STATE OF MARYLAND

PUBLIC SERVICE COMMISSION

January 15, 2019

The Honorable Thomas V. "Mike" Miller, Jr.
President of the Senate
State House, H-107
Annapolis, Maryland 21401

The Honorable Michael E. Busch
Speaker of the House of Delegates
State House, H-101
Annapolis, Maryland 21401

Re: ***Master Meter Conversion Study - Required by Maryland House Bill 1491, Chapter 532, Section 2 of the Laws of Maryland - 2018 (MSAR #11699)***

Dear Mr. President and Mr. Speaker:

On May 8, 2018, the Governor signed into law H.B. 1491, which required that the Maryland Public Service Commission ("Commission") report the results of a study to assess the feasibility of transitioning master meters installed and used for gas and electric to energy allocation systems or submeters in apartment buildings or complexes, condominiums, and housing cooperatives. The law required the results of this study be reported to the General Assembly by January 15, 2019, in accordance with § 2–1246 of the State Government Article, *Annotated Code of Maryland.* To perform this study, the Commission retained an expert consulting firm on submetering conversions, DNV GL Energy Insights. The study results that are responsive to H.B. 1491's requirements are described below, and the DNV GL Energy Insights Final Report to the Commission is attached.

Background

A master meter is a single meter in a multi-unit building used to measure the total amount of electricity or natural gas used in all individually leased or owned units and all common areas. Master meters have been used for decades in apartment buildings, condominiums, and housing cooperatives in Maryland. Where master meters exist, the utility bills the building owner or manager for the total energy usage associated with the account. The building owner or manager

may pass these utility costs directly to building occupants as a specific periodic assessment or may include the utilities in the cost of rent.

Residents of master metered buildings typically do not know how much electricity and natural gas they use individually and, therefore, have little incentive to reduce waste or invest in energy efficiency measures. In addition, utility-sponsored programs and incentives for reducing energy consumption are not typically available to master-metered building residents since they are not a utility customer.

However, devices exist which allow building owners and managers to individually bill residential units in master-metered buildings and also give residents more information about and control of their own energy usage. These devices are known as "submeters" and the use of such devices in master-metered buildings typically results in lower energy costs for the building and a more equitable distribution of the energy costs among the unit occupants.

For master-metered buildings constructed before 1978, the landlord or manager billed residents using a system such as allocating the property's utility bill to individual residents based on their square footage or as a fixed charge. In 1978, a law (the precursor to Md. Ann. Code, Public Utilities Article ("PUA") § 7-301) was enacted that prohibited the installation of master meters in new construction and required that individual utility meters be installed in each unit of a multi-unit dwelling.[1] However, installing individual meters is more expensive than installing a single master meter and requires additional space for the individual metering equipment and associated wiring.

In 1988, the precursors to PUA § 7-303 (submeters) and PUA § 7-304 (energy allocation systems) were enacted that allowed submeters or energy allocation systems in lieu of individual utility meters in multi-unit buildings. In 2010, PUA § 7-304.1 was codified with the passage of House Bill 1138 and provided mastered meter account holders with an exemption from the

[1] Existing master-metered buildings were not required to be retrofitted with individual meters.

PUA § 7-301, § 7-303, and § 7-304 requirements if the applicant could demonstrate a "net energy savings." Since PUA § 7-304.1 became law, no applicant has applied for an exemption.

In May 2018, House Bill 1491 eliminated PUA § 7-304.1 and directed the Commission to perform a study to assess "the feasibility of transitioning master meters installed and used for gas and electric to energy allocation systems or submeters in apartment buildings or complexes, condominiums, and housing cooperatives."

The study required by House Bill 1491 sought data regarding:

(1) the number and location of residential multiple occupancy buildings or complexes, condominiums, and housing cooperatives that currently use a master meter for gas, or electric;
(2) the estimated cost of transitioning master meters used for gas, or electric to energy allocation systems or submeters;
(3) the number of master meter accounts for apartment buildings or complexes, condominiums, and housing cooperatives that have been in arrears over two or more billing cycles during the period of the study; and
(4) any existing programs in the State to assist landlords or tenants in converting master metering systems into energy allocation or submetering systems.

To perform this study, the Commission retained a consulting firm (DNV GL Energy Insights) with expertise in retrofitting master-metered buildings with individual submeters. DNV GL Energy Insights' team members bring over 40 years of experience in the areas of utility operations, regulatory compliance, customer billing analysis, energy program potential and evaluation, load modelling, cost effectiveness analysis, and statistical modelling and analysis.

Itemized Response to House Bill 1491 Study Requirements

(1) **The number and location of residential multiple occupancy buildings or complexes, condominiums, and housing cooperatives that currently use a master meter for gas, or electric**:

Response: For the Maryland investor-owned electric utilities, 840 electric master-metered accounts in Maryland were identified. Approximately 539 accounts are served by PEPCO Holdings, Inc. ("PHI"), consisting of Potomac Electric Power Company ("Pepco") and Delmarva Power & Light Company ("Delmarva"); 291 accounts are served by Baltimore Gas and Electric Company ("BGE"); and 10 accounts are served by Potomac Edison ("PE"). For the Maryland investor-owned gas utilities, 3,393 gas master metered accounts were identified, with 259 accounts served by BGE and 3,134 accounts served by Washington Gas Light Company ("WG"). The names and addresses of these accounts can be obtained by the General Assembly from the Commission, upon request.

Southern Maryland Electric Cooperative Inc. is the largest non-investor owned utility in Maryland with over 163,000 customers, and it reported having no master-metered accounts. Maryland's remaining cooperative and municipal utilities are relatively small in comparison and they were not included in the study because the impact would be negligible for study purposes.

Many of the utilities' billing systems do not typically identify accounts as serving a master-metered building; thus, the results of the DNV GL Energy Insights' study are based on extrapolating what account information the utilities did provide. Some utilities were able to identify master-metered buildings through analysis of the following:

a. Codes in billing systems which indicate multi-tenant accounts that require notification of other parties before service terminations as an indicator of a shared meter (PE);
b. Rate categories of buildings with master-metered gas accounts (WG);
c. Account flags that note common areas (BGE); and
d. Energy program records, which identify addresses but is not linked to the billing system (Pepco and Delmarva).[2]

(2) **The estimated cost of transitioning master meters used for gas, or electric to energy allocation systems or submeters**:

Response: Based on data from PHI, BGE, and PE, the total electric energy savings potential in Maryland for large buildings is at least 64 million kilowatt hours per year, valued at $7.7 million. The costs to submeter large master-metered accounts, 146 accounts covering 34,876 apartments, is estimated at $22.9 million. The gross annual savings would be offset by a $1.0 million increase in annual meter reading costs. Altogether, such a conversion would result in a payback period of 3.4 years. If incentives or rebates were offered to subsidize the conversion, a $100 rebate per apartment would reduce the payback period to 2.9 years, while a $200 rebate would reduce the period to 2.3 years.

Natural gas energy savings and costs were calculated based on the data received from BGE and WG. The conversion costs would vary widely, depending on whether a building will be submetered for both electric and gas, and can share the same building communications system. Assuming no shared data communications, the cost to submeter the 85 largest master-metered gas accounts, representing 7,700 apartments, is estimated at $5.1 million. The gross annual savings would be offset by an increase of $231,000 in meter reading costs. Altogether, that would result in a payback of

[2] This information was supplemented by data provided in Case No. 9361, *In the Matter of the Merger of Exelon Corporation and Pepco Holdings, Inc.*

6.6 years. However, a rebate of $100 per apartment would reduce the payback to 5.5 years, while a $200 rebate reduces the payback to 4.5 years.

To make these conversion cost estimates, a wide variety of assumptions had to be made, especially given the inability to identify master-metered accounts and existing submetered and energy allocation accounts with 100% certainty. These assumptions used in this study are documented throughout Section 5 and Section 6 of the Final Report.

Additionally, the economic analysis of transitioning master-metered accounts to submetered accounts or energy allocation systems was derived based on large account buildings with at least 75 residential units using electric and 40 residential units using natural gas.

(3) **The number of master meter accounts for apartment buildings or complexes, condominiums, and housing cooperatives that have been in arrears over two or more billing cycles during the period of the study**:

Response: Of BGE's 291 master-metered electric accounts, 51 were identified to be in arrears by more than two months as of the last quarter of 2018. Of BGE's 259 master-metered gas accounts, 42 were identified in arrears by more than two months. Of PHI's 539 master-metered electric accounts, 16 were identified to be in arrears by more than two months. Of WG's 3,108 master metered gas accounts, only 79 were identified to be in arrears by more than two months. PE reported that none of its 10 master-metered electric accounts were in arrears by more than two months. Under existing state law, the owner/customers of those master metered accounts in arrears may contact the utility company directly to seek additional billing assistance or, the Commission, if there is an unresolved dispute.

Energy usage and arrears data constitutes confidential customer data for which DNV GL Energy Insights was required to sign Non-Disclosure Agreements for the purpose of reporting aggregate data for this study. Accordingly, this data is not publicly available. DNV GL Energy Insights has also provided analysis on the impact of submetering on arrearages in Section 5.2.3 of its Final Report to the Commission. However, no definitive conclusions could be drawn about the arrearage effect of submetering and energy allocation of master-metered buildings, other than the conclusion that reduced bills facilitated by submetering or energy allocation systems would result in making the bills easier to pay and thus reducing arrearages.

(4) **Any existing programs in the State to assist landlords or tenants in converting master metering systems into energy allocation or submetering systems**:

Response: No existing programs in the State were found that directly assist landlords or tenants in converting master metering systems into energy allocation or submetering systems. Existing utility related energy savings incentives and efficiency programs are primarily available only for utility account holders.

Conclusion

The issues highlighted in this study present both legislative and regulatory opportunities regarding master-meter conversions. Although the data reviewed in this study has statistical limitations, as noted above, the results indicate that energy savings generally result when master-metered buildings are converted. The study also finds the adoption of programs that reduce the expense of conversions (by providing rebates for submetering and energy allocation systems) would encourage building owners to consider making an investment to convert. Although the Commission submits this study for the General Assembly's consideration and for informational purposes, it does not specifically recommend any action at this time. The Commission, however,

will continue to review this issue and report to the General Assembly as appropriate. Please do not hesitate to contact me should you require additional information.

Sincerely,

Jason M. Stanek
Chairman

JMS:tlj

Attachment

cc: Sarah Albert, Department of Legislative Services (5 copies)

Maryland Public Service Commission – Master Meter Conversion Study

Final Report

Submitted to The Maryland Public Service Commission
In Response to RFP PSC #05.24.18 House Bill 1491

Submitted by:

DNV GL Energy Insights, Inc. (DNV GL)
Joseph S. Lopes, Senior Principal Consultant
15 Glen Street, Suite 201B, Glen Cove, New York 11542
and
Herbert E. Hirschfeld, P.E.
15 Glen Street, Suite 201, Glen Cove, New York 11542

Date of issue: January 11, 2018

Project Charter Document

Project Name:	
Project Number:	L2C 167094
Client:	Maryland Public Service Commission
Date of issue:	January 11, 2018
Date of last revision:	December 18, 2018

Confidentiality

for DNV GL Energy Insights, Inc.	
Prepared by:	Approved by:
Joseph S. Lopes Senior Principal Consultant	Curt D. Puckett Head of Department, Key Initiatives

Table of Contents

List of Exhibits

List of Tables

1 EXECUTIVE SUMMARY

In May 2018, House Bill 1491 directed the Maryland Public Service Commission (MD PSC) to perform a study to assess "*the feasibility of transitioning master meters installed and used for gas and electric to energy allocation systems or submeters in apartment buildings or complexes, condominiums, and housing cooperatives*". The objectives spelled out in the House Bill were the following:

(1) Identify the number and location of residential multiple occupancy buildings or complexes, condominiums, and housing cooperatives that currently use a master meter for gas, or electric;

(2) Estimate the cost of transitioning master meters used for gas, or electric to energy allocation systems or submeters;

(3) Estimate the number of master meter accounts for apartment buildings or complexes, condominiums, and housing cooperatives that have been in arrears over two or more billing cycles during the period of the study (last 12 months); and

(4) Identify any existing programs in the State to assist landlords or tenants in converting master metering systems into energy allocation or submetering systems.

The resulting study findings are to be reported to the General Assembly on or before January 15, 2019. This report details the results and forms the basis for presentation to the General Assembly.

1.1 Background

In the context of the issue being addressed by House Bill 1491, master-metered buildings are defined as residential multifamily buildings with one utility meter covering all apartments within the building for either electric or natural gas service. Since utility bills are only issued for the building as a whole, individual residents do not see a separate bill or allocation based on what they use. Submetering is where individual apartment energy consumption in those buildings is measured by either meters or other energy allocation systems[1] (e.g. flow sensors or run-time devices that can approximate usage indirectly) for the purpose of allocating and separately billing apartment residents for the energy they use. Submetering of electricity has an extensive background in New York State, going back to technical demonstration programs in the 1980's, state assessment and educational programs in the 1990's, utility and state incentive and R&D programs from the 1990's through present day. The Project Team has drawn on this experience for much of its research, including its own substantial and continuous participation in these studies, utility and state programs going back to the 1980's.

