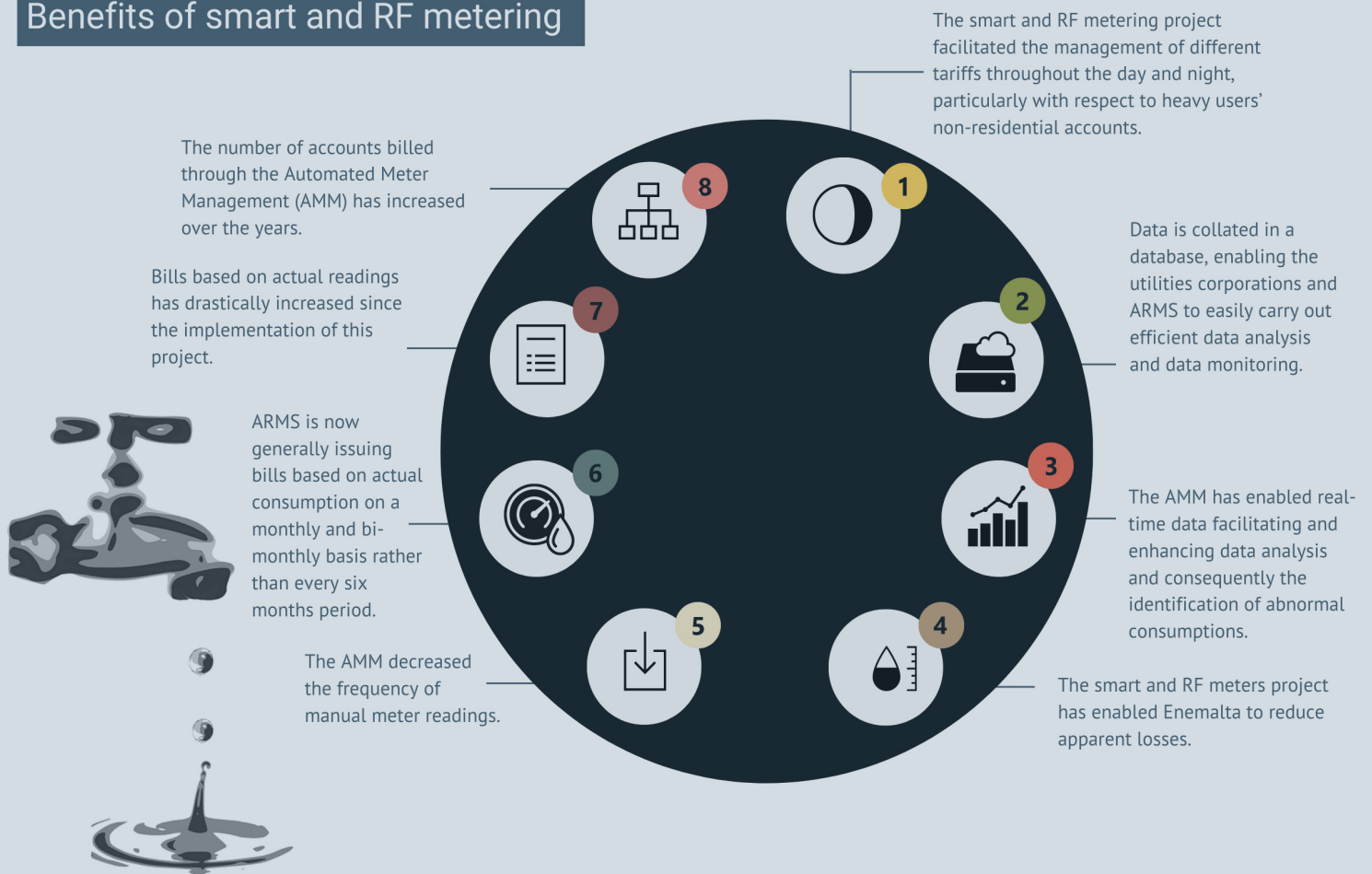
Smart and RF meters investment costs (2009 - 2020)

Enemalta	WSC	Total
€' million	€' million	€' million
85.1	45.6	130.8

Outline of project roll-out as at end of 2020

	Electricity	Water
Number of accounts	318,347	289,723
Number of meters installed and connected to the AMM system	100 per cent	91 per cent
Billable every 20 days	94 per cent	87 per cent

Benefits of smart and RF metering



The Budget Speech for Financial Year 2022 noted that Government is committed to adopt a new billing methodology which is fair on all consumers. The Budget Speech noted that the new system will permit unutilised consumption within lower tariff bands to be carried forward to subsequent periods.

Executive Summary

Introduction

1. The electricity smart and water radiofrequency (RF) meters project implemented by Enemalta public limited company (plc) and Water Services Corporation (WSC) required a total investment of €131 million, out of which approximately €52 million were earmarked for the metering infrastructure, over a period of 12 years ranging from 2009 to 2020. The bulk of this investment materialised up to 2013. The project was primarily intended to ensure that utilities' billing is based on real-time readings of actual consumption. This project would not only introduce real-time automated readings, but it would also contribute to more accurate billing, reducing the need to estimate consumption in cases of inaccessible or malfunctioning utilities meters. Moreover, the project was intended to minimise apparent losses, that is, unbilled consumption in terms of incorrect billing (wrong meter readings, incorrect estimates, etc), water leakages and theft. The main consideration for this project was Enemalta plc. Although WSC was included in the scope of the project, there were no detailed assessments regarding the impact of the project on this entity.
2. The financial materiality involved, the project's critical importance to upgrade the utilities companies' infrastructure and customer expectations were the main drivers for the National Audit Office (NAO) to engage in this review. This performance audit sought to determine the extent to which the smart and RF meters project enhanced the efficiency and effectiveness of the utilities' revenue generating arm, namely through billing. Consequently, this audit was concerned with assessing whether the operation of smart and RF meters is yielding pre-determined results leading to a more effective and efficient billing process. During this audit, the NAO elicited auditees' feedback on various aspects of this review, including through early drafts of this Report. With respect to the final draft of the Report, WSC stated that there were no additional comments as, in most cases, the Corporation's input was taken in consideration. On the other hand, Enemalta plc and Automated Revenue Management System (ARMS) pointed out some technical and accounting issues which were considered by the NAO for the purposes of the final draft.

The operation of electricity smart and water radiofrequency (RF) meters

3. This performance audit discussed the envisaged financial savings that were expected to be reaped following project implementation. While apparent losses relating to electricity decreased from 7.64 in 2009 to 1.42 per cent in 2019, as referred to in Section A.7. in Appendix I, non billed consumption relating to water remained stable in the region of 30 per cent of total supply over the lifetime of the project. Moreover, the utilities entities did not manage to fully capitalise on the potential efficiency gains connected with

project implementation due to a number of issues, mainly pertaining to the questionable ‘smartness’ of the implemented technology with respect to the WSC RF system.

4. Although not referred to in quantifiable terms, the project led to the upgrading of the companies’ back office infrastructure but also generally resulted in a more qualitative service to customers in terms of billing frequency, accuracy together with real time monitoring of consumption, allowing WSC to alert its clients in a timely manner as regards to abnormal consumption trends. Business transformation achieved through the introduction of the Enterprise Resource Planning (ERP) and the Energy Management System (EMS) are yielding positive results for example in the area of electric vehicles.
5. Unlike electricity smart meters, the water meter setup is susceptible to various technical faults. A recent study by WSC and ARMS calculated that there are 17,928 water meters flagged for inspection. Within this context, a stopped water meter only refers to at least two identical consecutive readings. Repeated readings, however, do not necessarily imply a stopped meter. Over the past months, WSC and ARMS implemented an intelligent algorithm that identifies meters requiring an inspection. These algorithms being implemented by WSC are an effort to smarten the RF data acquisition technology.

Smart and RF meters’ contribution to billing efficiency, frequency and accuracy

6. Due to the interpretation of what constitutes a ‘stopped’ water meter and various technical issues resulting in delays in the transmission of readings, in 2020, the percentage of bills issued by ARMS based on automated readings amounted to 80 and 67 per cent for electricity and water bills respectively. The low percentage relating to water bills is mainly due to an over estimation of stopped water meters which are billed on the basis of estimated consumption as well as meters which have not yet been switched to automated billing. The over estimation of stopped water meters arises since the billing agency uses the term ‘stopped’ as an all-encompassing category which groups together meters transmitting repetitive readings. Such circumstances do not necessarily imply that the meter is damaged.
7. Practices adopted by the utilities companies and ARMS with respect to billing have always been based on pro rata basis which is a ‘billing frequency’ that requires pro rata calculations to process multiple bills in a year. In these circumstances, the billing calculation applies annual tariff bands and eco-contribution reductions on a pro rata basis, that is, either monthly or bi-monthly. Billing calculations based on this billing methodology were generally found to be correct. However, this methodology with respect to electricity consumption is the subject of litigation before the Courts of Law. NAO established that a variance materialises between the two billing methods whereby the heavier consumers are those mostly affected. On the other hand, the annualised billing methodology will lead to cases where consumers with unstable consumption traits may incur higher utilities costs. This implies that more in-depth studies are required as quasi-favouring the heaviest peak consumers would deviate from the fundamental polluter pays principle enshrined in

Article 191 of the Treaty on the Functioning of the EU (TFEU). Moreover, for fairness' sake, NAO cannot ignore the fact that this complex issue has important financial implications in respect of both public utilities. Obviously, since the case is sub judice, it is prudent for the NAO to limit its comments to the foregoing.

8. The Budget Speech for Financial Year 2022 noted that Government is committed to adopt a new billing methodology "which is fair on all consumers" (*li hija ġusta għal kulħadd*). The Budget Speech noted that the new system will permit unutilised consumption within lower tariff bands to be carried forward to subsequent periods. To this end, the Minister for Finance and Employment announced that Government will be working on changes to the current legislative provisions.
9. Despite the high level of automation, questions arise relating to cost efficiency at the billing agency. The number of staff employed by ARMS has increased significantly in recent years. In cases, such as those relating to the legal office, it is clear that such increases were necessary to strengthen ARMS' position in questions of litigation. However, it was not always evident as to why most departments within ARMS were augmented with human resources when both the billing and the administrative functions were generally automated. ARMS contends that the increase in staff is reflected both in the increased services being offered by ARMS as well as in the efficiency of internal processes and in the departments within the company. Although billing is one of the main functions performed by ARMS, the entity contended that this is not the only function carried out. ARMS fulfills other important functions including customer care, finance, debt collection and revenue management, which previously used to be carried out by WSC. Naturally, the expansion of the company's operations necessitated an increase in the head count.

Overall Conclusion

10. The electricity smart and water radiofrequency (RF) meters project generally yielded positive results, including the automatic transmission of real-time readings enabling the billing agency to issue most of its bills based on actual consumption. Additionally, Enemalta managed to substantially decrease the amount of unbilled electricity lost through apparent losses and an aggressive revenue collection policy. Also, WSC utilised Automated Meter Management (AMM) data to detect in real time, third party internal leakages, thus reducing unnecessary financial burden, operational manpower and improved customer experience.
11. The cost of this project was material and its effectiveness cannot be exclusively assessed in terms of its financial merits. From a financial point of view, the project did not recover all of the capital invested. Yet the project provided a modern billing infrastructure for the utilities to strengthen their billing function, leading to more efficient revenue collection. The utilities transferred their billing function to ARMS, the operational costs of which can be considered as an overhead that is ultimately borne by clients.

Recommendations

12. In view of the findings and conclusions emanating from this performance audit, the NAO is proposing the following recommendations which have been categorised at the strategic level, as well as the operational level of the utilities and billing agency:

Strategic

- i. In accordance with measures announced in the Budget Speech for Financial Year 2022 and the subsequent conclusions of current court cases, consideration is to be given for the updating, better definition and harmonisation of current legislative provisions on the billing methodology of electricity and water consumption. As noted in the Budget Speech, these revisions would enable a new billing methodology which is fair on all consumers.
- ii. Irrespective of the outcome of the court case referred to in the preceding recommendation, it is proposed that the utilities companies are to conduct in-depth studies to ensure that the polluter pays principle enshrined in Article 191 of the Treaty on the Functioning of the EU remains central to any billing methodology adopted.
- iii. The utilities companies and the billing agency are encouraged to establish long-term definitive Key Performance Indicators (KPIs). While acknowledging that the longitudinal monitoring of trends is important since it helps the respective organisations to review their periodical performance, this state of affairs cannot formally and conclusively assess the extent to which specific performance indicators deviate from the ultimate target, as the latter has not been determined.
- iv. The utilities and the billing agency are encouraged to update the current Head of Terms (HoT) agreement to better reflect current circumstances and future developments regarding operational aspects as well as a customer interface which is increasingly based on technological innovations. Within this context, an updated HoT would ensure that the three stakeholders are synchronised when implementing operational and logistical improvements.

Utilities companies

- v. Water Services Corporation is encouraged to sustain its effort in adopting a more proactive approach in tackling under-registered and stopped water meters. WSC should also take action on sites where there is probably no consumption of water, such as in abandoned buildings. This will supplement efforts on stopped water meters notified by customers.
- vi. Water Services Corporation and ARMS, in terms of the Head of Terms (HoT) agreement between the stakeholders, are encouraged to increase their efforts in further addressing non-technical losses, as this would substantially increase its revenue.

ARMS

- vii. The opportunity exists for the billing function to exploit further automation functions provided through the AMM. This may entail ARMS to review its current increasing operational costs, particularly the cost item relating to salaries and wages. This may necessitate that ARMS reviews its procedures relating to manual meter reading and the correction of bills. While acknowledging that increasing client demands for better customer care and real time information require significant investment and recurrent expenditure, the billing agency should increasingly strive to achieve better cost efficiency of its processes particularly in view of the high level of automation within the billing process.

Chapter 1 | Terms of Reference

1.1. Introduction

- 1.1.1. The electricity smart and water radiofrequency (RF) meters project implemented by Enemalta plc and Water Services Corporation (WSC) required a total investment of €131 million, out of which approximately €52 million were earmarked for the metering infrastructure, over a period of 12 years ranging from 2009 to 2020. The bulk of this investment materialised up to 2013. For the purposes of this Report, smart meters are used to refer to the new electricity meters, whereas RF meters are used to refer to the new radiofrequency water meters, as opposed to analogue meters. This project has to be seen within the context that the utilities corporations, in 2020, generated revenue through the sale of electricity and water amounting to €329.8 million and €71.1 million respectively.
- 1.1.2. The project was primarily intended to ensure that utilities' billing is based on real-time readings of actual consumption. This project would not only introduce real-time automated readings, but it would also contribute to more accurate billing which would reduce the need to estimate consumption in cases of inaccessible utilities meters. Moreover, the project was intended to minimise apparent losses, that is unbilled consumption. The main consideration for this project was Enemalta plc. Although WSC was included in the scope of the project, there were no detailed assessments regarding the impact of the project on this entity.
- 1.1.3. The financial materiality involved, the project's critical importance to upgrade the utilities companies' infrastructure and customer expectations were the main drivers for the NAO to engage in this review. This performance audit sought to determine the extent to which, the smart and RF meters project enhanced the efficiency and effectiveness of the utilities' revenue generating arm, namely through billing. Consequently, this audit was concerned with assessing whether the operation of smart and RF meters is yielding pre-determined results leading to an effective and efficient billing process. This audit follows an investigation and a subsequent follow-up report which were carried out by this Office in November 2011 and August 2012 respectively. The 2011 investigation acknowledged that progress had been made since the change-over to the new system and the take-over by Automated Revenue Management System (ARMS). However, at the time, there were still material deficiencies that had to be addressed. Moreover, it also acknowledged that further progress in the project implementation of smart and RF meters had to be achieved before any tangible return on the significant investment made could materialise.

1.1.4. During this audit, the NAO elicited auditees' feedback on various aspects of this review, including through early drafts of this Report. With respect to the final draft of the Report, WSC stated that there were no additional comments as, in most cases, the Corporation's input was taken in consideration. On the other hand, Enemalta plc and ARMS pointed out some technical and accounting issues which were considered by the NAO for the purposes of the final draft.

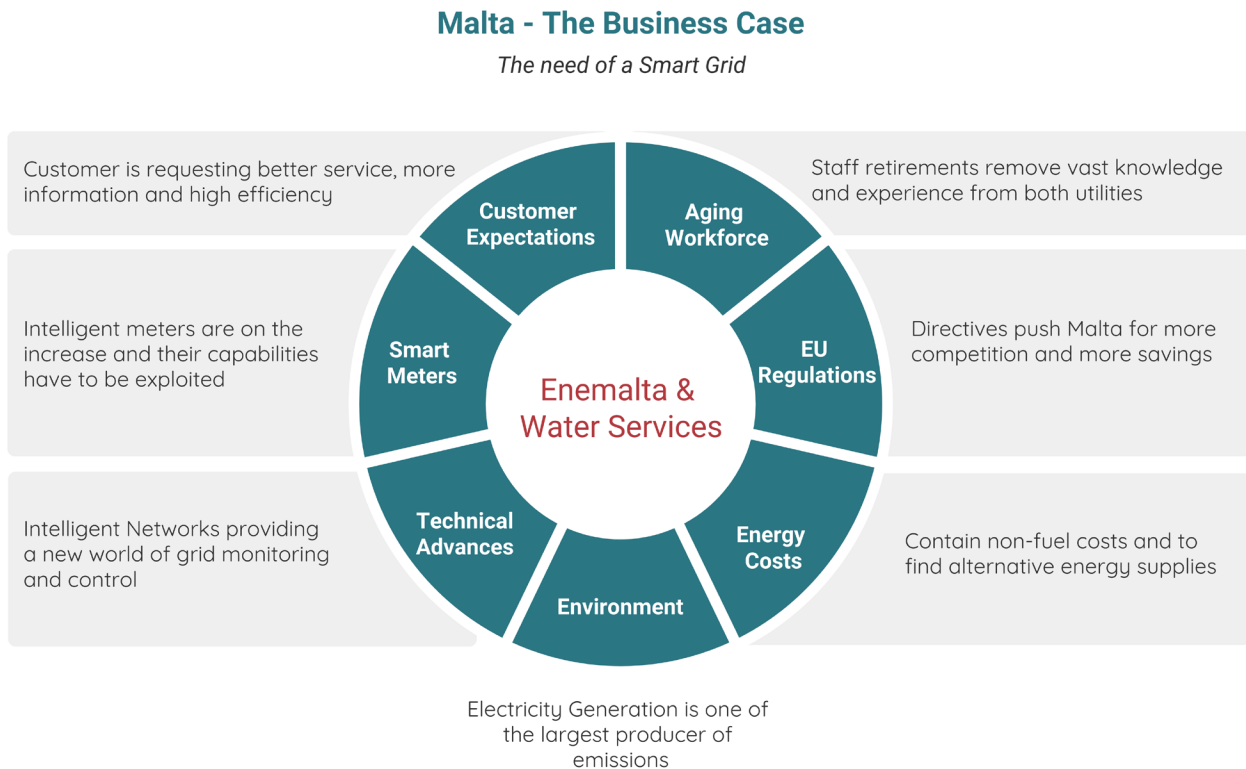
1.1.5. This introductory Chapter discusses the following:

- a. The capital invested in the smart and RF meters project;
- b. The roll-out and coverage of smart and RF meters;
- c. Audit focus;
- d. Audit methodology; and
- e. Report structure.

1.2. The utilities corporations invested over €131 million during a period of 12 years

1.2.1. Through the Government tendering procedures, the business case for the smart and RF meters project was presented by International Business Machines (IBM) to the two utilities entities in 2007. Therein, it was stated that the intelligent metering system would address customer expectations and provide better services. Moreover, the system was intended to facilitate compliance with requirements in European Union (EU) regulations, contain customer energy costs, enable utilities to better monitor and control as well as address knowledge gaps particularly those related to unbilled consumption. Figure 1 refers.

Figure 1 - The need to set up a smart and RF metering system



Source: IBM Corporation 2010, 'Lessons from building the Smart Grid - Malta Case Integrated Utilities Business Systems (IUBS)'.

- 1.2.2. In December 2008, Enemalta and WSC partnered with IBM and engaged in a €78 million implementation of the Integrated Utilities Business Systems (IUBS) programme. This amount forms part of the total project value of €131 million invested by Enemalta and WSC over a period of 12 years. Table 1 refers.

Table 1 - Smart and RF meters investment costs (2009 - 2020)

	Enemalta €	WSC €	Total €
IUBS Capital (software and licenses)	42,232,880	35,538,843	77,771,723
Automated Meter Management (AMM) Hardware	42,874,320	10,077,659	52,951,979
Personal Digital Assistant (PDA)	-	32,496	32,496
Total	85,107,200	45,648,998	130,756,198

Source: Enemalta and WSC.

- 1.2.3. The investment costs portrayed in Table 1 also illustrate the complementary investment that was required to ensure the implementation of the smart and RF meters project. The establishment of ARMS was deemed necessary as it was allocated the role of the utilities billing function, previously carried out by WSC. This was a joint venture between both utilities entities to facilitate the billing process. Apart from the initial investment, the utilities also finance the day-to-day operations of ARMS. To this end, in 2020, Enemalta and WSC's contribution to ARMS represented a 50:50 ratio which amounted to €5.7 million per utility corporation. This differs from the provisions of the Head of Terms (HoT) Agreement officially endorsed by WSC and ARMS in January 2014, which stipulated a 60:40 ratio between Enemalta and WSC respectively.

- 1.2.4. In addition to the above, recently the WSC invested in an intelligent programme algorithm to monitor and detect abnormal consumption and understand the root cause of repetitive readings during the billing process. Moreover, WSC also introduced other programmes to double check in real time any anomalies within the billing process as well as to monitor and detect abnormal readings and water leakages not yet detected by consumers.

1.3. The roll-out and coverage of smart and RF meters

- 1.3.1. It is not the intention of this Report to analyse the historic roll-out of the smart and RF meters project. This was the subject of the previously mentioned audit investigation which was published in 2011. The intention of this Section is merely to provide background information and context to the analysis presented in the subsequent Chapters of this Report. Originally, the roll-out of the programme was intended to span over a five-year period. The timetable and structure of the plan was built in such a way as to ensure business continuity and alignment with the overarching strategy. Moreover, the programme was planned out so as to maximise benefits as early as possible within the programme and facilitate the change that was introduced by the Automated Meter Management (AMM).

1.3.2. In practice, this target was partially attained as, by 2014, the roll-out of smart and RF meters totalled 94 and 79 per cent respectively. Eventually, the utilities companies registered significant roll-out progress as by end of 2020, 100 per cent¹ and 93 per cent of electricity and water meters respectively were installed. These figures are to be viewed within a context whereby as at end of 2020, the electricity and water utilities companies had 318,347 and 289,723 accounts respectively. Table 2 refers.

Table 2 - Outline of project roll-out

	As at end of 2014		As at end of 2020	
	Number	Per cent	Number	Per cent
Number of electricity accounts	277,859	100	318,347	100
Out of which:				
Number of smart meters installed and connected to the AMM system	261,187	94	318,347	100
Out of which:				
Electricity reading via AMM is provided every 20 days	169,494	61	299,246	94
Number of water accounts	260,089	100	289,723	100
Out of which:				
Number of RF meters installed	206,065	79	269,131	93
Out of which:				
Number of RF meters connected to the AMM system	200,707	77	264,135	91
Out of which:				
Billable RF meters every 20 days	195,519	75	251,243	87

Source: Enemalta and WSC.

1.3.3. Table 2 shows the high roll out of Smart and RF meters, all of which should be able to transmit timely consumption readings for billing purposes, considered to be every 20 days. In practice, the number of meter readings which ARMS are comfortable using for billing purposes is significantly lower than the 94 and 87 per cent for electricity and water respectively. The matter will be discussed further in Section 2.4.

¹ Any remaining non-smart meters are considered not active.

1.4. Audit focus

1.4.1. Against this backdrop, this Report sought to evaluate the extent to which the smart and RF meters project enhanced the efficiency and effectiveness of the utilities operations including their revenue generating function, namely through billing. In this regard, this review sought to assess the extent to which the smart and RF meters project:

- a. Is yielding pre-determined results; and
- b. Is leading to an effective and efficient billing process.

1.4.2. All issues and conclusions presented in this Report, unless otherwise indicated, reflect the situation up to January 2021.