Submetering of master metered buildings has been confirmed as a significant source of energy and demand savings, particularly for electricity, but – in concept – for any commodity where consumers do not receive a price signal in proportion to what they use, as would be the case for natural gas, as well, for master

[1] As per COMAR Sec. 20.26.01.01, energy allocation systems... allocate to an occupant of an individual dwelling unit a portion of the cost of gas and electric energy consumed in an apartment house based upon devices which indirectly approximate use of gas or electric energy.

metered buildings. Submetering provides an incentive for individual apartment residents to reduce energy waste, conserve energy, and invest in more efficient appliances and lighting. The resulting reduced bills would presumably improve affordability of energy and reduce arrears.

1.2 Project Scope

The project scope consisted of:

1. Kick-off Meeting – Refine the scope, provide data request and establish coordination with Maryland electric and gas utilities
2. Regulatory Review – Review utility rates, rules and regulations related to master-metering and submetering; identify programs and incentives; identify potential barriers
3. Population Assessment – Identify master-metered and submetered accounts and associated usage and number of apartments to identify potential for submetering implementation in terms of savings and costs; identify arrearage frequency for master-metered and submetered accounts and any causality
4. Technical and Field Assessment – Identify technical issues affecting submetering implementation based on case studies and conduct a feasibility study of a Maryland building complex to gather savings potential and cost factors
5. Stakeholder Meetings – Conduct two stakeholder meetings, meet with MD PSC staff and Legislators
6. Program Reporting and Presentation – Draft a Report and provide a presentation to the General Assembly summarizing the Project results

1.3 Project Results

1.3.1 Regulatory Review

Results are summarized as follows:

- Electric utilities do not identify master meters in billing systems or provide separate rates for master-metered accounts, but accounts are mostly classified as commercial rate accounts. Gas utilities may identify master-metered accounts separately
- Code of Maryland Regulations (COMAR) allows submeters and energy allocation systems, but only for retrofits. New buildings must have individual metering.
- Submeter equipment is approved by the MD PSC but submetering of buildings is not subject to approval by the MD PSC or require notification to the state or utility. Energy Allocation Systems must be approved by the MD PSC but there are no reporting requirements.
- Allowable meter-reading costs that building owners may charge to residents are set to $1/month/meter in PSC regulations vs. $2.50-$5 actual costs, as per vendors and New York experience.
- Existing program initiatives under Maryland Department of Housing and Community Development's (DHCD) Multifamily Energy Efficiency Improvement Programs and Multifamily Energy Efficiency and

Housing Affordability-EmPOWER do have some application to some master-metered buildings, but application to the apartment sector of those buildings may be limited, depending on ownership of equipment and effects on apartment usage without the apartment resident's payment responsibility.

1.3.2 Population Data Analysis

Results for counts and usage of master-metered accounts are summarized as follows:

- Data was collected from Baltimore Gas & Electric (BGE), Potomac Edison/First Energy (Potomac Edison), Washington Gas (a division of WGL), and Pepco Holdings, Inc. (PHI), consisting of Potomac Electric Power Company (PEPCo) and Delmarva Power and Light Company (DPL).
- Utilities provided lists of accounts considered to be multifamily master-metered accounts, and which were submetered based mostly on secondary information since billing systems do not have a specific code for identifying master-metered buildings; there are no reporting requirements for master-metered buildings that submeter.
- All utilities provided usage and arrears data, but apartment counts were not available without secondary research, which was not feasible within the time and resources available.
- Number of apartments for BGE was estimated for electric accounts using a 5,000 kWh/year per-apartment usage estimate from several hundred New York City case studies, confirmed by data on an individually-metered BGE building, reflecting smaller city apartments. For PHI and Potomac Edison, average usage per apartment was based on the Marylander Feasibility Case study, conducted during the project, which resulted in 7,127 kWh/year per apartment. The number of apartments for Gas accounts was similarly estimated based on estimated usage of 800 therms/year per apartment.
- Larger buildings would be expected to have better cost-effectiveness due to the economies of scale associated with larger meter installations and amortization of fixed costs for central system data communications and collection systems. For the purposes of the study, these "large" buildings are defined as buildings with over 75 apartments for electric master-metering (60 for Potomac Edison[2]) and 40 apartments for gas. This was based mainly on experience conducting technical/economic feasibility for electric submetering in New York for over 200 buildings.
- A total of 840 electric accounts totalling about 42,000 apartments and over 390 million annual MWh were identified as master-metered. For the large electric accounts, 146 buildings totalling over 34,000 apartments and about 322 million kWh were identified, with potential savings of about 64 million kWh/year.
- For gas accounts, a total of 3,400 master-metered accounts totalling an estimated 29,000 apartments and over 30 million annual therms usage were identified. For the larger accounts with over (estimated) 40 apartments, 85 buildings totalling 7,700 apartments and over 8 million annual therms usage were identified, with potential savings of over 800,000 therms/year.
- Submetered accounts could only be identified by secondary data, in some cases, and owner contact.

[2] For Potomac Edison, 2 of the 10 buildings were estimated at between 60-70 apartments so these were considered large.

Results for arrears for master-metered accounts are summarized as follows:

- For WGL, arrears percentage for 79 accounts over two months in arrears was about 2.5% of the 3,108 identified master-metered accounts. Of those, none of the 10 accounts identified as submetered were in arrears. Given the small sample, there is no statistical significance that can be assigned to the effect of submetering on arrears.
- For large WGL accounts (Over 40 apartments), only 1 of the 41 accounts over 40 apartments were in arrears, again an insignificant statistical result.
- For BGE, the arrears incidence for the 291 identified electric master-metered electric accounts was 17.5% and 16.2% for the 259 identified gas master-metered accounts that constitute a total of about 2% of the usage of all master-metered accounts. For larger buildings (over 75 electric apartments and 40 gas apartments), none of the 16 electric accounts and only 1 of the 42 gas accounts was in arrears over 2 months.
- For Potomac Edison, only 2 master-metered accounts were identified as arrears, but neither over 60 days as of the last accounting.
- For PHI, 3.0% of the 539 identified master-metered accounts and 2 (1.6%) of the 126 large accounts were identified as over 60 days in arrears.
- With the small number of identifiable submetered accounts and the insignificant number of those in arrears, there is no statistical significance that can be assigned to the effect of submetering on arrears, as compared to the overall master-metered account population.

1.3.3 Technical Feasibility

Generally, a pre-screening would need to be done to collect sufficient data, including at least one year of billing data, to confirm the general characteristics of the building/building complex and confirm potential viability for submetering implementation. Additional parameters would include items that would affect savings potential and required cost:

- Building category (rental, coop, condo); Building type (high-rise, low rise, garden apartment); Management company and ownership; Number of buildings in complex (if multiple), number of floors, layout
- Major building systems (heating, cooling, water heating) and whether they are within the apartment sector or centrally provided; Major plans, such as cogeneration, solar, replacement of major systems or building shell upgrades
- Method of rent or maintenance payments, basis for current energy allocation and whether resident costs are subsidized
- Available funds for potential building investments

Cost considerations would be based on:

- Submeter options, including qualified meters (under ANSI C-12 metering standards) and energy allocation systems

- Submetering of gas accounts where existing gas metering was not available was assumed to involve only energy allocation systems and not installing meters that would require cutting into gas pipes as the cost and safety considerations would preclude feasibility[3]
- Potential meter locations, including central meter room, utility rooms or in apartments
- Data Communications for remote reading, where manual reading is not feasible or cost-effective
- Potential for more than one meter required per apartment
- Physical installation constraints of meters, such as location within apartments and wall construction

Feasibility Case Study (Marylander Condominiums)

- Marylander Condominiums is located in Prince George's County, served by PEPCo for electric and WGL for natural gas
- Marylander Condominiums is a seventeen (17) building residential garden apartment complex comprising two hundred (200) apartments with a single building Power Plant distributing central gas heating/water heating, with apartment cooking gas
- Each building contains a central breaker panel for each apartment located in that particular building, with each apartment containing a wall mounted circuit breaker panel, as well
- The central building complex chiller is no longer operational, so apartments now provide their own room A/C units. If the central chiller was operational, the electric consumption would be lower in the apartments, providing less opportunity for savings from electrical submetering. The cooling provided to the apartments would be instead provided by natural gas via the central system, in the same way as currently used for heating
- Total electric consumption is 1.7 million kWh at an average electric cost of 11.56 cents/kWh
- The apartment sector is estimated as 80% of building consumption, with the average annual usage per apartment estimated at 7,127 kWh
- The submetering of natural gas is not feasible, as the supply of natural gas from the utility is to a central power plant and heating usage would need to be collected at each apartment's fan coil unit, spread out over the 17-building complex
- Electric submetering could be installed either by 1) manually-read meters in each building, 2) remote read meters in each building, or 3) remote read meters in each apartment
- Projected annual electric savings is 365,000 kWh (20.9% of current building total), valued at $42,000. This estimate is based on applying 25% savings to only apartment sector usage, based on results of over 200 feasibility studies and evaluation of savings for those buildings implementing electrical submetering in New York State
- Total installed cost is estimated at $120,000 to $169,000 for the three options, making paybacks 4.0, 4.3 or 4.7 years for the three installation options

[3] Gas submetering is not allowed in New York State due to safety considerations, as per discussion with NYPSC staff member.

- Option three (apartment meters) could include integrated temperature sensors which would provide monitoring and potential for boiler control savings (not included)
- Overall conclusion is that submetering of electricity is feasible and reasonably cost-effective, even without any incentives which would improve cost-effectiveness

1.3.4 Cost/Benefit Assessment

Given the population of candidate accounts that are master-metered and the likely savings associated with them, the overall paybacks for electric larger buildings (over 75 apartments) would be 3.4 years without any incentives, which would be reduced to 2.9 years with a $100 per apartment incentive and 2.35 years with $200 per apartment incentive.

For gas master-metered accounts not in buildings also being electrically submetered, large buildings (over 40 apartments) would have a payback of 6.6 years with incentives. When combined incrementally with electrically submetered buildings, the incremental payback would be only 1.7 years without incentives.

1.4 Summary of Conclusions

In terms of data obtained relating to the four main objectives, the following table details each objectives data collection process:

	HB 1491 Objective	Information Collected	Information Not Collected	Notes
1	The number and location of residential multiple occupancy buildings/complexes, condos, and housing cooperatives that currently use a master meter for gas, or electric;	Lists of individual Master-metered accounts, with usage and arrears data was provided by all utilities. Appendix C details the data fields.	Only WGL provided a list of submetered accounts (10)	Utility billing records typically do not identify either master-metered (except WGL) or submetered buildings or their locations, but secondary data was successful in identifying specific locations of gas and electric master meters in Maryland. Some sites may have been missed.
2	The estimated cost of transitioning master meters used for gas, or electric to energy allocation systems or submeters	Electric submetering cost data and estimates from vendors and case studies for over 200 buildings in New York State. Gas submetering based on estimates from vendors experienced in gas submetering and energy allocation systems.	No data on actual gas submetering and energy allocation system case studies.	Submetering Costs for gas are uncertain due to very few case studies but better when gas submetering is an add-on to an electric conversion.
3	The number of master meter accounts for apartment buildings or complexes, condominiums, and housing cooperatives that have been in arrears over two or more billing cycles during the period of the study	Utilities provided list of each master-metered account arrearage, either past-due amount (BGE, with months estimated by DNV GL) or identifying accounts with over 2 months arrears (all other utilities)	Only WGL provided a list of submetered accounts (10), none in arrears.	Incidence of arrears is low (Given the difficulty in identifying Submetered buildings, data on arrears is not available except WGL.

	HB 1491 Objective	Information Collected	Information Not Collected	Notes
4	Any existing programs in the State to assist landlords or tenants in converting master metering systems into energy allocation or submetering systems.	Information from MD PSC, research on utility programs, MEA programs, EMPOWER, interviews with utilities, two stakeholder calls (including utilities and MEA) were used to confirm programs and applicability to master-metered buildings and submetering implementation	n/a	There are currently only programs to assist master-metered buildings in energy efficiency measures but these are not specifically accessible by the apartment residents without separate accounts. Provisions could be made in existing programs to facilitate savings in master-metered buildings.

In terms of the specific results, the following sections summarize conclusions:

1.4.1 Feasibility

Overall, electrical submetering is feasible, particularly for large buildings, with paybacks of under 4 years.

Gas Submetering is feasible, with an estimated payback of 6.6 years for stand-alone systems in large buildings. However, costs are uncertain and can vary widely and case studies are not at all common in Maryland. For incremental gas submetering via energy allocation systems for buildings already being electrically submetered it is much more feasible with incremental paybacks of under 2 years since the gas submetering system could share the electric submetering data communications system and be installed at the same time.

It should be noted that costs and savings potential can vary by many factors, so a feasibility study should be done for any building or account considering submetering.

1.4.2 Potential

There is sufficient savings potential, especially in the larger master-metered electrical buildings, to justify further study of the justification for state or utility programs to promote submetering via any combination of education, financial incentives and regulatory treatment.

1.4.3 Effect on Arrears

Unfortunately, due to a number of factors no definitive conclusions could be drawn about the arrearage effect of submetering of master-metered buildings. However, it is logical to conclude that reduced bills of 10% - 20% would likely result in making the bills easier to pay and therefore reducing arrearages.

1.4.4 Other Barriers and Factors

Other factors that affect the potential for submetering are as follows:

- The currently allowed $1/meter/month charge is insufficient to cover the actual cost of meter reading and billing after submetering implementation. Costs are estimated as $3 - $5/meter /month.
- There is no bulk electric rate for master-metered buildings, which are treated like any other account by the utilities and regulators. A bulk rate for submetered accounts would provide an additional incentive for building owners to submeter.
- There are no incentives specifically for submetering currently in place, which could be provided by utilities, the Maryland Energy Administration (MEA) or other entity. This would help defray the initial cost, a major barrier to implementation.
- Current electric and gas costs are likely to increase, providing additional savings in the future. As an example, New York's electric rates are nearly double those of Maryland utilities, which provides higher savings value and shorter paybacks.
- There is a low engagement on submetering with housing associations in Maryland, especially compared to New York, with some associations in both states. For example, the Council of New York Cooperatives and Federation of New York Housing Cooperatives conduct annual conferences which have included workshops devoted to submetering for many years in New York. Better dissemination of facts and case studies on submetering by these trusted organizations would encourage building owners to consider submetering. For example, publication and distribution of "how to" manuals similar to those provided by the New York State Energy Research & Development Authority (NYSERDA) and Consolidated Edison Company in New York State by stakeholder entities in Maryland would improve understanding of submetering.
- Demonstration projects and identification of case studies in Maryland would provide valuable information for buildings considering submetering, overcoming the perceived lack of information.
- Financing of initial costs, especially for rental buildings is a significant barrier, as it is with any capital project. Apartment residents in Coops and Condos are, in effect owners, and would share in the savings attributed to submetering, as reduced bills would be passed along in the submetered bills. For owners of rental properties, their investment in submetering infrastructure would need to be recouped, which would not occur if all the savings from reduced electric and gas costs were passed along to their tenants. Procedures would need to be established either by implementing a lower rent reduction (subject to lease terms) or by a shared savings method to recoup the investment over time, providing savings to the average tenant but passing along a portion of the investment costs as well as the meter-reading and billing costs.

2 BACKGROUND

On May 8, 2018, the Governor of Maryland signed House Bill 1491 which included a provision to require the Maryland Public Service Commission (MD PSC) to perform a master meter conversion study. Specifically, the provision states:

> *The Public Service Commission shall conduct a study on the feasibility of transitioning master meters installed and used for gas and electric to energy allocation systems or submeters in apartment buildings or complexes, condominiums, and housing cooperatives.*

In the context of the issue being addressed by House Bill 1491, master-metered buildings are defined as residential multifamily buildings with one utility meter covering all apartments within the building for either electric or natural gas service. Since utility bills are only issued for the building as a whole, individual residents do not see a separate bill or allocation based on what they use. Submetering is where individual apartment energy consumption in those buildings is measured by either meters or other energy allocation systems (e.g. flow sensors) for the purpose of allocating and separately billing apartment residents for the energy they use. Submetering of electricity has an extensive background in New York State, going back to technical demonstration programs in the 1980's, state assessment and educational programs in the 1990's, utility and state incentive and R&D programs from the 1990's through present day. The Project Team has drawn on this experience for much of its research, including its own substantial and continuous participation in these studies, utility and state programs going back to the 1980's.

Submetering of master metered buildings is acknowledged as a significant source of energy and demand savings. This is accepted for electricity, but is also true for master metered natural gas, or any commodity where its consumers do not receive a price signal in proportion to what they use. Studies and implementation over 25 years in New York State, primarily sponsored by the New York State Energy Research and Development Authority (NYSERDA) and Consolidated Edison Company of New York (Con Edison), have confirmed the energy-savings benefits of electrical submetering (Ref: "Demonstration of New Submetering Technologies, NYSERDA Report 86-8):

> *Submetering allows building owners and managers to convert master metered residential buildings into individually submetered units, giving residents more visibility and control of their own energy usage. The result is lower energy costs for the building and a more equitable distribution of the energy (electricity and natural gas) costs among the actual consumers.*
>
> *Converting to submetering can:*
>
> - *Reduce annual energy use and improve economic viability for ownership;*
> - *Improve resident satisfaction and control of individual energy use;*

- *Improve energy efficiency, safety[4], and building maintenance issues[5];*
- *Increase long-term building (and apartment) property value;*
- *Allow for individual apartment participation in demand response or load curtailment programs as currently allowed in New York;*
- *Provide a mechanism for individual apartments to employ smart submeters. Replacing building master meters with smart meters without submetering the apartments limits or precludes tenant participation based on their individual efforts within their apartments; and*
- *Provide an incentive for individual apartment residents to replace appliances and lighting with more efficient devices.*

In concept, residents of master metered buildings do not know how much electricity and natural gas they use and, therefore, are not accountable for what they use and have no incentive to reduce waste or invest in energy-saving measures. On the contrary, their perception is typically that their energy is "free" since it is included in their rent or common charges and any actions they may consider to reduce their consumption would not be reflected in their costs. In addition, utility incentives for reducing energy consumption, such as audits, rebates for efficient lighting, and purchase of more efficient appliances are not typically available to them without a utility account number since they do not make payments directly to their utility. Studies conducted primarily in New York by the Project Team have consistently demonstrated that 25% of apartment sector electric usage is consumed by only 10% of the tenants (regardless of tenant type population), whose "abuse" of the equal allocation required without metering is unfair to their neighbors and wasteful, on the order of 20-25% or more, as confirmed by pre-post studies on submetered buildings conducted under NYSERDA sponsored programs. Finally, since master-metered buildings will tend to have higher usage per-capita than comparable individually-metered buildings, as per case studies, it is likely that the rate of arrears in bill payment would be higher and would be expected to be reduced by lowering their energy bills and facilitating their participation in state, utility or other incentive programs that help reduce usage.

NYSERDA and Con Edison sponsorship of programs for electric submetering, incentives and accompanying R&D projects in New York State have demonstrated both the savings potential, savings achieved and the success in facilitating related energy and bill-saving initiatives. These include demand response, energy management, time-differentiated pricing, new tenant investment in energy equipment and measures, and even fostered improved relations among owners, tenants, renters, and coop shareholders.

The issues involved in electric vs. gas submetering are significantly different, with central gas systems for heating, cooking and water heating being typical and central electric cooling (as opposed to room A/C) not as typical. Stand-alone energy allocation systems for central system usage have typically been found by the

[4] Electrical submetering can be considered to improve the safety of the building. This is particularly true in older buildings with older wiring systems. Since submetering results in reduction of apartment electrical usage, it also decreases the load on the building wiring system, thereby lowering the possibility of overloading the building systems, which can increase the risk of electrical fires. In a project that the Project Team worked on where the building was seeking to refinance, the financial institution stipulated that because of the age of the wiring, the building had to submeter in order to be granted approval for refinancing.

[5] Where submetering systems provide remote data communications capabilities and include temperature sensors, apartment visits for heat complaints are minimized

Project Team in past studies to be neither logistically nor economically viable, but are addressed in this report, as are their use in incremental submetering systems where data communications systems can be shared. In addition, methods for measuring electric usage are quite different than for gas systems, as are sensors and metering options, so cost issues are also distinct by fuel. Submetering of gas accounts where existing gas metering is not available is only considered viable using energy allocation systems and not installing meters that would require cutting into gas pipes, as the cost and safety considerations would preclude cost-effectiveness and feasibility[6].

3 STUDY OBJECTIVES

The objectives spelled out in the House Bill were the following:

(1) the number and location of residential multiple occupancy buildings or complexes, condominiums, and housing cooperatives that currently use a master meter for gas, or electric;
(2) the estimated cost of transitioning master meters used for gas, or electric to energy allocation systems or submeters;
(3) the number of master meter accounts for apartment buildings or complexes, condominiums, and housing cooperatives that have been in arrears over two or more billing cycles during the period of the study; and
(4) any existing programs in the State to assist landlords or tenants in converting master metering systems into energy allocation or submetering systems.

On or before January 15, 2019, the Commission shall report the findings of the study to the General Assembly, in accordance with § 2–1246 of the State Government Article.

4 PROJECT SCOPE AND METHODOLOGY

The Project Team led by DNV GL Energy Insights, Inc. (DNV GL), with Project Manager Joseph Lopes, along with subcontractor Herbert E. Hirschfeld, P.E. were retained in August 2018 to execute the following scope of work to address the project requirements.

4.1 Task 1 – Kick-off Meeting

The Project Team (Hirschfeld and Lopes) conducted a kick-off meeting at the PSC offices in Maryland on August 29, 2018 after preparing and delivering a draft agenda and draft data request related to future tasks, finalized at the meeting. The meeting agenda was as follows:

- Introductions
- Background of Submetering

[6] Gas submetering is not allowed in New York State due to safety considerations, as per discussion with NYPSC staff member.

- Background of Submetering in Maryland (MD PSC)
- Review of Scope of Work
- Timeline and Next Steps

4.2 Task 2 – Regulatory Review

The Project Team conducted a regulatory review to determine the applicability of Maryland-specific regulations and the potential for related regulations from other states (specifically including New York) that could affect the potential for implementation of submetering in Maryland:

1. Review laws and rules related to master metered submetering conversions, as applicable;
2. Review utility rates and qualifications for metering related to master metered buildings and submetering;
3. Review existing related incentives and policies by government, regulators and utilities and eligibility issues relating to residents of master metered buildings. Utilities specified for data collection included:
   a. Baltimore Gas & Electric (BGE), an Exelon subsidiary
   b. Potomac Edison, a subsidiary of First Energy
   c. Washington Gas, a division of WGL Holdings, a subsidiary of AltaGas
   d. Potomac Electric Power Company (PEPCo) and Delmarva Power & Light Company (DPL), both part of PEPCo Holdings Inc. (PHI) and Exelon subsidiaries.

   Municipals and electric cooperative utilities within Maryland were deemed by the MD PSC project manager as having few potential candidates for master metered building conversions, so were not included in the project scope; and
4. Review potential barriers to implementation based on past experience of the Project Team in New York State, as well as other vendors, building organizations, and Maryland building owners and managers contacted during the project.

4.3 Task 3 - Population Assessment

1. The Project Team coordinated with MD PSC and local utility staff to determine the information needed to address the project objectives. Applicable information was incorporated into the data request referenced in Task 1 and set out in the introductory letters sent to each utility.[7] The information requested included:

   a. Billing information on master metered buildings

[7] Each utility signed Non-Disclosure Agreements (NDAs) with DNV GL which protect individual customer data but allow the Project Team to report aggregated data by utility.

i. Determine locations, clustering and characteristic patterns of master-metered buildings;
ii. Determine count (buildings, apts.), usage (total and per apt.) for master-metered and any submetered buildings, where data is available;
iii. Identify types and counts of building types (garden, high-rise, low rise); and
iv. Identify counts of master-metered buildings in arrears for apartment buildings or complexes, condominiums, and housing cooperatives that have been in arrears over two or more billing cycles during the past year; compare with arrears rates for comparable non-master-metered buildings.

b. Identify building segments and configurations that affect submetering implementation, including:
   i. Identify building ownership types and associated implementation issues (owners/rentals, unit owners, coop shareholders, income/subsidized);
   ii. central vs. apartment-level systems for heating, cooling, water heating;
   iii. electric and gas distribution within buildings relating to isolating apartment level usage; and
   iv. alternate supply sources, such as cogeneration, PV and wind.

c. Population Projection - Based on analysis conducted and field visits, Project Team will extrapolate results to the full estimated population of master metered buildings in Maryland
   i. Project sample results to population; and
   ii. Estimate savings, cost and overall program feasibility.

After the initial project introduction letters, followup emails and phone calls were made with each utility separately to ensure a complete understanding of the data requests and discuss what information would be available. Of particular concern were:

- How each utility could identify master-metered buildings and those buildings that were also submetered from identifiers in the billing system files, what alternatives there might be, and the relative accuracy and completeness of identifier options in completing the counts and usage; and
- How each utility could identify arrears data for master-metered and – where possible – submetered buildings.

4.4 Task 4 – Technical and Field Assessment

The Project Team conducted a technical assessment, including a field assessment in Maryland to identify typical conditions, projected cost, savings and implementation variables and estimate factors for key segments that would enable a paper study projection to the whole state of Maryland. This paper study was conducted by the Project Team, based on conditions and building types that sources could identify, including vendors, housing organizations and several management companies, as well as experience in New York state with similar buildings. In addition, discussions with housing organizations, vendors and building

managers provided an overview of the type, size and conditions of applicable buildings from which to base estimates of cost factors in common with or different from the prior experience of the Project Team.

Based on a list of applicable buildings identified through Maryland Delegate Alonzo Washington, one building complex was quickly identified, agreed to a visit and a full assessment, and was considered representative of many of the likely characteristics of master-metered building complexes in Maryland, in terms of size, type (garden apartments were considered most common outside of Baltimore) and configuration of metering and building systems. With the MD PSC's project manager's approval, the Project Team conducted a full feasibility study of that building complex, using the same methods and procedures as used as a standard for such feasibility studies performed for utility (Con Edison, Long island Power Authority/PSEG-LI) and state agency (NYSERDA) studies in New York State. A summary of the process, methods, data and results of that study are included in Chapter 5.

4.5 Task 5 - Conduct Stakeholder and MD PSC Meetings

A total of 4 meetings were planned to brief stakeholders, provide training, and present report findings:

a. First Stakeholder Meeting – This meeting was conducted on November 1, 2018 via conference call. Attendees included utilities, Maryland Energy Administration (MEA) staff, MD PSC staff and the Project Team. Separate notes from the meeting were provided to the MD PSC. This meeting briefed the MD PSC and stakeholders as to the scope, status and timeline of the project.
b. Second Stakeholder Meeting - This was also conducted via conference call on December 6 and included Project Team members and attendees at the First Stakeholder Meeting, as well as other stakeholders identified by MD PSC. Delegate A. Washington was invited and his office was represented. This meeting included preliminary findings of the population analysis and discussion of the feasibility study results.
c. Commission Staff Meeting, with MD PSC and the Project Team was held January 3, 2019.
d. Legislator Meeting (expected in January or February, 2019), with Project Team members, expecting to accommodate up to a full day of meetings, at MD PSC discretion. Conference Call or in-person will be determined when scheduled.