1.5. Audit methodology

1.5.1. The attainment of the aforementioned objectives entailed a number of methodological approaches. These involved the following:

- a. **Adherence to ISSAIs** - The audit was carried out in accordance with the Standard for Performance Auditing, International Standards of Supreme Audit Institutions (ISSAI) 3000.
- b. **Documentation review** – This included a thorough analysis of the legislative framework, together with the related strategies that were carried out. The literature review undertaken during the planning stage of the audit encompassed audits carried out by United Kingdom (UK) NAO.
- c. **Semi-structured interviews** – These interviews enabled the collation of qualitative data, which in turn was used to corroborate information arising from other sources and approaches. To this end, the NAO interviewed key officials within the Ministry for Energy, Enterprise and Sustainable Development, Enemalta, WSC and ARMS.
- d. **Data analysis** – This approach was required to determine the roll-out and coverage of smart and RF meters, as well as to verify and identify concerns within the billing process. This analysis entailed a tracer study of a randomly-selected sample of 100 accounts held by ARMS during a period of one year ending in January 2021. This sample represented a 95 per cent confidence interval with a ten per cent error rate.

- e. **Financial analysis** – This Office analysed the variance arising through pro-rata billing against annualised billing. This Office could only elicit these variances but is restricted from commenting on the results since this issue is subject to litigation within the Courts of Law and therefore pertains to a sub-judice case. The financial analysis also extended to a review of actual savings achieved by utilities through the evaluation of unbilled trends.

1.6. Report structure

1.6.1. Following this introductory Chapter, the Report proceeds to discuss the following:

- a. Chapter 2 discusses the extent to which the smart and RF meters project contributed to increased efficiency and effectiveness of the utilities' operations as well as attained pre-determined targets.
- b. Chapter 3 focuses on the billing process which depends on the input of smart and RF meters. The Chapter also discusses the accuracy of the billing process.

1.6.2. The overall conclusions and recommendations related to this performance audit are presented in this Report's Executive Summary from page 8 to 10.

Chapter 2 | Assessing the operation of electricity smart and water radiofrequency (RF) meters

2.1. Introduction

2.1.1. Over its current lifespan of 12 years, the €131 million invested in the electricity smart and water radiofrequency (RF) meters project elicited mixed results. On the one hand, it facilitated the interface between the customers and the utilities corporations, enhanced the quality of billing through more automated and frequent readings and enabled utilities corporations to address apparent losses within their respective distribution networks. On the other hand, while the National Audit Office (NAO) positively notes that apparent losses relating to electricity decreased from 7.64 per cent in 2009 to 1.42 per cent in 2019, as shown in Section A.7. in Appendix I, non billed consumption relating to water remained stable in the region of 30 per cent of total supply over the lifetime of the project, as shown in Section B.8. in Appendix I.

2.1.2. This Chapter discusses:

- a. An outline of the technology involved in smart and RF metering;
- b. The extent to which the project attained pre-determined Key Performance Indicators (KPIs) and specific performance criteria devised by the NAO for the purpose of this audit;
- c. Benefits resulting from the smart and RF meters project;
- d. Prevailing inefficiencies in meter reading and billing consumption; and
- e. Financial implications arising from the smart and RF meters project.

2.2. The utilities metering infrastructure is managed by a single centralised system

2.2.1. This Section provides an outline of the processes involved in the meter reading and billing processes. This overview is not intended to illustrate a detailed exposition of the technology in use. The intention is to provide context for the ensuing discussion within this Chapter.

2.2.2. The smart and RF meters project through the provision of the Integrated Utilities Business Systems (IUBS) programme's primary objective was an Information and Communications Technology (ICT)/Business Process Transformation across four main themes:

- a. Enterprise Resource Planning (ERP) which refers to a type of software that organisations use to manage day-to-day business activities such as accounting, procurement, project management, risk management and compliance, and supply chain operations.

- b. Customer Relationship Management and Billing (CRM) which includes the principles, practices, and guidelines an organisation follows when interacting with its customers during the billing process.
- c. Automated Meter Management (AMM) which is a technology used in utilities meters for collecting the data that is needed for billing purposes.
- d. Energy Management System (EMS) which is an automation system that collects energy measurement data from the field and makes it available to users through graphics, online monitoring tools, and energy quality analysers, thus enabling the management of energy resources.

2.2.3. From a customer perspective this entailed that Enemalta plc replaced all electricity meters to smart meters and Water Services Corporation (WSC) installed RF modules on the existing installed water meters, replacing some as the need arose to enhance the services provided. From the utilities perspective, under this programme, Enemalta and WSC have replaced their legacy systems with ERP, developed by Systems Analysis Programme (SAP) Corporation, which is an enterprise software that integrates and automates internal and external business processes and management information across all departments and functions of the two utilities organisations and the billing agency.

2.2.4. The smart meters, which are used to measure electricity consumption, transmit the relative data through Enemalta's distribution network on a daily basis². Smart meters transmit actual meter readings in digital format to the AMM. On the other hand, RF modules installed on meters transmit totalised water meter readings as an index on a daily basis every four hours. Water meter readings are subject to connectivity problems but these mainly relate to specific areas experiencing reception-related problems.

2.2.5. The utilities corporations remained responsible for the installation and maintenance of smart and RF meters up to their connectivity to the AMM. Furthermore, the utilities corporations also assume responsibility for monitoring the technical aspect of the system as well as for carrying out data analytics to identify abnormal consumption patterns. Moreover, this enables them to react in cases of faulty meters or when the system flags any abnormalities in meter readings. On the other hand, Automated Revenue Management Services (ARMS) takes responsibility for the automated issuance of utilities bills. ARMS also has the faculty to react in cases where its monitoring of data, received through the smart and RF meters, flags abnormal consumption patterns. According to the company's Memorandum and Articles of Association, the objects of the company, include inter alia:

- a. Service registration, customer information and care, invoicing, billing, revenue management of monies collected from utilities customers;

² Enemalta uses Enel's Telegestore metering technology whereby as of 2020 it uses both generation of meters available in the market (more than 50 million units deployed worldwide).

- b. To take legal and judicial action in relation to defaulters;
- c. To develop business intelligence services, undertake product development and carry out sales and marketing;
- d. Call centre services; and
- e. To administer and manage an integrated utilities business system.

2.3. The project is generally not appropriately supported by pre-determined quantitative Key Performance Indicators

2.3.1. This Performance Audit sought to assess the extent to which the utilities corporations and ARMS satisfied pre-determined KPIs established during the initial and ongoing phases of the project. The corporations and ARMS maintained periodical information regarding various operational and financial activities. This information measures the utilities and ARMS' progress over time. However, these stakeholders did not provide performance indicators outlining what the corporations and ARMS were targeting to achieve within specified timeframes.

2.3.2. Using the metering system information retrieved from the IUBS, the utilities corporations measure and monitor performance across a range of variables, which on occasions, is reviewed on a daily basis. While, the indicators elicited through this approach enable the longitudinal monitoring of trends, they are not supported by definitive targets. This implies that the utilities corporations are cognisant of the periodical performance of their respective organisations but cannot formally and conclusively assess the extent to which specific performance indicators deviate from the ultimate target, as the latter has not been determined. Table 3 provides the trends relating to key performance indicators. A detailed presentation of these indicators is attached in Appendix I.

2.3.3. The KPIs outlined in Table 3 show that the utilities, are generally improving their performance over time. This is clearly evident with respect to variables relating to the number of smart and RF meters installed, their connectivity to the AMM and reachability through transmission of readings. While the performance indicators relating to apparent losses is showing favourable trends in the case of Enemalta, with respect to unbilled water consumption, no significant improvement has been registered contrary to the provisions of the Head of Terms (HoT) agreement between ARMS and WSC³.

³ The reasons contributing to the stable trend of unbilled water consumption is discussed further in Section 2.4.4.

Table 3 - Key Performance Indicators relating to smart and RF metering

Enemalta			WSC		
Performance Indicators	Target	Trend Analysis (upwards, stable, downwards)	Performance Indicators	Target	Trend Analysis (upwards, stable, downwards)
Total Accounts on A-Route ⁴	NA	Upwards	Active Water meters	NA	Upwards
Total Reachable	NA	Upwards	Number of Meters Replaced	NA	Upwards
Total number of smart meters	NA	Upwards	Number of RF Modules Installed	NA	Upwards
A-Route % over Total Accounts	96%	Upwards	% of active Meters Billable by AMM	NA	Upwards
			Number of meters on AMM - correctly associated	NA	Upwards
Heavy Consumers – Total Reachability %	NA	Upwards	% Billing Meters on AMM - read daily	NA	Stable
Heavy Consumers – AMM Reachability %	NA	Upwards	% Billing Meters on AMM - read within 10 days	NA	Stable
Decreasing apparent losses	NA	Downwards	Decreasing apparent losses	NA	Stable

Source: Enemalta plc and Water Services Corporation.

2.3.4. On the other hand, ARMS has established a range of billing and revenue collections KPIs. This is a definitive improvement on the situation reported by this Office in 2012. Table 4 provides an outline of the KPIs used by ARMS in relation to the issuance of bills and the collection of revenues and debts. A detailed presentation of these indicators is attached in Appendix I.

Table 4 - ARMS' Key Performance Indicators (2012 - 2020)

Performance Indicators	Target	Trend Analysis (upwards, stable, downwards)
Total number of bills issued per year	NA	Upwards
Revenue collected per year from the sale of electricity	NA	Downwards
Revenue collected per year from the sale of water	NA	Upwards
Percentage of revenue collected over total invoiced - Electricity	NA	Downwards
Percentage of revenue collected over total invoiced - Water	NA	Upwards
Yearly aged debtors	NA	Downwards
Total number of interactions with customers per year	NA	Downwards

Source: ARMS, Enemalta and WSC.

⁴ Accounts being billed on actual AMM data.

2.3.5. Table 4, as well as Section C of Appendix I, shows that a trendline considering data over an eight-year period relating to amount of uncollected revenue / debts per year and total number of interactions with customers per year were on a decreasing path. While the trendline still shows a decreasing path, during the last three years, this path has been reversed as the amount of uncollected revenue in 2018 stood at €79.7 million, rising to €89.4 million in 2020. The COVID-19 pandemic was a contributing factor in these circumstances. Table 4 shows that the ratio of revenue collected from the sale of electricity over the total invoiced decreased between 2012 and 2020. With respect to the ratio of revenue collected from the sale of water over the total invoiced, the relative upward trendline was influenced by peaks during 2014 and 2016. Since the last peak, this ratio has been on a declining trend.

2.3.6. Similarly, as shown in Section C.7. of Appendix I, a trendline plotted against data relating to the annual amount of customer interactions with ARMS over an eight-year period shows a decreasing path. However, during the last three years, customer interactions with ARMS have increased from around 235,000 in 2018 to 375,000 in 2020. The interpretation of such data is subject to some degree of limitations. These figures include all categories of customer interactions with the billing agency. This would include customer enquiries and complaints as well as customer enquiries about the application of new and other services, such as the closing of accounts. This limitation arises since ARMS does not maintain data regarding customer enquiries and complaints solely relating to billing.

2.3.7. Despite the benchmarks indicated in Table 4, the utilities corporations contend that in view of the material financial contribution they make, the opportunity exists that their relationship with ARMS is further strengthened through the establishment of operational KPIs approved by all parties. This approach would define what is expected from ARMS in relation to its functions. This would necessitate amendments to the joint venture agreement between the parties.

2.4. **Despite significant improvements since the introduction of smart and RF meters, various inefficiencies prevail**

2.4.1. There is no doubt that the electricity smart and RF meters project has facilitated the metering of electricity and water consumption. In turn, this has led to more positive outcomes with respect to utilities' billing. On the other hand, the utilities corporations and ARMS are not fully reaping the benefits of this project through inherent inefficiencies.