4.6 Task 6 - Program Reporting and Presentation

Ongoing project reporting and conference calls were held throughout the project, as well as a monthly complete status report, coinciding with monthly invoicing and budget/timeline status.

A Final Report outline was provided to the MD PSC for review and comments were incorporated, representing the first in a series of steps involving the final report and presentation identified in this task. Specifically:

- Draft Report Outline;
- Draft Final Report, prior to the Commission Staff Meeting;
- Review of Draft Report by MD PSC and any designated reviewers;
- Final Report Draft; and
    a. Presentation Draft for Legislator Meeting - The Final Report and Presentation identifies program implementation and policy issues, including regulatory issues, identification of barriers, tenant and ownership issues, equipment accuracy and reliability requirements, equipment costs and integration with other energy conservation measures

5 PROJECT RESULTS

Results are presented in several categories, as outlined in the scope of work:

- Regulatory Review
- Population Data Collection (counts, usage and arrears)
- Technical Feasibility

5.1 Regulatory Review

The Project Team conducted an assessment of existing conditions, rules, regulations and codes that affect the potential for submetering of master-metered buildings, including:

1. Utility rates and qualifications for metering related to master metered buildings and submetering
    a. Existence of bulk rates that provide incentives to maintain master-metering vs. individual metering.
        i. None of the electric utilities provide separate rates for master-metered buildings, which were assigned rates based on size (residential or commercial).
        ii. For Gas Utility WGL, master-metered gas buildings are served under a separate rate - Schedule 3: "Firm Group Metered Apartment Sales Service", covering any multiple-dwelling building or project comprised of four or more dwelling units (apartments) supplied through one meter or a battery of meters. Subcategories for "Heating and/or Cooling" and "Non-Heating and Non-Cooling" are used.
        iii. For BGE Gas customers, buildings with 3 or more units within a building are categorized under Schedule C: General Service Gas, along with other non-domestic customer accounts.
2. Existing related incentives and policies by government, regulators and utilities and efficiency program eligibility issues relating to residents of master metered buildings.
    a. Eligibility for only utility account-holders to participate in efficiency and other programs

        All utilities verified that applicants must have an account to participate in utility energy programs.

    b. Maryland Department of Housing and Community Development's (DHCD) Multifamily Energy Efficiency Improvement Programs

        These programs promote energy efficiency and affordability in the State's multifamily rental housing developments for "affordable" rental households. "Affordable" in this context means rental housing with existing income or rent restrictions, or housing with units that serve tenants with low to moderate incomes, as determined by the department. Loans and grants are available for the purchase and installation of cost effective energy conservation measures for building rehabilitation identified by an energy audit conducted by a qualified auditor. The measures identified in the energy audits include specific equipment incentives for measures in

apartments, but only payable to the owners. The programs provides for some within-apartment measures for refrigerators, lighting, and thermostats, but not window air conditioners and only if the measures pass the cost effectiveness criteria. Thermostat measures would only apply to central systems. Refrigerator incentives may only apply if the owner provides the apartment refrigerators. So, qualifying existing affordable buildings have some options for implementing energy-saving measures but the application to apartment consumption are limited.

c. EmPOWER Maryland Multifamily Energy Efficiency and Housing Affordability ("MEEHA") Program

The EmPOWER Maryland program is funded by utility rate payers through utility companies serving Maryland and regulated by the MD PSC. EmPOWER Maryland, initially established in 2008 and subsequently extended, most recently in Senate Bill 184, codified Commission Order No. 87082 and established energy electricity savings goals of at least 2 percent per year of gross weather-normalized sales through 2023, with 2016 as the base year. As with the DHCD MEEHA Program noted above, multifamily buildings are eligible but applicability of measures to apartment sector within multifamily buildings may be limited.

3. Potential regulatory barriers to implementation of submetering

   i. No code is currently required in billing systems to identify master-metered or submetered accounts.

   ii. Allowable meter-reading cost is set to $1/month in COMAR regulations vs. $2.50-$5 actual costs purportedly experienced, depending on automation (manual is higher).

4. Approval procedures other than meters meeting code

   i. Code of Maryland Regulations (COMAR)[8] allows submeters and energy allocation systems, but only for retrofits. New buildings must have individual metering.

   ii. Submeter equipment is approved by the MD PSC but submetering of buildings is not subject to approval by the MD PSC.

   iii. Energy Allocation Systems must be approved by the PSC.

   iv. Notification of submetering implementation is not required by either the MD PSC or utilities, other than the approval of energy allocations systems by the MD PSC.

   v. No other approvals were identified.

5.2 Population Data Collection

For Task 3a of the Project Scope of Work, the following utilities were contacted to provide data from their billing systems and other connected databases, where available:

- Baltimore Gas & Electric (BGE)
- Potomac Edison/First Energy
- Washington Gas (WGL)

[8] Code of Maryland Regulations (COMAR) Subtitle 26 for Energy Allocation Systems and Subtitle 25 for Electric and Gas Submeters

- PEPCo Holdings, Inc., specifically Potomac Electric Power Company and Delmarva Power & Light Company

The data request included the following items:

a. Determine locations, clustering and characteristic patterns of master-metered buildings;

b. Determine count (buildings, apts.), usage (total and per apt.) for master-metered and any submetered buildings, where data is available;

d. Identify types and counts of building types (garden, high-rise, low rise); and

e. Identify counts of master-metered buildings in arrears for apartment buildings or complexes, condominiums, and housing cooperatives that have been in arrears over two or more billing cycles during the period of the study; compare with arrears rates for comparable non-master-metered buildings

Specifically, the items requested and issues encountered, were as follows::

- A list of buildings considered to be multifamily master-metered accounts, and which were submetered
    - Identification of master-metered buildings is not certain; billing systems do not typically identify master-metered buildings; there are no separate electric rates for master-metered buildings (as there are in the Con Edison service area in New York, for example).
    - Depending on size, buildings with multiple residents may be under residential or commercial electric rates.
    - Identification of submetered buildings is even less certain; no billing system codes exist and there is no requirement in Maryland for buildings to report their submetering implementation to any utility or regulators, only for meters to comply with ANSI C-12[9][10] metering standard, which is only verified if there is a complaint reported. The ANSI C-12 metering standard is also used for meter accuracy in other states, including New York.
    - Only a subset of submetered buildings were able to be positively identified due to the aforementioned utility data limitations.
    - Utilities were able to identify master-metered buildings at least partly through:
        - "Dunning" Code, which indicates multi-tenant - the account requires notification of other parties before disconnecting or indicator of a shared meter (may not be apartments) (Potomac Edison)
        - Rate category of buildings with master-metered gas accounts (WGL)
        - "Public Service" account flags that note common areas (BGE)

[9] From COMAR, Electrical Submetering requirements http://mdrules.elaws.us/comar/20.25.01.04

[10] From National Electrical Manufacturers Association. https://www.nema.org/Standards/ComplimentaryDocuments/ANSI%20C12.1-2014-contents-and-scope(1).pdf

- Research through energy program records, which identified addresses but is not linked to the billing system (PEPCo Holdings, Inc.), supplemented by total counts for buildings and apartments developed during Case 9361 ("IN The MATTER OF THE MERGER OF EXELON CORPORATION AND PEPCO HOLDINGS, INC.")

- Annual (or monthly, if available) energy consumption for electricity and natural gas:
  - All utilities were able to provide monthly (BGE) or annual (PHI, Potomac Edison, WGL) usage.
  - PEPCo Holdings, Inc. (Potomac Electric Power Company and Delmarva Power & Light Company) usage for identified master-metered buildings was made available via cross-linking sites to the billing system.
- Number of apartments
  - This data was not available from any of the utility billing systems, although some customer system notes were available that noted counts, but only for small buildings (Potomac Edison).
  - The number of apartments could be determined from public records, management companies, or housing associations, given time and resources, especially for the larger building complexes, given time and resources. However, even that would not be straight-forward, since apartment counts by utility account would need to be cross-checked by individual building.
  - In order to estimate total costs for the population of master-metered buildings, the number of apartments would need to be estimated. As an estimate for this report, a calculation was made based on these assumptions:
    - The apartment sector of master-metered buildings can be estimated as 70%-75% of total building consumption for either electric or gas usage. This is in line with experience from over 200 electrical submetering feasibility studies completed in New York for non-central air conditioner buildings. For high-rises (primarily in cities), this estimate would be slightly higher (75% or more) and for suburban sites (garden apartments) would be slightly lower (70%). For centrally-cooled electric building use, the estimate would be about 50%, based on case studies in New York State.
    - Average annual apartment electric consumption for cities (BGE) can be estimated as about 5,000 kWh. This is also in line with experience from over 200 feasibility studies completed in New York City for buildings without central cooling systems. Data from individual apartments in a 23-unit building in BGE also confirmed this estimate, with an average of 4,400 annual kWh per apartment.
    - For more suburban/rural buildings (PHI and Potomac Edison), average electric usage per apartment would be considered higher due to larger unit sizes, and so was based on the Marylander Feasibility Case study (PEPCo), conducted during the project, which resulted in 7,127 kWh/year per apartment.
    - A cross-check of the resulting estimate of master metered apartments supplied by Pepco Holdings Inc. during Case 9361 ("IN The MATTER OF THE MERGER OF EXELON

CORPORATION AND PEPCO HOLDINGS, INC.") is within 8% of the estimated total apartments produced by the above estimates and, therefore, confirms this estimate with reasonable accuracy for use in this study.

- Based on these assumptions, the calculation #of Apts. = (Total kWh * 75%) / 5,000 for BGE and Total kWh * 70%) / 7,127) was used as a reasonable estimate of number of apartments.
- For gas master-metered buildings, an estimate is not as well documented, since the bulk of master-metered buildings are centrally heated by either oil or gas, so an average usage per-apartment is not feasible for estimating number of apartments based on overall account usage.
- Buildings with both electric and gas could use the electric estimate for gas master-metered apartment counts.
- The number of accounts is likely comparable to number of buildings. However, building complexes can often have multiple buildings and multiple accounts. For the purposes of assessing submetering, each account is considered a unit, since the cost of submetering is mainly a function of a building, and remote communications covering multiple buildings and accounts – even within a building complex - may not be feasible.

- Arrears data for master-metered accounts was obtained, but comparable statistics on submetered buildings was insufficient to provide a means to compare master-metered and submetered buildings. Complete lists of master-metered buildings were difficult to identify, and since none of the utilities' billing systems have specific data fields in their billing systems for submetered buildings, a comparison was not possible.
- Comparison of arrears patterns between master-metered and submetered buildings
    - Because there are so few confirmed submetered buildings available, the sample of buildings in arrears was insufficient to provide a precise enough estimate of either master-metered or submetered arrears data.

5.2.1 Estimate of Master-Metered Counts and Usage

For the purposes of this report and given the limited amount of data available, an estimate of counts and usage for master-metered buildings was calculated. In addition to the total counts and usage by utility and total, a subset of those buildings of a certain minimum size was extracted, under the assumption that those would be the best candidates, given the economies of scale associated with central data collection systems. For electric accounts, that breakpoint was assumed to be 75, based on the minimum number of apartments successfully implementing submetering in the database of over 200 buildings compiled by the Project Team in previous projects in New York State. Since Potomac Edison only provided 10 buildings and 2 were between 60 and 75, those over 60 apartments were considered large.

The savings estimate for electric usage was assumed to be 20%, in line with the experience in New York State projects. For the gas accounts, since only heating in apartments would be saved, an estimate of 10% savings was used, comparable to a 4 degree setback in thermostats vs. a 40 degree change on a cold day

(65 degrees vs. 25 degrees). There were no documented case studies available to confirm the savings in gas from submetering, but vendors who have been involved in gas submetering have confirmed that 10% is a reasonable estimate for the purpose of this analysis.

Table 1 - Total Counts and Usage for Master-Metered Electric Accounts

	Maryland Utilities Summary of Master-Metered Account Analysis - Electric Accounts											
	Master-Metered Electric					Master-Metered Electric >Min # Apts.						
Master-Metered Accounts	Accts	Apts	Annual kWh	Est. kWh/Apt.	kWh/Acct	Min	Accts	Apts	Annual kWh	Est. kWh/Apt.	kWh/Acct	Savings (kWh)
PEPCO & DPL (PHI)	539	37,679	357,954,564	9,500	664,109	75	126	31,184	296,324,869	9,502	2,351,785	59,264,974
BGE	291	3,934	28,192,449	7,166	96,881	75	16	3,370	22,465,712	6,667	1,404,107	4,493,142
Potomac Edison	10	449	4,572,786	10,181	457,279	60	4	322	3,275,360	10,181	818,840	655,072
TOTALS	840	42,062	390,719,799	9,289	465,143		146	34,876	322,065,941	9,235	2,205,931	64,413,188

The BGE buildings were generally larger than the Potomac Edison buildings, which can be explained by the larger number of high-rises in the city of Baltimore and assumed lower usage. For the large accounts, BGE master-metered buildings are estimated to average over 211 apartments while PHI average 247 apartments and Potomac Edison buildings average 80 apartments.