Major improvement brought about by the project mainly related to meter reading and billing automation

2.4.2. The major improvements brought about by this project are the following:

- a. The number of accounts billed through the Automated Meter Management (automatic readings) has increased over the years. Prior to the implementation of the smart and RF meters project all meter readings and bills were worked out through a billing programme operated by WSC. However, these figures remain below what potentially could be attained through the project. This assertion considers that 94 and 87 per cent of electricity and water meters respectively could be used for billing purposes. Nonetheless, this audit acknowledges the technical challenges to ensure that these proportions be further improved.
- b. The number based on actual readings has drastically increased since the implementation of this project. Prior to the introduction of automatic meter readings, in addition to provisional bills based on estimates, the utilities corporations issued bills based on actual consumption twice annually. Automated meter readings brought about a three-fold increase of bills based on actual consumption. ARMS is now generally issuing bills based on actual consumption on a monthly and bi-monthly basis.
- c. The Automated Meter Management decreased the frequency of manual meter readings. This implies fewer reading errors which used to occur through transcription inaccuracies. Nonetheless, as will be discussed in Chapter 3 of this Report, the number of meter readers continued to increase over time.
- d. Utilities corporations apply different tariffs to electricity and water consumption as stipulated in the law. To this end, the smart and RF metering project also facilitated the management of different tariffs throughout the day and night, particularly with respect to heavy users' non-residential accounts.
- e. Through the smart and RF meters project, data is collated in a database, enabling the utilities corporations and ARMS to easily carry out efficient data analysis and data monitoring.
- f. The AMM has enabled real-time data facilitating and enhancing data analysis and consequently the identification of abnormal consumptions.
- g. The smart and RF meters project has enabled Enemalta to reduce apparent losses (or non-technical losses) that mainly arise through unbilled consumption, namely due to billing errors and theft. The level of such losses in 2009 amounted to 156,395,827 kilowatt-hour (kWh) units, which implies an apparent loss index of 7.64 per cent. In 2019, these losses decreased to 37,022,140 kWh units, that is an apparent loss index of 1.42

per cent. The decrease in apparent loss index in a given year has a cumulative positive effect over the next years as it is assumed that unidentified theft will continue unless it is stopped by the utility company. It is to be noted that the apparent loss index considers the level of units of electricity distributed to consumers. Applying the prudence concept and assuming that efforts to reduce non-technical electricity losses are estimated at the average selling price during the period under review, then savings amount to around €45 million. Records maintained by Enemalta show that since the introduction of smart meters 12 years ago the company managed to recoup €12.6 million in addition to this amount in terms of recovered revenue from identified theft cases as well as related fines and repayments of unregistered consumptions based on an estimation mechanism.

Operational issues hinder project efficiency optimisation

2.4.3. On the other hand, the utilities entities and ARMS, in accordance with the provisions of the HoT agreement, have not been able to fully exploit the potential benefits of the smart and RF meters project. A case in point relates to apparent losses concerning water consumption. Additionally, some problems relating to the transmission of automatic readings concerning both utilities corporations prevail.

Despite the project, WSC's apparent losses have not been reduced

- 2.4.4. WSC's apparent losses have remained stable from 2009 to 2020 at approximately 30 per cent which equates to an apparent loss index of 10. Four factors contribute to these circumstances:
- a. Under registration of meters brought about by the water meters' inability to detect very low flow of water even though the water meters are of the highest specifications available on the market. This is exacerbated by the indirect plumbing systems which are extensively used in Malta and Gozo. These plumbing systems are generally dependent on float-valve-controlled water storage such as roof water tanks. Such plumbing systems are conducive to a situation where there will always be a quantity of water that would be consumed without the billing meter registering it. A study carried out by WSC in 2008 estimated that at least 10 per cent of water consumption remained unbilled through the use of such plumbing system even for a new meter. Ageing of the meter obviously further exacerbates the under registration of water consumption.
 - b. The high number of 'flagged' stopped water meters also contributes to unbillable consumption particularly as flagging may not necessarily imply that the meter is actually stopped or damaged. In instances where meters are categorised as stopped, the possibility might arise that the actual consumption exceeds that estimated by ARMS for billing purposes. During 2020, as will be further outlined below, there were 205,891 out of the 1,758,001 water consumption bills issued by ARMS under the 'Stopped' billing category, which amounts to 12 per cent of water consumption bills issued during the year in question. In reality, as outlined in paragraph 2.4.5, the number of truly stopped water meters is much lower.

- c. The number of water accounts has increased significantly from 243,250 to 289,723 over 11 years. This represents an increase of almost 20 per cent. In light of the first point in 2.4.4 (a), an increase in the number of meters automatically increases the overall under registration quantities.
- d. The final reading of meters flagged as stopped (being that they are still working but registering constant consumption on their dial), is rejected by the billing system thus inflating further billing anomalies. In 2020, WSC contended that close to €300,000 were lost due to this anomaly alone. This variance materialises due to the difference in monetary value (estimation), between the actual final readings on the physical meters and the actual final readings billed by the system. This issue has been addressed by WSC with the implementation of algorithms to double check actual final readings used for billing.

Under 18,000 water meters are flagged as stopped and are awaiting inspection

2.4.5. Unlike electricity smart meters, the water meter setup is susceptible to various technical faults. A recent WSC and ARMS exercise calculated that there are 17,928 water meters flagged for inspection. Within this context, a stopped water meter only refers to at least two identical consecutive readings. Repeated readings, however, do not necessarily imply a stopped meter. To address this issue, over the past months, WSC and ARMS implemented an intelligent algorithm that identifies meters requiring an inspection. These algorithms being implemented by WSC are an effort to smarten the RF data acquisition technology.

2.4.6. During the same period, data pertaining to ARMS with respect to the number of bills issued in the 'Stopped' billing category amounted to 205,891 water bills. Considering that the majority of bills are issued on a bi-monthly basis and that six bills are issued per year, NAO roughly estimates that there were around 34,315 stopped water meters in 2020. Moreover, NAO has been informed that this variance could also be attributed to the water meter replacement programme which is being undertaken by WSC.

Despite the progress of time, the full potential of automated meter readings is still not fully reflected in the billing process

2.4.7. In 2020, according to data provided by ARMS, 80 and 67 per cent of the bills relating to electricity and water consumption were based on automatic readings and calculations⁵. These percentages, being automatically transmitted, exclude readings taken manually by meter readers. The reasons for these circumstances are generally specific to each of the utilities companies.

⁵ It is being assumed that bills issued in 2020 under the 'Consumer' category pertain to meters which are all transmitting automated readings via the Automated Meter Management. The percentages of bills based on actual readings increase to 92 and 78 per cent for electricity and water bills respectively as these consider readings taken manually by meter readers.

Enemalta plc

- 2.4.8. In view of Malta's high population density and the increasing number of new electricity accounts, the power supply distribution network through which meter readings are transmitted has at times become saturated. In some instances, Enemalta installed a number of Low Voltage Concentrators (LVCs) to mitigate this problem. However, it was not always cost-effective to install LVCs in other localities to facilitate the transmission of readings from the meter to the AMM system⁶. This results in the untimely transmission of readings to ARMS and consequently they cannot be considered for the scheduled issuance of the bill.

Water Services Corporation

- 2.4.9. Similarly, Malta's high population density and the increasing requests for new water meter accounts continue to influence the issuance of bills based on automated readings. In part, this occurs as the RF meters technology in use is at times hindered by interference which prevents the radio waves from transmitting to the AMM system. These circumstances become more prevalent in underground and remote areas experiencing reception problems.
- 2.4.10. In addition, the blanket interpretation of repeated readings as stopped meters significantly affects the percentage of bills based on automatic readings.

2.5. Conclusion

- 2.5.1. The smart and RF meters project constituted a material investment at a time when the utilities corporations were faced with increased demands from customers about billing accuracy and operational efficiency. The NAO evaluated this project through financial and operational criteria as well as from a customer expectation perspective.
- 2.5.2. The latter part of this Chapter discussed the envisaged financial savings to be reaped following project implementation. While Enemalta practically managed to eliminate apparent losses, the financial savings, although material, remained short of the capital invested. On the other hand, apparent losses concerning water consumption generally remained at a stable level. Moreover, the utilities entities did not manage to fully capitalise on the potential efficiency gains connected with project implementation. The cost of this project was material and its effectiveness, however, cannot be exclusively assessed in terms of its financial merits. From a financial point of view, the project did not recover all the capital invested. Yet the project provided a modern billing infrastructure for the utilities to strengthen their billing function.

⁶ In order to tackle known worldwide limitations of the Programmable Logic Controller technology, Enel have developed the latest generation of Open Meter with a fallback RF technology to support transmission. This meter was made available for the utilities companies in early 2020 and Enemalta was one of the first to invest in such meters to improve reachability figures. The deployment of these meters in mid-2020 contributed to the drastic linear improvement of electricity reachability.

- 2.5.3. Although not referred to in quantifiable terms, the project led to the upgrading of the corporations' back office infrastructure but also generally resulted in a more qualitative service to customers in terms of billing frequency, accuracy together with real time monitoring of consumption, allowing WSC to alert its clients as regards to abnormal consumption trends. Business transformation achieved through the introduction of ERP and EMS are yielding positive results, for example in the area of electric vehicles.

Chapter 3 | Smart and RF meters' contribution to billing efficiency, frequency and accuracy

3.1. Introduction

3.1.1. The electricity smart and water radiofrequency (RF) meters project led to the upgrading of the corporations' back office infrastructure but also generally resulted in a more qualitative service to customers in terms of billing frequency and accuracy. This Chapter discusses:

- a. Significant operational improvements registered with respect to billing accuracy and frequency;
- b. Billing regulations in terms of whether bills are calculated on a pro rata or annualised basis; and
- c. Processing inefficiencies prevailing at the billing agency.

3.1.2. This performance audit sourced data and information from the utilities corporations and Automated Revenue Management System (ARMS). Moreover, for the verification of data integrity purposes and to elicit further information, which was not available from the above-mentioned sources, NAO conducted a tracer study comprising 100 randomly-selected accounts which were billed by ARMS covering a one year period up to January 2021⁷. In total, eight out of the 100 accounts also included photovoltaic meters. Considering that the number of accounts amounted to 338,625 as at end of October 2020, the NAO sample enabled that findings and conclusions are presented at the 95 per cent confidence interval with a ten per cent error rate.

3.2. Significant operational improvements registered with respect to billing accuracy and frequency

3.2.1. The smart and RF meters project facilitated the accuracy and frequency of billing. Consequently, this project facilitated a more reliable and timely input for the billing process. This Section discusses improvements in more detail.

⁷ Some accounts only included one utility and thus the sample for electricity and water case studies was reduced to 93 and 85 respectively.

Increasingly, billing is considering automated meter readings

3.2.2. The utilities bills received by clients indicate whether the invoice is based on actual readings or otherwise. Actual readings noted in the “A” category within Table 5 includes both readings derived through the AMM system as well as readings registered through the meter readers. However, the total number of readings which note actual consumption also include the “C” category which relates to customer readings and the “F” category which denotes that ARMS have issued the final bill pertaining to a particular account after its closure. Table 5 shows the various billing categories used in the computation of bills.

Table 5 - Classification of 2020 bills per different categories⁸

		Water							
	Water only	Electricity only	A	C	E	F	N	S	Total
		-	46,435	3,374	5,789	640	15,333	13,437	85,008
Electricity	A	213,815	1,149,420	8,687	32,919	6	77,104	178,951	1,660,902
	C	11,996	7,381	80,172	334	14	912	1,931	102,740
	E	6,296	9,217	189	16,120	3	729	1,087	33,641
	F	1,637	9	14	2	8,850	1	9	10,522
	N	28,112	53,397	565	3,335	-	30,833	10,433	126,675
	S	29	257	14	5	-	50	43	398
	Total	261,885	1,266,116	93,015	58,504	9,513	124,962	205,891	2,019,886

Billing categories legend: A (Actual), C (Consumer), E (Estimated), F (Final bill), N (Not read, estimated), S (Stopped).
Source: ARMS.

3.2.3. Table 5 shows that, in 2020, the total number of bills covering both utilities which were based on actual readings as denoted by columns and rows entitled Actual, Consumer and Final amounted to 1,238,442 bills⁹. This number represents 61 per cent of the total number of bills issued in 2020. On the other hand, when analysing electricity and water bills separately, in certain instances only one of the two utilities were charged on actual consumption. During this period, electricity bills based on actual consumption as denoted by the aforementioned rows amounted to 1,774,164¹⁰. Similarly, during the same period, water bills based on actual consumption amounted to 1,368,644¹¹. The foregoing implies that the number of electricity and water bills based on actual readings amounted to 92 and 78 per cent respectively.

3.2.4. This implies that these readings have either been elicited from the Automated Meter Management (AMM) system or else through a meter reader. Prior to the project, in 2010, electricity and water bills based on actual consumption stood at 53 and 50 per cent respectively since these were mainly available through manual meter reading.

⁸ The total number of bills for 2020 of 2,019,886 does not include reversals and claim adjustments.
⁹ As denoted by cells A-A, C-C and F-F in Table 5.
¹⁰ The addition of 1,660,902 (A), 102,740 (C) and 10,522 (F).
¹¹ The addition of 1,266,116 (A), 93, 015 (C) and 9,513 (F).

3.2.5. Nonetheless, in 2020, 160,714¹² (eight per cent) and 389,357¹³ (22 per cent) of electricity and water bills were based on estimates noted by the “E”, “N” and “S” billing categories in Table 5¹⁴. This mainly materialised due to meters not transmitting readings to the AMM on a regular basis and / or due to water meters erroneously flagged as stopped or actually malfunctioning meters.