For gas master-metered accounts, the estimated number of apartments is not as accurate, unless a matching electric account could be identified, which was possible for BGE accounts where the utility provides both electric and gas. As with the electric accounts, BGE master-metered buildings were generally much larger, attributable to more high-rises. In addition, gas master-metered buildings who implement submetering for both electric and gas should be able to economize on the central data communications system as long as sensors, energy allocation systems or meters used to measure gas consumption either directly or indirectly (e.g. at the apartment fan coils) can "piggy-back" their data transmittals via a shared communications system. Large buildings are defined for gas accounts as those over 40 apartments.

Table 2 - Total Counts and Usage for Master-Metered Gas Accounts

	Maryland Utilities Summary of Master-Metered Account Analysis - Gas Accounts											
	Master-Metered Gas					Master-Metered Gas > Min # Apts.						
Master-Metered Accounts	Accts	Apts	Annual Therms	Est. Therms /Apt.	Therms/Acct	Min	Accts	Apts	Annual Therms	Est. Therms/Apt	Therms/Acct	Savings (Therms)
BGE	259	6,002	6,543,467	1,090	25,264	40	43	5,460	5,823,955	1,067	135,441	582,396
WGL	3,134	23,612	23,612,016	1,000	7,534	40	42	2,239	2,239,102	1,000	53,312	223,910
TOTALS	3,393	29,614	30,155,483	1,018	8,888		85	7,699	8,063,057	1,047	94,859	806,306

5.2.2 Estimate of Submetered Counts and Usage

For each utility, the Project Team requested a count and total usage of the submetered accounts in their service territory. While there was no billing code identifying master-metered accounts for the electric accounts, the utilities were able to provide a list of individual accounts and total annual usage for those accounts using other means, as noted earlier. However, with no codes for which of the master-metered accounts have been submetered, investigation was only able to identify a count and usage for submetered accounts for WGL.

- For WGL, 11 accounts were identified, with 10 having at least a half-year of usage data to include, totalling 67,485 therms.

With sufficient time and resources, including investigation of public records, surveys of vendors and management companies, additional submetered accounts would likely be identified, but was not feasible within the time and budget constraints of this project.

5.2.3 Estimate of Arrears Impacts of Submetering

Due to the inability to readily identify submetered master-metered accounts in the utility billing systems, there was no straightforward way to analyze billing arrears data to determine how submetered accounts' payment histories may have differed from the master-metered accounts or even the general customer population.

Analysis of the arrears data for the master-metered accounts identified by the utilities did produce some results, as noted in the table below:

For WGL, a total of 3,143 master-metered accounts was provided, of which 3,108 had sufficient data to use (including at least a half-year of usage data). Usage was annualized to 365 days where the billed periods differed. The number of apartments is very approximate and based on an assumption of 800 Therms per apartment, which assumes gas heating in the building. Since this is gas utility-only data, the apartment counts could not be verified against electric use data:

Table 3 - WGL Arrears Analysis

Master-Metered Accounts (>0 Apts.)	WGL Master-Metered Gas Accounts			
	Accts	Apts	Annual Therms	Therms/Acct
Total	3,108	23,599	23,598,572	7,593
Current	3,029	23,182	23,182,234	7,653
Arrears 61-90 days	79	416	416,338	5,270
Percent in arrears	2.5%	1.8%	1.8%	

Master-Metered Accounts (>0 Apts.)	WGL Submetered Gas Accounts			
	Accts	Apts	Annual Therms	Therms/Acct
Total	10	67	67,485	6,749
Current	10	67	67,485	6,749
Arrears 61-90 days	0	0	0	
Percent of all	0.0%	0.0%	0.0%	

Master-Metered Accounts (>0 Apts.)	WGL Non-Submetered Gas Accounts			
	Accts	Apts	Annual Therms	Therms/Acct
Total	3,098	23,531	23,531,086	7,596
Current	3,019	23,115	23,114,748	7,656
Arrears 61-90 days	79	416	416,338	5,270
Percent of all	2.6%	1.8%	1.8%	

As noted, only 2.5% of accounts, covering 1.8% of annualized usage, were in arrears over 61 days. Data was also included for arrears over 90 days, but there were no additional accounts so that has been excluded. None of the 10 submetered accounts were in arrears, making any comparison not feasible, either to the non-submetered accounts or the overall results. Given the small sample, there is no statistical significance that can be assigned to the effect of submetering on arrears.

For larger accounts (over 40 estimated apartments), the results are as follows:

Table 4 - WGL Arrears Analysis - Large Buildings

Master-Metered Accounts (>=40 Apts.)	WGL Master-Metered Gas Accounts			
	Accts	Apts	Annual Therms	Therms/Acct
Total	41	2,106	2,106,102	51,368
Current	40	2,044	2,044,084	51,102
Arrears 61-90 days	1	62	62,018	62,018
Percent in arrears	2.4%	2.9%	2.9%	

The incidence of arrears is insignificantly different from the overall average (2.4% vs. 2.5% for overall). As these are larger accounts, the percentage of annual therms is higher (2.9% vs. 1.8% overall).

For BGE, data was provided to show monthly usage for both gas & electric accounts and the amount of arrears but not how many months. Using an estimate of months based on average rate and amount of arrears, the number of months was estimated.

For all accounts the arrears statistics are as follows:

Table 5 - BGE Arrears Analysis

Master-Metered Accounts (>0 Apts.)	BGE Master-Metered Electric Accounts		
	Accts	Annual kWh	kWh/Acct
Total	291	28,192,449	96,881
Current	240	27,578,301	114,910
Arrears > 2 months	51	614,148	12,042
Percent in arrears	17.5%	2.2%	

Master-Metered Accounts (>0 Apts.)	BGE Master-Metered Gas Accounts		
	Accts	Annual kWh	Therms/Acct
Total	259	6,543,467	25,264
Current	217	6,424,080	29,604
Arrears	42	119,387	2,843
Percent in arrears	16.2%	1.8%	

The analysis shows that about 16 – 18% of all master-meter accounts are at least 2 months in arrears, with those customers accounting for only about 2% of the annual consumption. As indicated, accounts in arrears are substantially smaller (by a factor of 8-10) than accounts with current balances, as confirmed by the analysis of large buildings below.

When only large accounts are analyzed, the incidence of arrears is much lower, with no electric accounts and only 1 gas account over 2 months in arrears.

Table 6 - BGE Arrears Analysis - Large Buildings

Master-Metered Accounts (>75 Apts.)	BGE Master-Metered Electric Accounts		
	Accts	Annual kWh	kWh/Acct
Total	16	22,465,712	1,404,107
Current	16	22,465,712	1,404,107
Arrears > 2 months	0	0	n/a
Percent in arrears	0.0%	0.0%	

Master-Metered Accounts (>40 Apts.)	BGE Master-Metered Gas Accounts		
	Accts	Annual kWh	Therms/Acct
Total	42	5,685,682	135,373
Current	41	5,629,428	137,303
Arrears	1	56,254	56,254
Percent in arrears	2.4%	1.0%	

For PHI, data was provided to show annual usage which of the accounts were over 60 days in arrears.

For all accounts the arrears statistics are as follows:

Table 7 - PHI Arrears Analysis

Master-Metered Accounts >2 Apts	PHI Master-Metered Accounts		
	Accts	Annual kWh	kWh/Acct.
Total	539	357,954,564	664,109
Arrears >2 months	16	2,974,914	185,932
Percent in Arrears	3.0%		

Master-Metered Accounts >75 Apts	Large PHI Master-Metered Accounts		
	Accts	Annual kWh	kWh/Acct.
Total	126	296,324,869	2,351,785
Arrears >2 months	2	2,269,240	1,134,620
Percent in Arrears	1.6%		

Arrears data was provided by Potomac Edison but only 2 accounts were arrears and neither for over 60 days.

5.3 Technical Feasibility of Master-Metering to Submetering

Based on the Project Team's experience in several hundred multifamily buildings of all types in New York, discussion with housing association representatives serving both Maryland and New York, and discussion with vendors serving both Maryland and New York, the Project Team was able to confirm that the physical characteristics of multifamily buildings in Maryland were comparable to those in New York. This made the New York case studies particularly relevant for application to the Maryland-specific issues in terms of cost and implementation factors. To confirm and supplement this, a detailed assessment was made of the feasibility for submetering implementation for one Maryland case study, considered typical of many Maryland buildings applicable to conversion of master-metering to submetering.

It should be noted that each building may be different, in terms of feasibility for submetering implementation, with a number of factors affecting whether the building is a viable candidate at all or, once the feasibility study visit and assessment is complete, whether there are factors that may disqualify the building or identify the building as not cost-effective due to certain conditions found. In identifying a candidate for the feasibility study, several buildings were considered and the choice was based on a building that had mostly typical characteristics, including a large garden apartment layout with electrical and gas master-metering and apartment cooling. Some building complexes may be better and some worse, and some may be considered not viable even before a visit based on their characteristics and conditions identified during pre-screening.

5.3.1 General Issues Considered in Conducting Feasibility Studies

Prior to conducting a feasibility study of a candidate building, there is a pre-screening data collection checklist to confirm that the building or building complex is a viable candidate for conversion from master-metering to submetering:

1. Confirm that the building is master metered, typically by examination of the utility bill - Obtaining a recent year's worth of utility bills rendered to the building(s) is sufficient for this purpose.
2. Identify the building category - If it is a rental building the landlord (or building owner) is the decision maker. If it is a cooperative or condominium the decision maker is the Board of Directors (BOD), usually comprised of up to ten (10) board members. That means that a majority or more than one person is the decision maker. Proper authorization is essential to gaining information and permission to conduct the field visit.
3. Identify the role of the management company - Some building managers may be uncooperative because they consider billing individual tenants or shareholders after submetering extra work on their part that is out of scope of their role. Their cooperation is essential, as they will ultimately have to field questions, complaints and other intrusive items which did not exist before submetering. If so, they may block contact with the BOD unless convinced that submetering is beneficial and in the long run the system can be utilized to assist them in their duties. For example, submeters are available with built-in (integral) temperature sensors which provides apartment temperature information via the Internet, simplifying the manager's ability to address apartment heat complaints and facilitating heating system operations.

4. Learn building history with regards to the issue of submetering - It is helpful to know how submetering may have been considered before and how it became a matter of consideration in the current timeframe. If the matter was brought up before and not resolved, some re-education (on current technology and regulations) may be critical. For example, the role or position of local politicians or organizations could have been or are currently a critical issue. Political support or opposition can make a significant difference with regards to cooperation and objectivity in the building's consideration.

5. Knowledge of whether the building(s) has interest or plans for adding/changing major building systems or energy conservation initiatives, such as cogeneration, solar, heating, cooling, and building shell (windows, roof, expansion) improvements, any of which would change the energy profile of the building(s).

6. Building and apartment characteristics – The building(s) size, number of apartments, number of buildings, and type of heating and cooling systems have a major impact on the potential submetering savings. Specifically, are heating and cooling provided by central or individual apartment systems? Are laundry services central or are they in individual apartments? Submetering can only effectuate a reduction in usage of the load inside the apartments due to resident actions, but not loads in the common area. For example, use of window or through the wall air conditioners contribute more load to the apartment than if there is a chiller which supplies cold water to apartment fan coil units or a central A/C system that provides cooling air through ductwork. For heating, a central boiler providing hot water or steam to the apartments will have only limited control within apartments, compared to individual room or apartment heating systems.

7. Identify regulations which apply to the particular building(s) in question – Whether the tenants are subsidized will affect how the billing of submetered usage will be handled. Will the subsidy be reduced as a result of reduced energy usage via submetering?

8. How energy costs are currently allocated in the building(s) – Under master-metering, individual apartments are still paying for energy, but it is allocated based on something other than actual consumption. For example, in a Coop building, typically each apartment is assigned a number of shares based on the relative value of the apartment and used for other allocation of costs such as staff salaries, administration and energy costs, according to budget items. Number of rooms, square footage and other units may also be used. Once the building is submetered, those allocations would be changed to actual consumption so budget amounts must first be removed from rent or maintenance costs, with a separate line item added back for "actual" energy costs for the apartment. Common area energy costs would still be allocated by a formula as before.

9. Whether or not there are government or utility grants or incentives available to the building(s) as an incentive to defray the submetering implementation cost – In some states, such as New York, programs funded by ratepayers or general taxes are used to provide incentives for adoption of energy conservation programs, similar to rebates for lighting and appliances.

As a result of the pre-screening data collection and assessment, the decision would then be made as to whether to proceed with the field visit to the building for a full feasibility assessment.

5.3.2 Electric vs. Gas Submetering

Electric and Gas Submetering are accomplished by either metering or energy allocation systems, each of which is addressed in the Code of Maryland regulations (COMAR).

Submetering Systems are regulated by the PSC under COMAR Section 20.25 (See Appendix A), which are intended to provide "uniform and reasonable standards for the accuracy, billing, and regulation of submeters", as well as rent reduction for owners who have previously included energy usage in tenants' rent or maintenance.

Submetering of electricity has an established track record in both residential and non-residential building applications, including down to end uses. Metering of electricity is typically provided by electro-mechanical or electronic devices. Electromechanical induction meters operate through electromagnetic induction by counting the revolutions of a non-magnetic, but electrically conductive, metal disc which is made to rotate at a speed proportional to the power passing through the meter. An electronic meter combines sensors and microprocessors to calculate instantaneous or period usage, demand and other factors for display and/or transmittal via telemetry.[11]

The State of Maryland requires all electric meters used for submetering to conform to ANSI C-12[12], an industry standard that is certified and fairly universally adopted and relates to accuracy and performance for various classes of meters specific to 0.1%, 0.2% and 0.5% accuracy categories.