The smart and RF meters project enabled bills based on actual consumption to be issued more regularly

3.2.6. EU Directive 2012/27/EU on energy efficiency stipulates that in order to enable final customers to regulate their own energy consumption, billing should take place on the basis of actual consumption at least once a year. National legislation reflects the provisions of this Directive. Moreover, current procedures stipulate that heavy consumers within a category of non-residential accounts are billed on a monthly basis, whereas the remainder of clients are invoiced on a bi-monthly basis. ARMS aims to base all bills on actual consumption. Table 6 shows that ARMS satisfied the billing frequency criteria in the vast majority of cases.

Table 6 - Utilities billing frequency based on NAO's tracer study (2020)

Billing frequency	Electricity		Water	
	Number of Bills	Per Cent	Number of Bills	Per Cent
Bills supposed to be issued on a bi-monthly period	92	100	85	100
Bills issued in less than 50 days	8	9	8	9.5
Bills issued within 50 - 70 days	71	77	67	79
Bills issued in 71 to 90 days	11	12	8	9.5
Bills issued in more than 90 days	2	2	2	2
Bills supposed to be issued on a monthly basis	1	100	NA	NA
Bills issued between 25 – 35 days	0	0	NA	NA
Bills issued in more than 65 days	1	100	NA	NA

3.2.7. For the purposes of determining the extent to which ARMS complied with the billing frequency criteria, the NAO subjectively assumed that it would be acceptable if the billing frequency was to have a plus or minus 10-day tolerance. Consequently, this review considered a billing duration of between 50 and 70 days when the billing frequency was to be of two months. Similarly, the same criteria was adopted for a one-month billing frequency.

¹² The addition of 33,641 (E), 126,675 (N) and 398 (S).

¹³ The addition of 58,504 (E), 124,962 (N) and 205,891 (S).

¹⁴ For the scope of this performance audit, NAO considered the E (Estimated), N (Not read, estimated) and S (Stopped) billing categories outlined in Table 5 as estimates.

3.2.8. Table 6 shows that:

- a. around 71 out of the 92 of the randomly-sampled electricity bills and 67 out of the 85 randomly-selected water bills adhered to the bi-monthly billing frequency criteria.
- b. In over two per cent of electricity and water cases, billing frequency criteria was exceeded by more than one month. ARMS contended that the reasons for these circumstances are the following:
 - i. the difficulty to replace meter readers in Gozo,
 - ii. the reversal of a bill, and
 - iii. the method of billing for temporary meters. Normally, these used to be billed upon the termination of the account or the renewal of the contract, if the client opts for an extension. Nowadays, following a change in policy, heavy consumers with temporary installations are being billed on a monthly basis.

3.2.9. In addition to the information derived from the tracer study, ARMS contended that another reason for deviations from the policy related to billing frequency would be when readings are submitted by clients requesting up to date bills.

The billing period criteria adopted were generally respected

3.2.10. In accordance with ARMS' practice of calculating bills, ARMS issues bills either on a monthly basis for heavy consumers within a category of non-residential accounts or on a bi-monthly basis for other users. The NAO again resorted to the tracer study undertaken for the purpose of this performance audit to determine the extent to which ARMS adhered to its billing period criteria. The same randomly selected sample of 100 accounts¹⁵ showed that generally the billing period criteria was complied with. For the purpose of this assessment, the NAO adopted the same assumption as outlined in paragraph 3.1.2. Table 7 refers.

Table 7 - Utilities billing period based on NAO's tracer study (2020)

Billing period	Electricity		Water	
	Number of Bills	Per Cent	Number of Bills	Per Cent
Bills supposed to be issued on a bi-monthly period	92	100	85	100
Bills issued in less than 50 days	7	8	6	7
Bills issued within 50 - 70 days	81	88	75	88
Bills issued in 71 to 90 days	4	4	4	5
Bills issued in more than 90 days	0	0	0	0
Bills supposed to be issued on a monthly basis	1	100	NA	NA
Bills issued between 25 – 35 days	0	0	NA	NA
Bills issued within 50 – 70 days	1	100	NA	NA

¹⁵ Sample limitations arise due to circumstances discussed in footnote 1.

3.2.11. Table 7 shows that:

- a. 81 out of 92 and 75 out of 85 of electricity and water bills respectively generally complied with ARMS' billing period criteria.
- b. None of the cases exceeded the billing period criteria by one month or over.

3.3. Billing calculations in accordance to utilities' pro rata billing methodology were generally found to be correct

3.3.1. Since the AMM formed a substantial part of the smart and RF metering project and is linked to an application related to the billing function, the NAO verified the extent to which the utilities companies' invoicing was correct. To this end, the NAO relied on the same 100 randomly selected accounts.

3.3.2. Similarly to the reasons outlined in paragraph 3.1.2, substantive testing related to 93 and 85 electricity and water accounts. With a few exceptions, testing was generally based on the last bill issued in 2020.

3.3.3. Irrespective of whether the billing calculation was carried out automatically or manually, or based on actual or estimated readings, all workings were found to be correct in accordance with the utilities companies' pro rata billing methodology. The pro rata methodology is referred to in national legislation concerning electricity and water supply. Therein it is stated that consumption tariffs are based on a cumulative consumption per annum and which may be billed on a pro rata basis. The utilities companies interpret legislative provisions on pro-rata billing as being on a monthly basis for heavy consumers and on a bi-monthly basis for other consumers.

3.3.4. The next Section of the Report compares the impact on bills calculations based on cumulative consumption per annum, that is annualised billing, while the issuance of bills maintains the current level of frequency on a monthly or bi-monthly basis.

3.4. The case for "annualised" billing is currently the subject of court litigation

3.4.1. Provisions in the subsidiary legislation 545.01 and 545.03, relating to electricity and water supply respectively, regulate the billing of consumption for both of these utilities. The electricity supply regulations outline the consumption tariffs based on a cumulative consumption per annum and which may be billed on a pro rata basis. On the other hand, the water supply regulations outline that consumption is billed on the basis of a one-year period, defined as a period of three hundred and sixty five consecutive days, provided that, when a reading is taken for a period of less or more than a year, the service charge and the tariff for water consumption shall be calculated on a pro rata basis. These provisions apply to all categories of users. The NAO acknowledges that different interpretations of the law on what constitutes pro rata billing exist.

3.4.2. Practices adopted by the utilities' corporations and ARMS have always been based on pro rata basis. In these circumstances, the billing calculation applies annual tariff bands and eco-contribution reductions on a pro rata basis that is, either monthly or bi-monthly. ARMS contends that its billing practices follow the instructions given by Enemalta and Water Services Corporation (WSC) which in turn follow what is catered for in the law. In addition, there is the Regulator's decision dated 19 August 2014, which states that the way bills are computed is in line with the relevant legislation. Moreover, WSC reiterates that the pro rata billing methodology of water consumption is completely in line with the water supply regulations noted in the preceding paragraph.

3.4.3. The pro rata calculation methodology with respect to electricity consumption is currently being challenged in the Courts of Law. As the case is still considered sub judice, the NAO considers it prudent to limit its observations on this issue to comparing the outcomes of pro rata and annualised billing in relation to the two utilities. To this end, this performance audit utilised the 100 randomly selected accounts which have been used for other evaluations within this review¹⁶. This performance audit subjectively established the criteria that a yearly €10 difference and above between the two calculation methods would constitute a material variance. Table 8 and 9 refer.

Table 8 - Comparison between annualised and pro rata electricity billing methodology

Type of Account	No. of Accounts	Difference between Pro Rata and Annualised Billing leading to extra charges to customer				Total difference (€)	No. of accounts affected by €10 or more per annum
		Service charge (€)	Consumption (€)	Eco-reduction (€)	Selling to the Grid (€)		
		Domestic	20	0	690		
Residential	53	0	246	256	0	502	26
Non-Residential	12	0	10	NA	NA	10	2

3.4.4. Table 8 imparts the following information:

- a. In addition to the information provided in Table 8, the NAO's analysis shows that 46 per cent of the total analysed accounts (39 out of 85 accounts) did not reveal any significant variance between the current pro rata and annualised billing methodology that is, the difference between the two calculations was less than €2.
- b. Nonetheless, 32 out of the 85 electricity accounts reviewed registered a difference between the current pro rata and annualised billing methodology of more than €10. The range of this difference was between €10.74 and €468.90. The latter amount relates to a domestic account with heavy consumption. 78 per cent (25 out of 32) of these variances relate to the category between €10 and €50.

¹⁶ Some accounts had to be excluded either because customer opted for only one utility or a yearly consumption could not be calculated for that account or the number of residents changed throughout the yearly billing cycle. Thus, the sample for electricity and water case studies was reduced to 85 and 78 respectively.

- c. NAO's workings show that, in the vast majority of cases, the annualisation methodology affects both the consumption and eco-reduction calculations. Workings show that the greater the number of tariff bands involved in calculating consumption as well as eco-reduction through the annualised method, the higher the risk that variances between pro rata and annualised billing materialise in favour of the utilities companies.
- d. When extrapolating these results on the total 324,501 electricity accounts, a net variance of around €4.6 million between the pro rata and annualised billing methodologies will result. On the other hand, an annualised billing system will also lead to cases where consumers incur higher utility costs.

3.4.5. When the above was discussed, the utilities companies contended that evidence exists that a drive towards a longer billing cycle will confer a higher eco-reduction rebate to the heaviest unstable energy users. The utilities companies further emphasised that the more conscientious stable users are hardly impacted by the current billing methodology, as noted in paragraph 3.4.3, attributing the principal billing variances between the annualised and pro rata billing methodologies to the heavy consumer class. This implies that more in-depth studies are required as quasi favouring the heaviest peak consumers would deviate from the fundamental polluter pays principle enshrined in Article 191 of the Treaty on the Functioning of the European Union (TFEU). Moreover, for fairness' sake, NAO cannot ignore the fact that this complex issue has important financial implications in respect of both public utilities.

Table 9 - Comparison between annualised and pro rata water billing methodology

Type of Account	No. of Accounts	Difference between Pro Rata and Annualised Billing		Total difference (€)	No. of accounts affected by €10 or more per annum
		Service charge (€)	Consumption (€)		
Domestic	15	0	152	152	4
Residential	52	0	305	305	8
Non-Residential	11	0	37	37	2

3.4.6. Although not the subject of court litigation, for the purpose of harmonisation between the two utilities, the NAO applied a similar methodology to the one discussed in paragraph 3.4.1 to evaluate the differences between the current pro rata and annualised billing calculations with regards to water consumption. The following refers:

- a. In addition to the information provided in Table 9, the NAO's analysis shows that 63 per cent of the total analysed accounts (49 out of 78 accounts) did not reveal any significant variance between the current pro rata and annualised billing methodology that is, the difference between the two calculations was less than €2.

- b. Nonetheless, 14 out of the 78 electricity accounts reviewed registered a difference between the current pro rata and annualised billing methodology of more than €10. This difference ranged between €10.12 and €104.79. 11 out of 14 of these variances relate to the category between €10 and €50.
 - c. The review noted that the greater the number of tariff bands involved in calculating consumption through the annualised method, the higher the risk that variances between pro rata and annualised billing materialise in favour of the utilities companies.
 - d. When extrapolating these results on the total 294,613 water accounts, a net variance of around €1.9 million between the pro-rata and annualised billing methodologies will result. On the other hand, an annualised billing system will also lead to cases where consumers incur higher utility costs.
- 3.4.7. Similarly to the situation concerning electricity, the possibility exists that a drive towards a longer billing cycle would favour the heaviest unstable water consumption. This raises the case for more in-depth studies as quasi-favouring the heaviest peak consumers would deviate from the fundamental polluter pays principle enshrined in Article 191 of the TFEU.
- 3.4.8. Given the current circumstances whereby the issue of electricity billing methodology is the subject of litigation before the Courts of Law, the NAO is limiting its comments to the above.
- 3.4.9. The Budget Speech for Financial Year 2022 noted that Government is committed to adopt a new billing methodology “which is fair on all consumers” (*li hija ġusta għal kulhadd*). The Budget Speech noted that the new system will permit unutilised consumption within lower tariff bands to be carried forward to subsequent periods. To this end, the Minister for Finance and Employment announced that Government will be working on changes to the current legislative provisions.