Energy Allocation Systems are regulated by the PSC under COMAR Section 20.26 (See Appendix A), and apply to either electric or gas. Implementation of an energy allocation system requires the owner to obtain approval from the PSC, with the application including owner and property information, technical description of the energy allocation system, method for calculating energy use and costs from the system, and billing format.

Energy allocation systems typically utilize either Run Time Devices (RTDs), which can detect start and stop "run" times, or a combination of RTDs and sensors. The sensors record elements such as water or air flow and temperature of the medium used to transmit heating and/or cooling from a central system to the individual apartments, enabling calculation of "run-time", based on how long the sensor detects use and a conversion rate of the sensors to units that are proportional to energy consumption. RTDs are limited to cases where the medium being measured for billing purposes operates or consumes energy at a constant (flow) rate, which mostly applies to large energy using appliances, i.e. central building air conditioning, furnaces, water heaters and single stage (on or off) gas fireplaces. Sensors for this application typically involve cutting through water pipes or ductwork, but for this study, cutting through gas pipes is not considered because of safety and cost considerations. The billing period accumulated "on" time interval being recorded can be multiplied by the constant appliance flow or burn rate constant to estimate the period utility consumption so as to facilitate reasonably accurate measurements for use in allocating usage proportional to amount used. For heating and cooling supplied by a central system, the flow and temperature differential through fan coils providing hot and cool air or heated/chilled water to each

[11] https://en.wikipedia.org/wiki/Electricity_meter

[12] Op Cit Ftn 3

apartment can be measured and used for allocation of building energy based on proportion of each apartment.

However, it is not considered feasible to utilize RTDs to derive any reasonably accurate measurement with respect to overall apartment electricity usage, as there are too many variable and different sized loads, such as refrigerators, washing machines, televisions, air conditioners, light bulbs, etc. As a result, they are generally not appropriate as a substitute for dwelling-level electrical submetering or energy allocation via sensors.

While energy allocation systems using sensors or RTDs are not nearly as accurate as metering, they can still provide a cost-effective option for gas billing, depending on which end uses are covered (e.g. central heat/cooling, water heat, cooking, fireplaces, and dryers), their costs for reading and billing, and the configuration of the distribution systems in the building. Costs for such energy allocation and RTD systems vary widely.

For the purposes of this study, submetering costs for retrofit of buildings implementing only gas submetering using energy allocation systems have been assumed to be the same as for electric, because cutting through water pipes (but not gas pipes) and installing sensors would still be necessary, which was confirmed by vendors with experience in both electric and gas submetering. Those costs would be significantly less under certain circumstances, such as if the gas submetering or energy allocation system can share the data communications system employed by an electrical submetering system in the same building. In that case, an experienced vendor reported that costs would be between $100 and $200 per apartment.

Location of Meters and Cost Implications

Costs for metering of electric and gas are subject to where the apartment total consumption may be obtained. For individually-metered apartment buildings, meters are typically in the basement or utility room, with all apartment meters located together, facilitating manual reading by utility staff, or may be upgraded to remote reading via a communications system, such as "drive-by" radio systems or using automated metering infrastructure (AMI), which link "smart" meters through a fixed network that can be read centrally by the utility. For master-metered buildings, a central location to collect metered data for all apartments would be the least costly option. For building complexes with multiple buildings (e.g. garden apartments), the meters for each building may be clustered together in one or more buildings, again facilitating less costly options for meter-reading.

In cases where apartment metering is not centralized, such as where circuits are only separated at the apartment level, electrical metering of each apartment may require meters within the apartment connected to the circuit panel. In that case, manual reading is not feasible since it would require meter readers to visit each apartment each billing period (monthly). Remote reading would then be the only viable option, with a data communications system that would collect readings centrally in the building complex or meter-reading vendor facility. This would apply to remote gas meter reading options, as well, but there are fewer case studies of this type of submeter installation.

Installation of meters in the apartments brings its own logistical and technical issues, including location of the meter, which must be reasonably close to the circuit panel – either flush-mounted or surface-mounted (which would mean a protrusion on resident walls). Wall construction could be a factor, as plaster walls

(typically in older buildings) will be more difficult and costly to mount meters in the apartments than sheet-rock walls, should that option be viable.

Another factor in cost and logistics is the possibility that more than one meter may be required, due to multiple electric risers or gas pipe locations within the apartment. There have been cases where electric risers have been added to enable upgrades in electric service capacity to provide, for example, air conditioning installations for each apartment. In those cases, two or even more meters may be required to capture all electric loads.

The existence of "Smart" meters or Automated Metering Infrastructure (AMI) installed for the building master meter has no bearing on the submetering implementation process, costs, savings or billing process since the building master meter is only applicable to the utility billing of the building as a whole. The utility would have no provision to access the submeters or apartment usage, as before submetering implementation. It should be noted that most electronic submetering systems and even energy allocation systems would have more capability than traditional (non-smart) utility meters due to the remote data communications system, should that feature be employed. This would enable the building owner to have real-time communications with all the apartment meters, providing readings on-demand, control signals, temperature readings and other status indicators, subject to the capabilities of the submetering system installed.

5.3.3 Building-Specific Feasibility Study Data Collection and Assessment

Once the pre-visit general data collection and assessment is completed and the building is deemed a viable candidate, the following steps would be performed to provide the additional data required to determine the technical/economic feasibility:

1. Costs and benefits, as they vary by building complex characteristics:
    a. Building type (garden, high-rise, low rise), size, segments, building construction; characteristics (e.g. plaster vs. sheetrock walls), and metering configurations (location: e.g. in apartments, hallways, meter rooms);
    b. Common areas served by the master-meter (e.g. garage, commercial space, community rooms);
    c. Building load configuration (heat, cool, cooking, central vs. room heat, cool and water heat), water heating, fuels for major end uses;
    d. Meter configuration (existing meter pans, master meter, meter rooms);
    e. Wiring (electric) and piping (gas) configuration (separate risers, meters per apt. required.
2. Rates for master-metered buildings (valuation of bill savings benefits), including existence of time-of-use, demand charges and other bill components;
3. Options for meter reading and data communications, including manual reading and processing and automated remote reading via a data communications system, such as powerline carrier (PLC[13]), or wireless communications;
4. Costs based on type of submetering system and associated communications options. Budget-level quotes from submetering equipment manufacturers who conduct business in Maryland, either directly or through sub-contractors, can be used to obtain equipment and installation cost information; and
5. Potential effect of incentives on costs and cost/effectiveness, based on hypothetical programs similar to and varying from comparable New York State history for Con Edison and NYSERDA.

5.3.4 Case Study Feasibility Study – Marylander Condominiums

The building complex selected by the Project Team was Marylander Condominiums, located in Hyattsville in Prince George's County, Maryland, which was suggested by Delegate Alonzo Washington representing Prince Georges County.

On October 10, 2018 a site visit was conducted in order to evaluate the feasibility of submetering the building complex. The site visit was conducted by Herbert E. Hirschfeld P.E., an independent consultant acting as a Technical Consultant and subcontractor to DNV GL Energy Insights. Mr. Hirschfeld was

[13] Power-line communication (PLC) carries data on a conductor that is also used simultaneously for AC electric power transmission or electric power distribution to consumers

accompanied by Jim Leonard of Intech 21 (an experienced submetering implementation company) to provide cost estimates for implementation. These cost estimates represent a budget estimate rather than a bid estimate, for which the building could be expected to pay at or below the amount. The Maryland PSC was represented by John Borkoski, Chief Engineer (and the MD PSC Project Manager) and Roger Austin, MD PSC Engineer. Representing Marylander Condominiums and acting as guide was Alejandro (Alex) Lopes, On-Site Manager.

It should be noted that Marylander Condominiums had considered electrical submetering in the past, however, due to lack of funds were unable to proceed.

- Marylander Condominiums is located in Prince George's County, served by PEPCo for electric service and Washington Gas for natural gas service.
- Marylander Condominiums is a seventeen (17) building residential complex comprising two hundred (200) apartments.
- A single building Power Plant receives all the electricity and all the natural gas required to satisfy the complex's electricity, apartment heating, domestic hot water (DWH) and cooking gas requirements.
- Gas fired boilers burn natural gas to produce hot water which is transmitted to apartment fan coil units to provide heat and to a central DHW heat exchanger to provide the apartments with hot water.
- The incoming electricity is supplied to the 17 buildings, which each contain a breaker panel to accommodate each of the apartments located in that particular building.
- Each apartment contains a wall mounted circuit breaker panel, as well.
- The apartment cooling had been provided by a chiller located in the Power Plant which provided chilled water to the apartment fan coil units. This chiller has not been operational for some time and, as a result, the apartments that desired air conditioning installed window air conditioners in their respective apartments. This change further increased the apartment electric usage and the need for submetering of electricity.

The results obtained from this site visit in addition to the input from building management and analysis of the utility bills provided by management are summarized as follows, taken from the Executive Summary of a separate report. Copies of the entire feasibility study were transmitted to John Borkoski and to the building management for consideration by the Marylander Condominiums BOD. The Marylander Condominiums has given the Project Team approval to share the data and results of their feasibility study publicly in this report.

The following is the Executive Summary from the feasibility study:

This feasibility evaluation has been prepared as a component of the "Master Meter Conversion Study" funded by the Maryland Public Service Commission (MD PSC) to assist the State in evaluating the potential benefit of submetering and associated issues. This report may be utilized by Marylander Condominiums for their own in-house evaluation in return for its participation in this project.

Pre-visit data collection included collection and analysis of building energy consumption, as noted in Table 8 below:

Table 8 - Marylander Condominiums Annual/Monthly Electric Usage and Costs

Marylander Condominiums
Electrical Energy Billing Data

UTILITY: Pepco — Oct-17 Through Sep-18

	Billing Period			Consumption kWh	Demand kW	Total Cost of Electricity
1	09/14/2017	-	10/11/2017	126,559	313.40	$14,245.00
2	10/12/2017	-	11/10/2017	106,316	265.00	$12,142.00
3	11/11/2017	-	12/11/2017	137,999	264.30	$15,614.00
4	12/12/2017	-	01/11/2018	183,747	358.80	$20,797.00
5	01/12/2018	-	02/09/2018	143,238	302.20	$16,591.00
6	02/10/2018	-	03/12/2018	129,777	243.60	$15,241.00
7	03/13/2018	-	04/11/2018	123,645	285.10	$14,901.00
8	04/12/2018	-	05/10/2018	101,451	235.60	$11,885.00
9	05/11/2018	-	06/12/2018	139,110	304.30	$16,716.00
10	06/13/2018	-	07/12/2018	178,003	384.90	$21,159.00
11	07/13/2018	-	08/10/2018	175,773	361.70	$19,924.00
12	08/11/2018	-	09/12/2018	201,871	390.50 *	$22,730.00
Total	09/14/2017	-	09/12/2018	1,747,489	390.50	$201,925.00
					* Annual Peak	
Monthly Averages				145,624		$16,827.08
Average Annual Electric Cost:						11.56 ¢/kWh

Average annual natural gas costs totalled $250,000, of which about $10,000 was for gas ranges within the apartments.

Upon completion of the required site survey, discussions with the building's superintendent and management, equipment manufacturers and contractors, review of pertinent building energy usage data and completion of the analyses described in this report, the following findings are offered:

1. The submetering of natural gas is not feasible for Marylander Condominiums as the supply of natural gas from the utility is to a central power plant, located on-site, which in turn produces and delivers hot water to each of the 17 buildings to provide apartment heating. Metering or measurement by an energy allocation system would need to be installed on each apartment's fan coil unit, with costs for sufficient accuracy not justified for only the heating season.

The submetering of electricity can be accomplished under three different scenarios with each method offering its own advantages.

Method #1 - install a multi-meter cabinet in each building electric room without the communications required to effectuate remote meter reading and billing. Under this scenario the meters would be manually read. This method would incur the minimum implementation cost, but higher ongoing costs for meter-reading.

Method #2 would be the placement of a multi-meter cabinet as described in Method #1 and adding an on-site wireless communications system to facilitate remote meter reading and billing.

Method #3 would be the placement of a submeter inside each apartment adjacent to the apartment circuit breaker panel and the installation of an on-site wireless communications system. This method would incur the maximum implementation cost but provide additional benefits which would likely offset this additional cost. This submeter would contain an integral temperature sensor to enable management to address apartment heat complaints and to provide apartment temperature input into a control algorithm to facilitate heating system optimization. An on-site communications system can also be tied into on-site security cameras, fire alarm equipment and apartment smoke and carbon monoxide (CO) detectors, as well notifications, such as time-of-use (TOU) periods, should such a rate option be chosen. These additional features have been implemented and evaluated in a number of NYSERDA (New York) R&D studies over the past 20 years and are technically feasible.

3. The electrical submetering implementation costs (not including ongoing meter-reading costs) for each of the three scenarios described above for all 200 apartments is estimated at:

   a. Method #1: $120,600, including installation.

   b. Method #2: $156,600, including installation.

   c. Method #3: $169,400, including installation.

4. The availability of proven submetering equipment meeting the standards established by the Maryland Public Service Commission which meets applicable ANSI-C.12 standards provides a choice of competitive equipment for this building application. This equipment list can be found on the Maryland Public Service Commission website under approved electric submeters. (https://www.psc.state.md.us/electricity/approved-electric-submeters/).