3.5. Despite automation substantial operational costs with respect to billing prevail

- 3.5.1. ARMS performs the billing function on behalf of Enemalta plc and WSC. For this purpose, in 2020, the electricity and water utilities companies contributed €5.7 million each to finance the relative billing operations which include revenue collection, credit control, and customer care service. Prior to the establishment of ARMS in 2010, the WSC carried out these functions on behalf of both utilities companies. Moreover, prior to the introduction of the project, Enemalta had its own Credit Control Department to manage larger customers and suspensions of electricity. According to ARMS' audited financial statements for 2018, in total, the total cost incurred by this entity was estimated at €7.3 million. The same financial statements illustrate that ARMS registered a profit of €111,492. To this end, this Section discusses aspects which increased ARMS' billing costs.

The number of billing staff at ARMS more than doubled between 2010 and 2020

3.5.2. Water Services Corporation was responsible for the billing function till about mid-2009. After this date, responsibility for the billing function was transferred to ARMS. In 2010, there were 92 persons responsible for billing at a cost of €1.6 million. These persons were mainly deployed as meter readers and billing and revenue clerks. Nonetheless, following the establishment of ARMS, an interim agreement signed in early 2011 between ARMS, WSC and General Workers Union led to the transfer of 135 employees from WSC to ARMS which, apart from billing related staff, also included customer care representatives, as well as other administrative staff. Such employees were transferred to enable ARMS to establish its administrative and financial departments to support its core function that is the billing of utilities. Between 2012 and 2020, the staff complement at ARMS increased by 119 per cent to 296, which contrasts with the increase in bills of only 18 per cent during the same period. Table 10 refers.

Table 10 - Staff complement at ARMS (2012 - 2020)

	Departments	2012	2013	2014	2015	2016	2017	2018	2019	2020
Core Function	Billing ¹⁷	72	64	42	56	50	57	54	85	94
	IT & BI	3	4	3	4	3	3	5	7	7
	Cust Care	31	24	23	69	64	66	76	86	91
	Debt Management	5	2	5	16	15	14	11	12	15
	Sub-Total	111	94	73	145	132	140	146	190	207
Supporting Function	Corporate, HR & Marketing	7	11	11	13	11	17	17	29	29
	Finance, Cash & Procurement	14	14	13	15	19	16	16	21	25
	Board of Directors	2	9	8	7	5	5	7	9	5
	CEO Dept	1	1	3	4	2	3	6	6	11
	Internal Audit	0	1	1	0	3	4	0	1	0
	Compliance	0	0	0	0	0	0	2	3	3
	Quality Assurance	0	0	0	0	0	0	0	0	3
	Legal	0	0	2	4	7	9	10	10	13
Sub-Total	24	36	38	43	47	54	58	79	89	
Totals	135	130	111	188	179	194	204	269	296	

Source: ARMS.

3.5.3. Table 10 can be interpreted in two segments. The first segment relates to ARMS' core function. This shows that up to 2018 there was a steady decline in the number of billing staff employed. At this time, the number of employees stood at 54 which is 25 per cent less than the complement within this department in 2012. This phenomenon correlates to the principle of automation whereby less staff are required to perform billing functions. The number of employees within the billing section increased sharply in 2019 and 2020. Information referred to NAO by ARMS shows that the lowest number of employees within the billing section was 50 in 2016. By 2019 the number of staff in the billing section increased to 85 and peaked at 94 in 2020. This implies that over a five-year period, the staff in the billing

¹⁷ Meter readers are included within the Billing Function.

section increased by 88 per cent. In part, such an increase relates to the rise in the number of bills issued annually. In this period, the number of bills increased from 1,893,958 in 2012 to 2,231,639 in 2020, which amounts to an increase of 18 per cent. However, it remains unclear whether the increase in the number of bills merited such an increase in the staff complement within the billing section. Of note is the fact that despite the increase in automated meter readings, the number of meter readers being employed within the billing section continued to rise as will be discussed in the next Section.

- 3.5.4. Similarly, during the period 2014 to 2020, employees within other departments pertaining to ARMS' core functions namely, the IT and Business Intelligence, Customer Care and Debt Management employed an additional 82 employees.
- 3.5.5. Table 10 also shows that ARMS increased its staff complement in its administrative departments. Since 2012, ARMS employed an additional 65 employees to strengthen the eight departments shown in Table 10. As at end 2020, these eight departments employed 89 persons which nearly constitute a threefold increase in the staff complement in 2012. Of note are the increases in the Corporate, HR and marketing department, the CEO department as well as the legal office which was established from scratch in 2014.

Despite metering automation, the number of meter readers continued to increase

- 3.5.6. For technical and verification purposes, meter readers remain an important element within the billing function since they support the accuracy of meter readings and can investigate instances whereby consumption readings are flagged by the AMM. Nonetheless, it would be expected that with the implementation of the smart and RF project, the role of the meter reader would assume an increasingly diminished role.
- 3.5.7. Between 2012 and 2020, the number of meter readers went up from 30 to 43, which resulted in an additional expenditure in salaries and wages of €96,975, increasing the personal emoluments expenditure to €639,109. ARMS contends that the increase in the number of these employees corresponds to technical exigencies. ARMS further argues that with the increase in meter readers, actual readings every two months is possible for meters not read remotely whereas before this was done every six months. Nonetheless, it remains questionable whether such number of employees in this role is strictly required when considering the increase in the number of automated readings emanating from smart and RF meters.

Billing Section labour costs per bill and ARMS' total annual expenditure show an increasing trend

- 3.5.8. A criterion which can be used to measure efficiency relates to the cost per unit, in this instance, the cost per bill issued by ARMS. The main objectives leading to the establishment of ARMS was to improve billing efficiency and customer service to clients.
- 3.5.9. An increasing trend transpires when determining the cost per bill issued strictly on the basis of labour costs incurred by the billing sections. ARMS' records show that in 2016 and 2020, there were 50 and 94 staff deployed in the billing section. Based on the average of ARMS' total annual salaries during this period then it is estimated that the annual wage bill would amount to €1,185,873 and €2,243,404 respectively. When considering that in 2016 and 2020 the billing section issued 1,906,716 and 2,231,639 bills respectively then the direct costs related solely to the billing function without considering any ancillary activities would amount to €0.62 and €1.01 respectively. While in part this rise can be explained by improvements in the working conditions of the staff employed at ARMS, it remains pertinent to note that during 2016 and 2020, the billing staff to bills issued ratio was around 1:38,000 and 1:24,000 respectively.
- 3.5.10. Nonetheless, a similar trend emerges when reviewing the rate of increase of ARMS' total expenditure when compared to the number of bills issued. Admittedly, such an evaluation raises some limitations since while ARMS' main function remains centred around utilities' billing, it also has ancillary functions such as receiving and directing requests for services, debt servicing and receiving applications for new services. During the period 2012 to 2020, ARMS' total expenditure rose from €6.5 million to €11.4 million. In the same period the number of billing transactions, which includes reversals, issued annually ranged from 1,893,958 in 2012 to 2,231,639 in 2020. This implies that directly or indirectly this would have an inflationary impact on the cost per bill incurred by ARMS. Table 11 refers.

Table 11 - Total Expenditure, Cost of Salaries and Wages and Number of Issued Bills (2012 - 2020)

Year	Total Expenditure	Cost of Salaries and Wages	Number of issued bills ¹⁸
2012	€6,467,096	€2,624,802	1,893,958
2013	€6,710,673	€2,621,106	1,804,238
2014	€8,117,404	€2,673,650	1,882,640
2015	€7,781,159	€3,649,835	1,921,855
2016	€7,962,733	€4,245,427	1,906,716
2017	€8,692,312	€4,739,093	1,934,709
2018	€7,414,286	€4,019,334	2,043,336
2019	€9,716,240	€5,343,611	2,152,301
2020	€11,422,054	€7,064,337	2,231,639

Source: ARMS' Management Accounts.

3.5.11. Both the discussion in paragraph 3.5.9 and the information portrayed in Table 11 show that the labour costs of staff who are strictly involved in the billing process and ARMS' annual total expenditure rose by 39 and 43 per cent respectively¹⁹. Such circumstances raise questions relating to cost efficiency of processes within ARMS particularly considering the high level of automation within the billing process. On the other hand, it is acknowledged that increasing client demands for better customer care and real time information require continuous investment.

3.6. Conclusion

3.6.1. This Chapter acknowledges that the electricity smart and water radiofrequency (RF) meters project brought about significant upgrading of the utilities billing function. On the other hand, certain inefficiencies remained and to varying degrees these costs are ultimately reflected in the profit and loss of the utilities companies and the billing agency.

3.6.2. At the outset, the project fulfilled its main objectives of bringing about significant operational improvements with respect to billing accuracy and frequency. This has led to bills being based on actual meter readings and enabled the billing agency to issue bills based on actual readings on a monthly or bi-monthly basis.

3.6.3. Billing practices adopted by the utilities companies and ARMS are fully based on the pro rata approach. The utilities companies contend that the billing calculation is in accordance with legislative provisions and entails the application of annual tariff bands and eco-contribution reductions on a pro rata basis that is, either monthly or bi-monthly. Billing calculations based on this billing methodology were generally found to be correct. The electricity billing methodology is the subject of litigation before the Courts of Law. NAO established that a

¹⁸ Number of issued bills includes reversal bills and claim adjustments.

¹⁹ Although this comparison does not relate to the same period, the trends are very similar, and it can be clearly concluded that labour costs incurred by the billing section and ARMS total expenditure are demonstrating an increasing trend of roughly equal proportions.

variance materialises between the two billing methods whereby the heavier consumers and those with unstable consumption would be those mostly affected. Since the case is sub judice, it is prudent for the NAO to limit its comments to the foregoing.

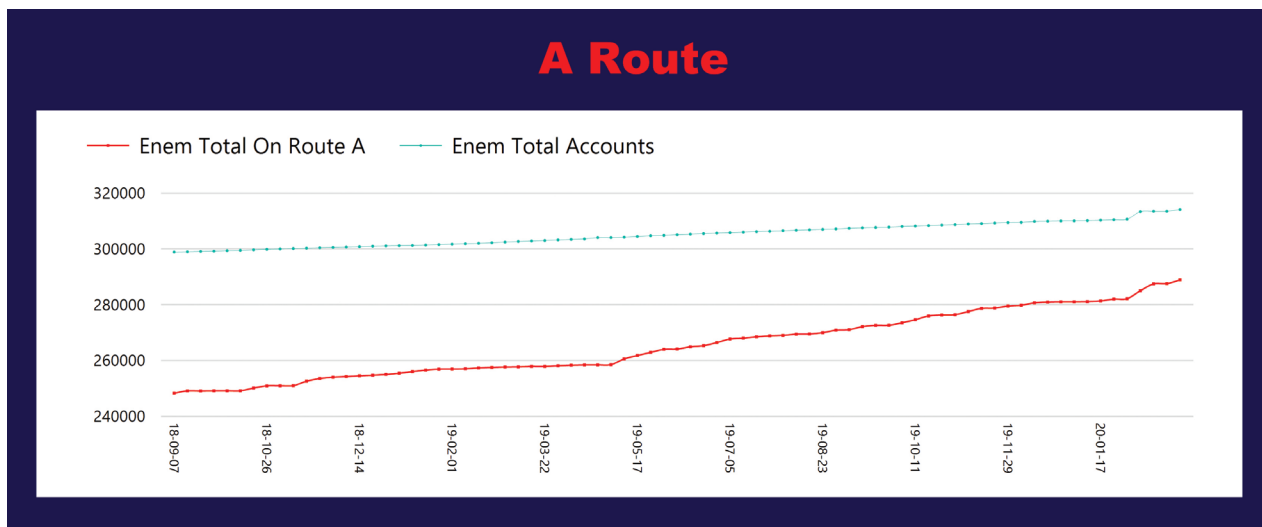
- 3.6.4. Despite the high level of automation, questions relating to cost efficiency at the billing agency arise. The number of staff employed by ARMS has increased significantly in recent years. In cases, such as those relating to the legal office, it is clear that such increases were necessary to strengthen ARMS' position in questions of litigation. However, it was not always evident as to why most departments within ARMS were augmented with human resources when both the billing and the administrative functions are generally automated. On the other hand, ARMS argues that when looked at holistically, the relationship between the overall progress registered by the company correlates with the increase in its headcount.

Appendix I - Key Performance Indicators (KPIs)

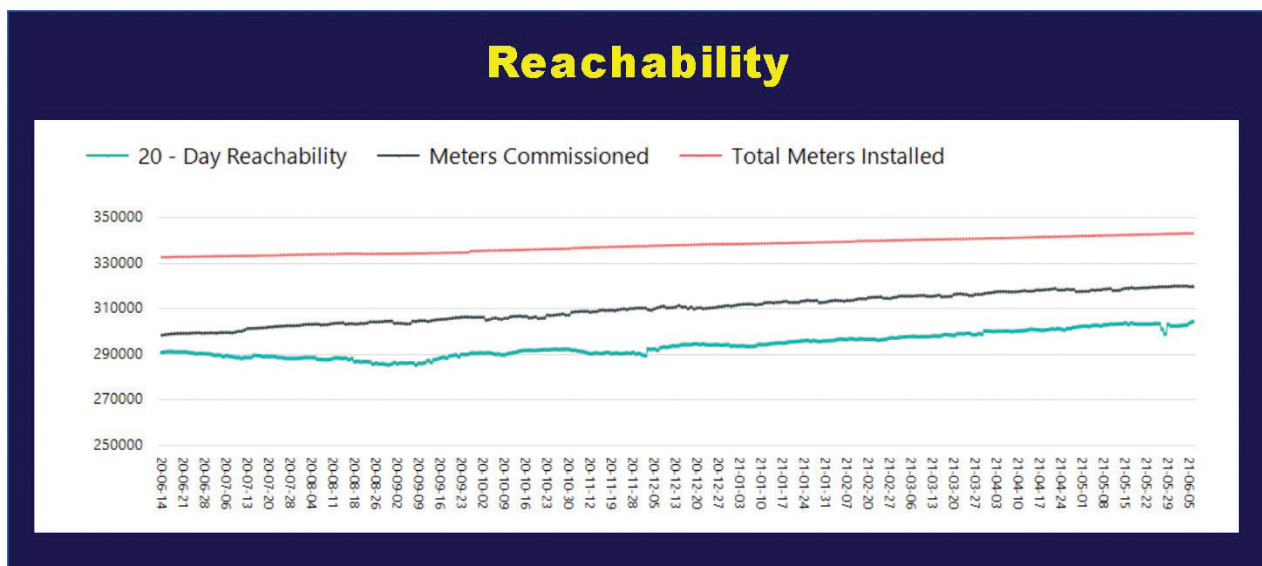
Appendix I relates to the Key Performance Indicators (KPIs) analysed in Section 2.3 of Chapter 2 of this audit. This Appendix outlines the utilities corporations and the billing agency's KPIs in more detail.

A. Enemalta plc KPIs

1. Total accounts on A-route (The meter is operated on 'A' route when it generally sends regular readings to the AMM system)



2. Total reachable accounts – Meters read through AMM (Automated Meter Management) data - 20-day reachability



3. Total number of smart meters
4. Meters commissioned (Meters which have communicated with AMM at least once)
5. A-route percentage over total accounts (Accounts being billed on actual AMM data over total number of accounts)

Date	Total number of smart meters	Meters commissioned	A-route percentage over total accounts
26/01/2021	337900	312189	94.16
27/01/2021	337941	312212	94.16
28/01/2021	337970	312254	94.16
29/01/2021	337991	312254	94.16
30/01/2021	338002	312341	94.17
31/01/2021	338032	312387	94.17
01/02/2021	338068	312421	94.17
02/02/2021	338101	312490	94.17
03/02/2021	338124	312490	94.17
04/02/2021	338155	312561	94.17
05/02/2021	338176	312601	94.16
06/02/2021	338201	312638	94.16
07/02/2021	338214	312679	94.16
08/02/2021	338214	312727	94.16
09/02/2021	338251	312798	94.16
10/02/2021	338273	312841	94.16
11/02/2021	338273	312890	94.16
12/02/2021	338291	312953	94.16
13/02/2021	338327	313001	94.16
14/02/2021	338330	313049	94.17
15/02/2021	338341	313114	94.17
16/02/2021	338360	313151	94.17
17/02/2021	338381	313204	94.16
18/02/2021	338423	313228	94.16
19/02/2021	338445	313467	94.16

6. Heavy consumers – total reachability percentage and reachability percentage on AMM meters²⁰

As at end of year	Heavy consumers – total reachability percentage	Heavy consumers – AMM reachability percentage
2017	71.01	83.61
2018	89.68	91.91
2019	95.42	96.03
2020	95.96	96.84

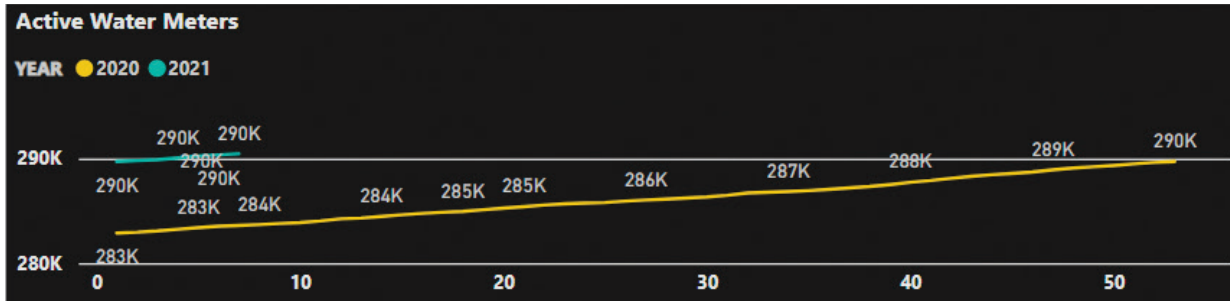
7. Decreasing apparent losses

Year	Apparent losses (kWh)	Percentage of total electricity supply	Total Electricity Accounts
2009	156,395,827	7.64	255,491
2010	149,456,332	7.49	259,370
2011	154,054,031	7.49	263,251
2012	200,285,193	9.25	267,440
2013	186,792,812	8.76	271,945
2014	110,535,206	5.20	277,859
2015	55,255,382	2.47	283,711
2016	17,699,283	0.78	289,212
2017	23,192,822	0.97	295,338
2018	27,912,038	1.13	301,753
2019	37,022,140	1.42	310,068
2020	NA	NA	318,347

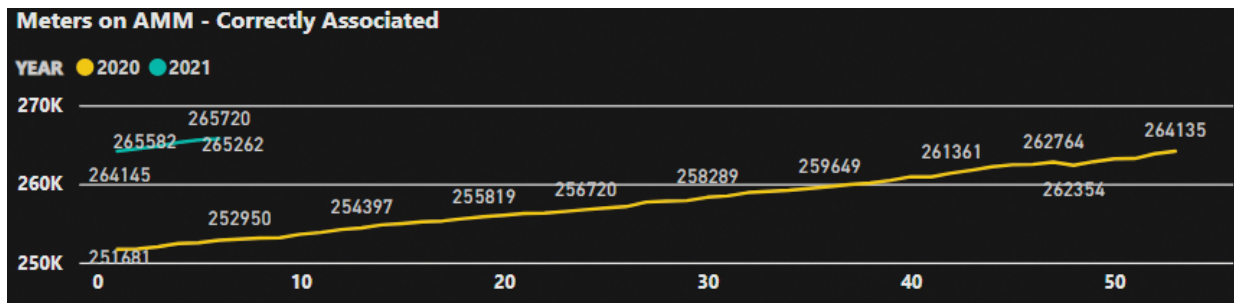
²⁰ AMM reachability refers to the reachability over meters that are smart and commissioned to AMM, whilst the total reachability refers to the amount over the total global number of meters (including those which are not on AMM).

B. Water Services Corporation KPIs

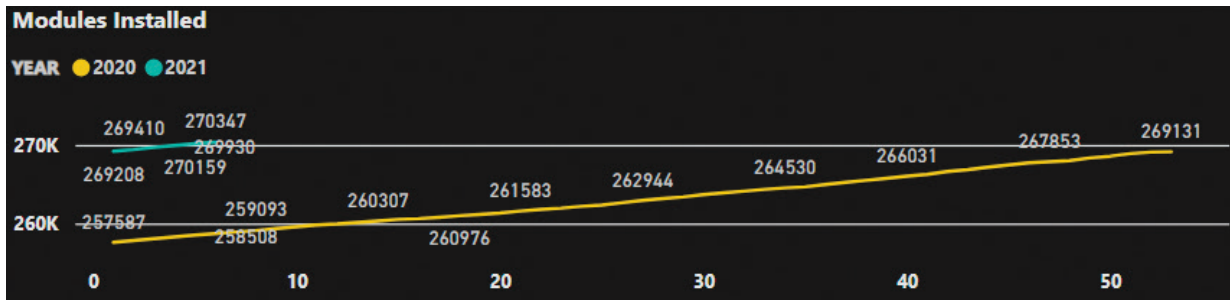
1. Active water meters (in thousands, K, over the number of weeks per year)



2. Number of meters on AMM - correctly associated



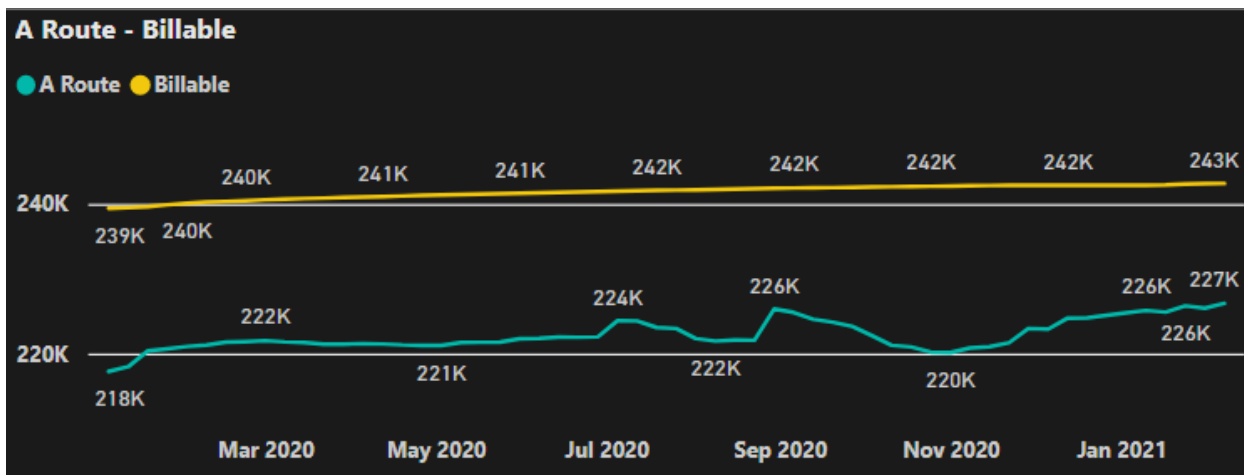
3. Number of RF modules installed



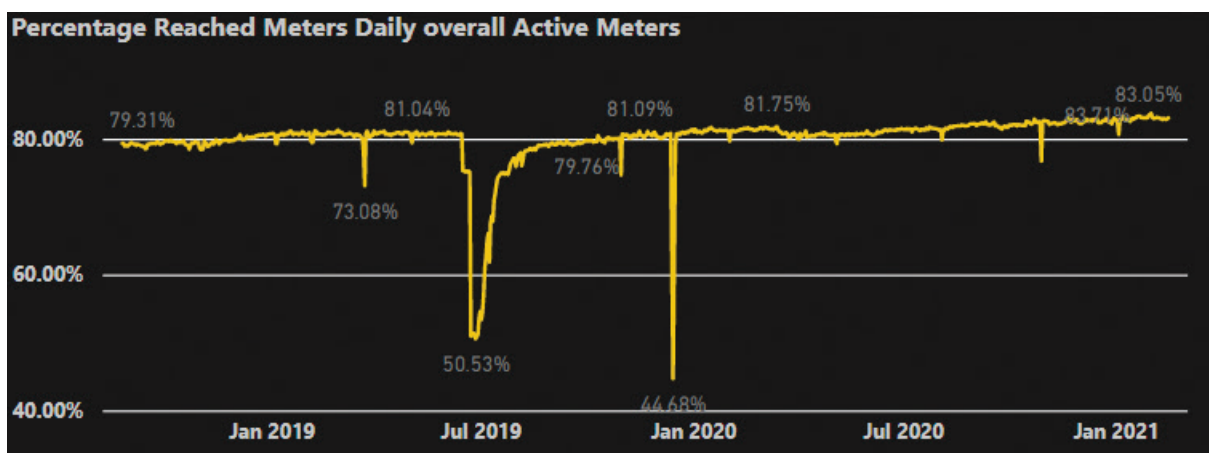
4. Number of meters replaced

Year	Meters Replaced
2014	10,800
2015	9,800
2016	12,700
2017	11,900
2018	17,100
2019	23,000
2020	27,000
Total	112,300