5. Electrical submetering implementations completed in similar New York residential complexes and documented in Con Edison and NYSERDA studies since 1991 have resulted in confirmed average energy savings of 20% and peak demand reductions averaging exceeding 25%. The projected annual reduction for Marylander Condominiums is estimated at 364,872 kWh which represents 20.9% of the total electricity usage for this residential complex, under the assumption that a reduction of 25% of the apartment sector usage would be accomplished as a result of submetered billing.

6. The summer peak demand reduction is estimated at 80 KW. This removes load off the utility grid during peak summer days, as well as reduces the monthly electric demand billing charge and could have additional bill reduction, depending on the distribution of savings versus time-of-use periods.

7. The payback associated with each submetering scenario is calculated at:

Method #1: 4.00 years (There are no additional fuel savings)

Method #2: 4.33 years (There are no additional fuel savings)

Method #3: 4.68 years (*which reduces to 2.43 years with fuel savings)

*It should be noted that under Method #3 - where the submeter with an integral temperature sensor is installed inside the apartment, additional fuel savings can be achieved when the apartment temperature input parameter is incorporated into a heating system or boiler controller algorithm.

8. Many utilities are moving forward with plans to replace "dumb" meters with "smart" meters" in order to institute and expand smart grid networks and energy conservation programs on a wider scale. The only meter currently installed at Marylander Condominiums is the whole-complex master meter. By submetering the apartments and installing "smart" submeters, each apartment will be able to apply some of the options available to buildings with "smart" utility meters, such as time-of-use pricing and demand response currently unavailable to apartments which do not have individual meters.

9. Master metered condominiums are unable to charge each apartment owner based on the actual amount of electricity consumed by the apartment. Accordingly, there is little incentive to conserve. Electric charges, which increase, are incorporated into the monthly maintenance bill allocated by some other parameter such as apartment size or number of shares. Experience from New York studies have confirmed that buildings have elected to submeter electricity because their respective Boards of Directors and Management felt that submetering and removing the apartment electric charges from the monthly maintenance bill would enhance the value of their respective apartments. Lowering the maintenance charges improves the ability for prospective buyers and apartment owners to secure financing and mortgages, thus improving the re-sale value of their apartment units.

10. Submetering allows each owner to assume greater control of his/her costs associated with their respective units. They would then be presented with incentives to replace inefficient lighting and appliances, including refrigerators and air conditioners, with more efficient equipment.

6 SUMMARY OF CONCLUSIONS

6.1 Total Potential Costs and Benefits

Appendix B contains the detailed aggregated data tables by utility, electric/gas and all/large buildings, with assumptions and results.

6.1.1 Electrical Submetering

Based on data from all three electric utilities, the total electric savings potential in Maryland is at least 64 million kWh per year (assuming 20% building savings) for buildings, valued at $7.7 million per year (at $0.12[14] /kWh).

The costs to submeter the 146 identified large master-metered accounts, covering 34,876 apartments, is estimated at $22.9 million ($1,500 fixed cost per account plus $650 per apartment for installed meters). The gross annual savings would be offset of $1.0 million in meter reading costs (at $2.50/month per apartment).

Altogether, that would produce a payback of 3.4 years without any incentives. A $100 per apartment incentive/rebate would reduce that to 2.9 years, while a $200 per apartment incentive/rebate would reduce that to 2.3 years.

6.1.2 Gas Submetering

Based on the data received from both (two) gas utilities, estimated savings and cost were calculated. The costs would vary widely, depending on whether the communications system could be shared with the electric system. Given that, annual savings (at 10%) are estimated at 0.8 million therms, valued at $1.25[15] / therm would be worth $1.0 million/year.

Assuming no shared data communications, the costs to submeter the 85 accounts in larger master-metered gas accounts, covering 7,700 apartments, is estimated at $5.1 million ($1,500 fixed cost per account plus $650 per apartment for installed meters). The gross annual savings would be offset by $231,000 in meter reading costs (at $2.50/month per apartment).

Altogether, that would produce a payback of 6.6 years without any incentives. A $100 per apartment incentive/rebate would reduce that to 5.5 years, while a $200 per apartment incentive/rebate would reduce that to 4.5 years.

For buildings that could share submetering costs that are submetered for both electric and gas, the incremental cost for gas submetering the 85 accounts in larger master-metered gas accounts, covering 7,700 apartments, is estimated at $1.7 million (an additional $1,500 fixed cost per account plus a reduced cost of $200 per apartment for installed meters/energy allocation equipment). The gross annual savings would be offset by an additional $46,000 in meter reading costs (at $0.50/month per apartment).

[14] Average net electric price from Marylander Condominiums (11.86 c/kWh) rounded to whole cents

[15] EIA average for 2017 Natural gas prices, assuming 80% Residential ($1.297/100ccf) and 20% Commercial ($1.027/100ccf) Rates, rounded to $1.25/100ccf=$1.25/Therm, with 100 ccf/therm https://www.eia.gov/dnav/ng/ng_pri_sum_dcu_SMD_a.htm

Altogether, that would produce a payback of 1.7 years without any incentives. A reduced incentive of $50 per apartment would reduce that to 1.2 years, while a $100 per apartment incentive/rebate would reduce that further to 0.8 years, making it eminently feasible as an incremental measure.

6.2 Impact of Submetering on Arrearage

Unfortunately, due to a number of factors, no definitive conclusions could be drawn about the arrearage effect of submetering of master-metered buildings, other than the logical conclusion that reduced bills of 10% -20% would likely result in making the bills easier to pay and reducing arrearage. Submetering will not affect the responsibility to the utility by the owner for the overall account payments, but reduction in apartment sector usage would lower the overall bill to be paid by the owner.

The factors to facilitate calculation of arrearage effects are:

- Inability to easily identify master-metered accounts in electric billing records and submetered accounts in both electric and gas billing systems; and
- The small number of identified submetered buildings was insufficient to provide a large enough sample of accounts to make any comparisons between master-metered accounts with and without submetering.

6.3 Other Factors Affecting Submetering Feasibility

In addition to the technical and economic factors discussed in this report, there are a number of other factors that would be relevant in assessing the feasibility of implementing a program that promoted or incentivized master-meter to submetering conversions in Maryland, including:

- Rate Structures – The existence of rates that favor conversions could include:
  - Special rate for master-metered buildings (this already exists for WGL for gas and has been in place for Con Edison in New York for electric rates); and
  - Special rate for master-metered buildings with submetering – Given the established savings for submetered buildings over unmetered apartment conditions, this may be a suitable incentive that can be justified and confirmed by application of standard cost-of-service methods.
- Regulatory Changes
  - Current allowable meter-reading costs are too low, at $1/meter/month, cover reasonable costs, as provided by the current marketplace; and
  - Allow time-of-use billing options for submetering which, under 20.25.01.05. Bills, Bill Forms, and Payments, only permits billing based on average per-unit costs, with all hours the same. Case studies in New York State have shown that apartment tenants can embrace time-of-use submetering, which helps both the building by reducing peak billing demand charges (where applicable) and contribution to the utility peak requirements.
- Market initiatives
  - Rebates to help defray the upfront costs of submetering implementation – Submetering adoption levels have consistently followed incentive levels in New York State;

- Technical and educational assistance for buildings considering submetering, including feasibility studies. This approach has been used in New York State since 1991.

- Financing procedures would need to be developed for rental buildings. Apartment residents in Coops and Condos are, in effect owners, and would share in the savings attributed to submetering, as reduced bills would be passed along in the submetered bills. For owners of rental properties, their investment in submetering infrastructure would need to be recouped, which would not occur if all the savings from reduced electric and gas costs were passed along to their tenants. Procedures would need to be established either by implementing a lower rent reduction (subject to lease terms) or by a shared savings method to recoup the investment over time, providing savings to the average tenant but passing along a portion of the investment costs as well as the meter-reading and billing costs.

APPENDICES

Appendix A. Maryland Regulations for Submetering and Energy Allocation Systems

Code of Maryland Regulations (Last Updated: November 28,2018)
Title 20. Public Service Commission

Sec. 20.25.01.01. General

A. Purpose of Submetering. The purpose of submetering is to encourage effective conservation and efficient use of electricity or gas by fairly allocating its cost among the ultimate users within a master metered apartment house, office building, or shopping center.

B. Availability of Submetering. An owner, operator, or manager of an apartment house, office building, or shopping center who has a master meter may install submeters in accordance with legislation enacted by the General Assembly of Maryland and with regulations adopted by the Public Service Commission of Maryland.

C. Authorization of Regulations. Public Utilities Article, §7-303, Annotated Code of Maryland, requires the Public Service Commission to make such reasonable regulations and standards as it deems necessary to carry out the provisions of this law.

D. Application of Regulations.

(1) These regulations apply to an owner, operator, or manager of an apartment house, shopping center, or office building which is not individually metered by a utility for electricity or gas for each dwelling unit, commercial rental unit, or store, and to the occupant or occupants of the units or stores.

(2) These regulations are intended to provide uniform and reasonable standards for the accuracy, billing, and regulation of submeters, and to define the respective responsibilities of the utility, the owner, and the occupant.

(3) If unreasonable hardship to a utility or owner results from the application of any regulation of this chapter, application may be made to the Commission for temporary or permanent relief.

(4) The adoption of these regulations in no way precludes the Commission from altering or amending them by subsequent proceedings.

(5) In implementing these regulations, an apartment house, office building, or shopping center is not a public service company as defined in Public Utility Companies Article, §1-101, Annotated Code of Maryland.

E. Rent Reduction. Except in units constructed, managed, operated, developed, or subsidized by a local housing authority as established under Article 44A, if the owner, operator, or manager elects to install submeters, during the term of any lease or agreement which includes the cost of electricity or gas consumed for the unit, the owner, operator, or manager shall determine the amount of electric or gas costs saved and pass this amount on to the occupant of the unit as a reduction in rent or payment.

Sec. 20.25.01.02. General Requirements

A. All Units Submetered. A unit in an apartment house, shopping center, or office building may not be submetered unless all units in that building are submetered.

B. Information in Leases. All rental contracts or leases between the owner and an occupant shall clearly state that:

(1) The apartment house, office building, or shopping center is submetered;

(2) Bills for electric or gas consumption shall be rendered based on the submeter readings;

(3) Electricity or gas for all common areas and common facilities shall be the responsibility of the owner and not of the occupant; and

(4) A copy of the regulations governing submetering in apartment houses, office buildings, and shopping centers shall be provided to every occupant by the owner at no charge to the occupant.

C. Execution of Application. The owner may reserve the right to require the occupant, before any electricity or gas is delivered, to execute an application or agreement for the purchase of electricity or gas. The occupant, by accepting the electricity, agrees to be bound by the applicable terms and conditions.

Sec. 20.25.01.03. Owners' Requirements

A. Right to Install Equipment. The owner has the right to install all necessary submetering equipment and wiring on the property occupied by the occupant in accordance with these regulations and with any other applicable national, State, or local codes or requirements.

B. Equipment Accessibility. The occupant shall provide suitable space for the installation of submetering equipment. All submeters shall be installed where they will be readily accessible for reading, testing, and inspection, and where these activities will cause minimum interference and inconvenience to the occupant.

C. Accessible to Owner. Access to submetering equipment shall be granted to the owner by the occupant.

D. Installation and Ownership. All submetering equipment shall be furnished and installed by the owner and shall be owned and maintained by the owner.

E. Responsibility for Maintenance. Maintenance, inspection, sealing, and testing of all submetering equipment shall be the responsibility of the owner.

Maryland Regulations for Energy Allocation Systems

Code of Maryland Regulations (Last Updated: November 28,2018)
Title 20. Public Service Commission
Subtitle 26. ENERGY ALLOCATION SYSTEMS
Chapter 20.26.01. General

Sec. 20.26.01.01. Applicability

A. The regulations contained in this subtitle govern the use of energy allocation systems which allocate to an occupant of an individual dwelling unit a portion of the cost of gas and electric energy consumed in an apartment house based upon devices which indirectly approximate use of gas or electric energy.
B. An energy allocation system may not be used unless approved by the Commission under this subtitle.
C. This subtitle does not apply to submeters which are governed by the provisions of COMAR 20.25.Sec.

Sec. 20.26.01.03. Filing Requirements

A. An owner shall file an application with the Commission for approval of an energy allocation system.
B. The application shall include the following information:
(1) The name and address of the owner;
(2) The name and address of the general partner, if the owner is a partnership;
(3) The name and address of the management agent, if any;
(4) The name and address of the apartment house;
(5) The number of individual dwelling units;
(6) A description of the energy allocation system, including a technical description of the energy allocation equipment;
(7) A description of the method for converting a measurement unit into approximate energy use;
(8) A description of the method for calculating the energy costs directly billed to an occupant, including the calculation of a per unit energy cost;
(9) A copy of all written information provided to an occupant including lease terms; and
(10) A copy of the proposed billing format

Sec. 20.25.01.04. Electric Submetering

A. Type of Submeter.

(1) All submeters installed in compliance with these regulations shall be of a type and class to properly and accurately register electrical consumption.

(2) The meter type and design shall meet the applicable provisions of the latest edition of the American National Standard for Electric Meters - Code for Electricity Metering, incorporated by reference in COMAR 20.50.02.02C.

(3) A submeter installed for billing purposes shall have been approved by the Commission.

B. Charges for Electricity. All charges for electricity used by an occupant shall be calculated from the readings of his or her submeter.