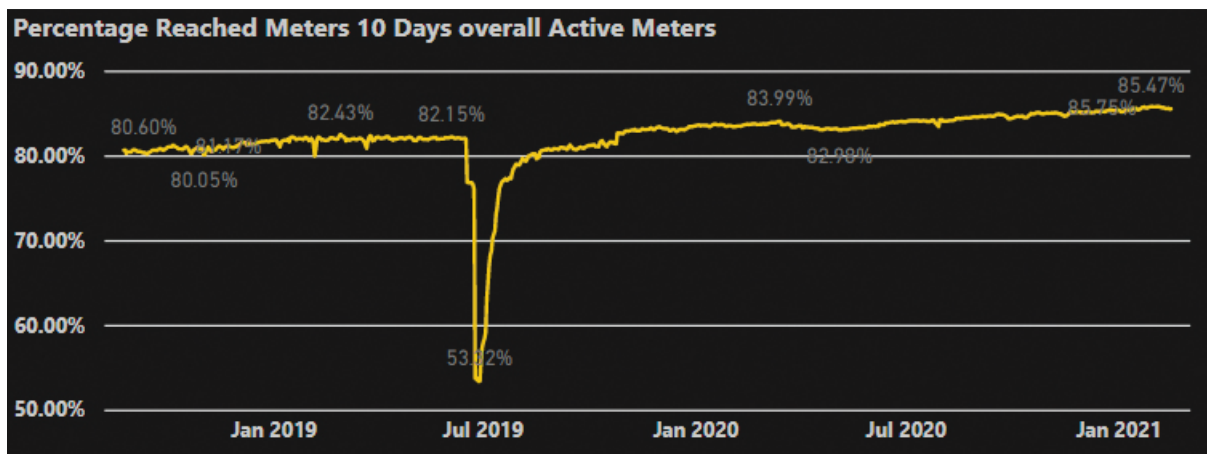
5. Number of active meters billable by AMM (in thousands, K)



6. Percentage billing meters on AMM - read daily



7. Percentage billing meters on AMM - read within 10 days



8. Apparent losses

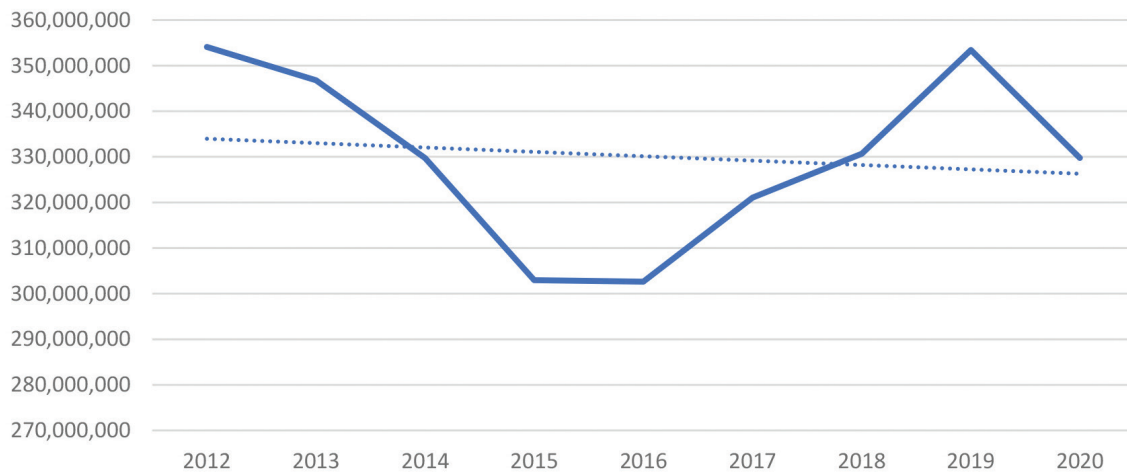
Year	Apparent Losses	Percentage of total water supply	Water Accounts
2009	8,193,268	28.09	243,250
2010	9,089,393	31.59	247,573
2011	9,790,445	33.00	250,285
2012	10,047,590	32.59	254,168
2013	9,152,424	30.02	255,544
2014	8,935,129	29.44	260,127
2015	9,188,407	29.48	265,262
2016	9,659,296	30.22	269,348
2017	10,381,683	31.36	274,419
2018	10,221,325	30.53	279,494
2019	9,436,889	27.22	285,682
2020	10,105,000	29.15	289,723

C. Automated Revenue Management System KPIs

1. Total number of billing transactions per year

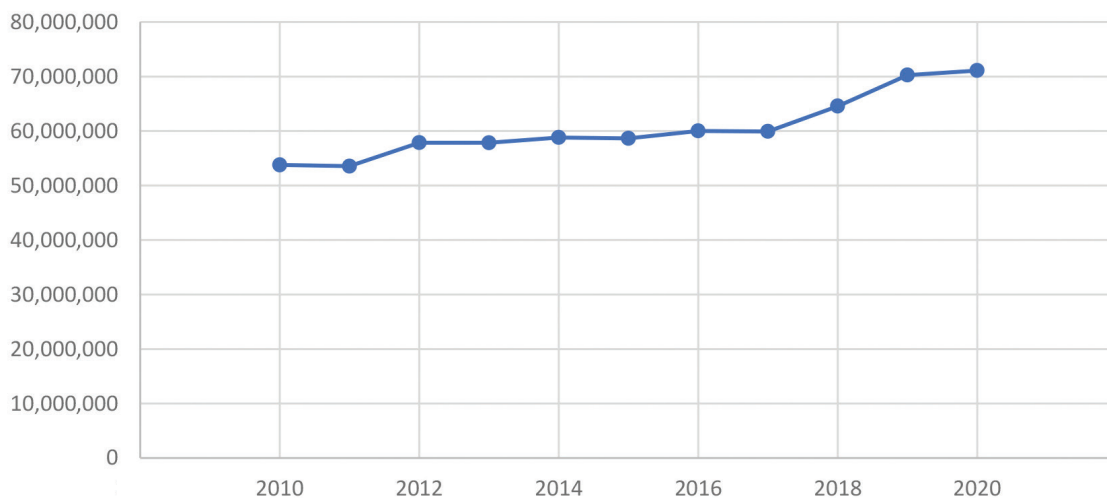
Year	Number of bills ²¹
2012	1,893,958
2013	1,804,238
2014	1,882,640
2015	1,921,855
2016	1,906,716
2017	1,934,709
2018	2,043,336
2019	2,152,301
2020	2,231,639

2. Revenue collected per year from the sale of electricity



²¹ Number of bills includes reversal bills and claim adjustments.

3. Revenue collected per year from the sale of water



4. Percentage of revenue collected over total invoiced – Electricity

Enemalta			
Year	Revenue Collected	Total invoiced	Percentage of revenue collected over total invoiced
2012	€386,777,720	€391,973,131	99%
2013	€364,719,230	€354,684,098	103%
2014	€361,460,816	€342,007,408	106%
2015	€368,581,771	€336,214,663	110%
2016	€303,626,826	€298,112,430	102%
2017	€330,508,089	€325,172,421	102%
2018	€321,404,735	€333,593,313	96%
2019	€332,985,789	€350,820,636	95%
2020	€318,195,809	€341,130,249	93%

5. Percentage of revenue collected over total invoiced – Water

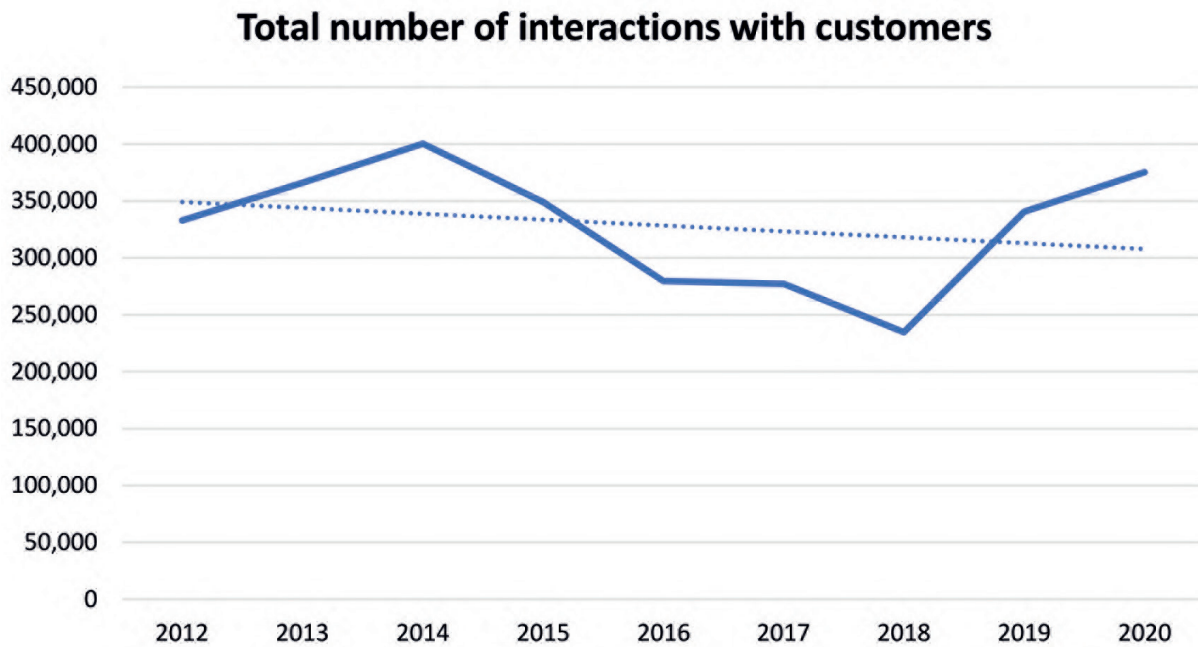
Water Services			
Year	Revenue Collected	Total invoiced	Percentage of revenue collected over total invoiced
2012	€58,802,581	€62,137,553	95%
2013	€60,919,866	€64,602,794	94%
2014	€64,205,281	€61,965,297	104%
2015	€65,644,004	€64,132,200	102%
2016	€63,804,415	€60,156,334	106%
2017	€65,114,390	€63,209,709	103%
2018	€65,336,677	€66,588,781	98%
2019	€71,862,178	€72,794,052	99%
2020	€74,340,725	€76,325,700	97%

6. Yearly aged debtors

Year	Aged debtors as at end of year
2012	155,438,617
2013	162,633,717
2014	146,153,465
2015	111,126,250
2016	95,485,587
2017	78,668,056
2018	79,672,412
2019	83,375,000
2020	89,428,481

7. Total number of interactions with customers per year

Year	Total number of interactions with customers
2012	333,061
2013	365,958
2014	400,389
2015	348,893
2016	279,793
2017	277,093
2018	234,709
2019	340,653
2020	375,361



Executive Summary

Chapter 1

Chapter 2

Chapter 3

Appendix

2020-2021 (to date) Reports issued by the NAO

NAO Annual Report and Financial Statements

May 2021 National Audit Office Annual Report and Financial Statements 2020

NAO Audit Reports

October 2020 Follow-up Reports by the National Audit Office 2020 Volume II

November 2020 Information Technology Audit: Planning Authority

November 2020 Performance Audit: An analysis of Malta Medicines Authority recruitment process

November 2020 Information Technology Audit: Malta Industrial Parks Ltd

November 2020 Report by the Auditor General on the Workings of Local Government for the year 2019

December 2020 Report by the Auditor General on the Public Accounts 2019

December 2020 A review of implementation of Sustainable Development Goal 1 - Malta's efforts at alleviating poverty

January 2021 Performance Audit: Is LESA suitably geared to perform its traffic enforcement function adequately?

February 2021 Performance Audit: The effectiveness of plastic waste management in Malta

April 2021 The contract awarded to the JCL and MHC Consortium by the St Vincent de Paul Residence for the management of four residential blocks through a negotiated procedure

May 2021 Performance Audit: Preliminary review: NAO's role in reviewing Government's measures relating to the COVID-19 pandemic

June 2021 Follow-up Reports by the National Audit Office 2021 Volume I

July 2021 Performance Audit: Fulfilling obligations in relation to asylum seekers

October 2021 Information Technology Audit: Examinations Department

October 2021 Follow-up Reports by the National Audit Office 2021 Volume II