C. Meter Accuracy. All submeters in service shall be tested by the owner as provided by this chapter.

D. Fast Submetering. If an occupant's submeter is found to be more than 2 percent fast as a result of a test, the owner shall:

(1) Recalculate the occupant's bills for the lesser of the period of the occupant's service or the period since the submeter was last tested.

(2) Make a refund or a credit to the occupant, if the adjustment so calculated exceeds $1.

E. Slow Submeter. If a submeter is found to be more than 2 percent slow as a result of a test and the unbilled amount exceeds $5, the owner may bill the occupant 1/2 of the unbilled error for the period of the occupant's service, or since the submeter was last tested, whichever is less, but not for a period longer than 12 months.

F. Accuracy Calculation. The average accuracy shall be the weighted average of the percentage registration at light load and at heavy load, giving the light load registration a weight of 1 and the heavy load registration a weight of 4.

G. Overcharge Adjustment. If an occupant has been overcharged as a result of an incorrect submeter reading, incorrect calculation of the bill, or incorrect submeter connection, the owner shall credit or refund the amount of overcharge to the occupant.

H. Undercharge Adjustment. If an occupant has been undercharged as a result of incorrect submeter reading, incorrect calculation of the bill, incorrect submeter connection, stopped submeter or similar reasons, the amount of undercharge may be billed to the occupant.

I. Meter Test by Owner. Upon application by occupant, the owner shall test the submeter for accuracy, at a laboratory approved by the Commission or on-site with instruments approved by the Commission, with no charge to the occupant, provided that no test was made within the past 18 months.

J. Testing upon Installation and Removal of Meters.

(1) A submeter may not be placed in service until it has been tested and adjusted by the owner at a laboratory approved by the Commission or on-site with instruments approved by the Commission to within plus or minus 1 percent of 100 percent accuracy.

(2) If any submeter is removed from service or replaced by another submeter, it shall be properly tested and adjusted by the owner at a laboratory approved by the Commission before being placed in service again.

Sec. 20.25.01.04-1. Gas Submetering

A. Type of Submeter.

(1) All submeters installed in compliance with these regulations shall be of a type and class to properly and accurately register gas consumption.

(2) A submeter installed for billing purposes shall have been approved by the Commission.

B. Charges for Gas. All charges for gas used by an occupant shall be calculated from the readings of the occupant's submeter.

C. Meter Accuracy. All submeters in service shall be tested by the owner as provided by this chapter.

D. Fast Submetering. If an occupant's submeter is found to be more than 2 percent fast at check flow, the owner shall:

(1) Recalculate the occupant's bills for the lesser of the period of the occupant's service or the period since the submeter was last tested:

(2) Make a refund or a credit to the occupant, if the adjustment so calculated exceeds $1.

E. Slow Submeter. If a submeter is found to be more than 2 percent slow at check flow and the unbilled amount exceeds $5, the owner may bill the occupant 1/2 of the unbilled error for the period of the occupant's service, or since the submeter was last tested, whichever is less, not for a period longer than 12 months.

F. Overcharge Adjustment. If an occupant has been overcharged as a result of an incorrect submeter reading, incorrect calculation of the bill, or incorrect submeter connection, the owner shall credit or refund the amount of overcharge to the occupant.

G. Undercharge Adjustment. If an occupant has been undercharged as a result of an incorrect submeter reading, incorrect calculation of the bill, incorrect submeter connection, stopped submeter or similar reasons, the amount of undercharge may be billed to the occupant.

H. Meter Test by Owner. Upon application by the occupant, the owner shall test the submeter for accuracy, at a laboratory approved by the Commission, with no charge to the occupant, provided that a test was not made in the past 18 months.

I. Testing upon Installation and Removal of Meters.

(1) A submeter may not be placed in service until it has been tested and approved by the owner at a laboratory approved by the Commission to an accuracy of 98.5-100.5 percent.

(2) If a submeter is removed from service or replaced by another submeter, it shall be properly tested and adjusted by the owner at a laboratory approved by the Commission before being placed in service again.

Sec. 20.25.01.05. Bills, Bill Forms, and Payments

A. Amount Billed to Occupant. The amount billed to any occupant shall be for only the quantity consumed by the unit, as recorded on the unit's submeter. Energy used in common areas and common facilities may not be billed to any occupant.

B. Calculation of Bills.

(1) The occupants' bills shall be calculated as follows: After receipt of the bill from the utility, electric supplier, or gas supplier, the owner shall divide the total net bill by the total number of kilowatt-hours or cubic feet as shown on the bill, to determine an average unit cost. This average unit cost shall be multiplied by each occupant's kilowatt-hour or cubic feet consumption to obtain the occupant's monthly bill.

(2) The total master meter net bill on which the owner shall calculate the average unit cost shall include: (a) Customer, energy, commodity, and demand charges by the utility, electric supplier, or gas supplier; (b) State and local taxes and surcharges by the utility, electric supplier, or gas supplier; and (c) Environmental surcharge by the utility, electric supplier, or gas supplier.

(3) The total master meter net bill on which the owner shall calculate the average unit cost shall exclude: (a) Late payment charge, if any; (b) Any connection charge; (c) Any charge for a bad check; and (d) Service charges.

C. Unit of Measurement. The unit of measurement of the occupant's consumption shall be the kilowatt-hour (kWh) for electricity and cubic feet for gas.).

D. Bill Information. The occupant's bill shall show:

(1) The bill date (the date the bill was prepared);

(2) The name of the occupant and the number, or other identification, of the unit;

(3) The dates and readings of the submeter at the beginning and at the end of the billing period;

(4) The amount of kilowatt-hours for electricity or cubic feet of gas billed in the billing period;

(5) The average unit cost used to compute the bill;

(6) The amount due for electricity or gas, the service charge by the owner, if any, the balance forward, and the total amount due;

(7) The name and address of the firm rendering the occupant's bill and the name and address where payment can be made;

(8) The name, address, and telephone number of the party which may be contacted in case of a dispute; and

(9) A statement to the effect that the bill is from the owner.

E. Estimated Bills.

(1) Estimated bills may not be rendered unless the submeter has been tampered with, is out of order, or access to it cannot be obtained, and in this case the bill shall be distinctly marked "estimated".

(2) The estimate shall be based on consumption for a similar billing period when available, and if not available, on the preceding billing period.

(3) The subsequent bill based on actual submeter reading shall show the total period between actual readings and shall indicate credit for the preceding estimate.

F. Mailing or Rendering of Bills.

(1) The owner shall render electric or gas bills to the occupants not later than 14 days after the owner receives the master meter bill from the utility.

(2) The submeters shall be read by the owner within 5 working days of the date the utility reads the master meter.

(3) Bills are due and payable upon receipt by the occupant and become past due if not paid within 20 days from the date of mailing or rendering.

G. Relationships Between Meter Reading and Billing Dates.

H. Service Charge. The owner may impose a service charge not to exceed $1 per unit per month to offset the administrative costs of billing.

Other record-keeping regulations also apply.

Submetering Regulations Summary – National Conference of State Legislators

Status of submetering regulations in all States

http://www.ncsl.org/research/energy/utility-submetering.aspx

Maryland

"Submetering" means the installation of equipment to determine the actual use of gas or electricity for each residential unit in an apartment house or commercial rental unit in an office building or shopping center. An apartment house, office building, or shopping center that contains a combination of dwelling units or commercial rental units is included under the requirements of this section. With the approval of the Commission, a local housing authority established under Division II of the Housing and Community Development Article may sub-meter any combination of apartment houses, commercial rental units, dwelling units, office buildings, and shopping centers. The Commission shall adopt regulations to establish standards to allocate fairly the cost of each unit's gas or electrical consumption. An owner, operator, or manager of an apartment house, office building, or shopping center who installs submetering equipment under this section to provide bulk metered service may not impose on a unit in the facility any utility cost except the charges that the Commission authorizes and that the gas company or electric company actually imposes on the owner, operator, or manager. The charges imposed shall be allocated among the units in proportion to the actual usage of cubic feet or kilowatt hours by the unit. The owner, operator, or manager

of an apartment house, office building, or shopping center may collect an additional service charge not exceeding $1 per unit per month to cover administrative costs and billing. If the owner, operator, or manager of an apartment house, office building, or shopping center installs sub-meters during the term of a lease or agreement that includes the cost of gas or electricity consumed for the unit, the owner, operator, or manager shall determine the amount of gas or electric costs saved by that unit; and pass that amount on to the unit's occupant as a payment or reduction in rent. The owner, operator, or manager of an apartment house, office building, or shopping center may not be considered a public service company; and may use metering equipment only to allocate fairly the costs of gas or electric service among the occupants of the apartment house, office building, or shopping center (Md. Public Utilities Code §7-303).

The Commission may authorize the use of a master meter in a residential multiple occupancy building for heating, ventilation, and air conditioning services without requiring individual metering or submetering for heating, ventilation, and air conditioning services if: the utility bill for heating, ventilation, and air conditioning services for each individually leased or owned occupancy unit is included in the rent for that unit; the Commission is satisfied that the use of the master meter for heating, ventilation, and air conditioning services will result in a net savings of energy over the energy savings that would result from individual metering or submetering for heating, ventilation, and air conditioning services; and each individually leased or owned occupancy unit has individual metered service for other energy services and directly receives the utility bill for the other energy services (Md. Public Utilities Code Ann. §7-304.1).

Appendix B. Cost/Benefit Calculations

Table 9 - Cost/Benefit Assumptions and Calculations

	Apts/Bldg		All Bldgs	Large buildings							Large Bldgs w Rebates			Large Bldgs w Rebates		
Master-Metered Accounts	All Units	Large Bldgs	Savings kWh	Fixed Cost/Bldg	Meter Cost per apt	Total Cost	Meter read per mo	Total read per year	Bill Savings @ $ 0.12	payback years	per apt rebate	Total Cost w Rebate	w rebate payback	per apt rebate	Total Cost w Rebate	w rebate payback
PEPCO & DPL (PHI)	69.9	247	71,590,913	$ 1,500	$ 650	$20,458,600	$ 2.50	$ 935,520	$ 7,111,797	3.3	$ 100	$ 17,152,700	2.8	$ 200	$ 14,034,300	2.3
BGE	13.5	211	5,638,490	$ 1,500	$ 650	$ 2,214,407	$ 2.50	$ 101,096	$ 539,177	5.1	$ 100	$ 1,854,921	4.2	$ 200	$ 1,517,936	3.5
Potomac Edison	44.9	80	914,557	$ 1,500	$ 650	$ 215,105	$ 2.50	$ 9,651	$ 78,609	3.1	$ 100	$ 178,435	2.6	$ 200	$ 146,265	2.1
TOTALS	50.1	239	78,143,960	$ 1,500	$ 650	$22,888,112	$ 2.50	$ 1,046,267	$ 7,729,583	3.4	$ 100	$ 19,183,056	2.9	$ 200	$ 15,695,500	2.3

	Apts/Bldg		All Bldgs	Large buildings							Large Bldgs w Rebates			Large Bldgs w Rebates		
Master-Metered Accounts	All Units	Large Bldgs	Savings Therms	Fixed Cost/Bldg	Meter Cost per apt	Total Cost	Meter read per mo	Total read per year	Bill Savings @ $ 1.25	payback years	per apt rebate	Total Cost w Rebate	w rebate payback	per apt rebate	Total Cost w Rebate	w rebate payback
BGE	23.2	127	1,308,693	$ 1,500	$ 650	$ 3,613,473	$ 2.50	$ 163,799	$ 727,994	6.4	$ 100	$ 3,004,477	5.3	$ 200	$ 2,458,481	4.4
WGL	7.5	53	4,722,403	$ 1,500	$ 650	$ 1,518,416	$ 2.50	$ 67,173	$ 279,888	7.1	$ 100	$ 1,233,006	5.8	$ 200	$ 1,009,096	4.7
TOTALS	8.7	91	6,031,097	$ 1,500	$ 650	$ 5,131,889	$ 2.50	$ 230,972	$ 1,007,882	6.6	$ 100	$ 4,235,983	5.5	$ 200	$ 3,466,077	4.5

- Note items in red are variable. Yellow highlighted items are key results presented in Sections 6.1 and 6.2.

Table 10 - Cost/Benefit Assumptions and Calculations for Incremental Gas Submetering

	Apts/Bldg		All Bldgs	Large buildings							Large Bldgs w Rebates			Large Bldgs w Rebates		
Master-Metered Accounts	All Units	Large Bldgs	Savings Therms	Fixed Cost/Bldg	Meter Cost per apt	Total Cost	Meter read per mo	Total read per year	Bill Savings @ $ 1.25	payback years	per apt rebate	Total Cost w Rebate	w rebate payback	per apt rebate	Total Cost w Rebate	w rebate payback
BGE	23.2	127	1,308,693	$ 1,500	$ 200	$ 1,156,492	$ 0.50	$ 32,760	$ 727,994	1.7	$ 50	$ 820,494	1.2	$ 100	$ 547,496	0.8
WGL	7.5	53	4,722,403	$ 1,500	$ 200	$ 510,820	$ 0.50	$ 13,435	$ 279,888	1.9	$ 50	$ 337,365	1.3	$ 100	$ 225,410	0.8
TOTALS	8.7	91	6,031,097	$ 1,500	$ 200	$ 1,667,312	$ 0.50	$ 46,194	$ 1,007,882	1.7	$ 50	$ 1,156,359	1.2	$ 100	$ 771,406	0.8

- Note items in red are variable. Yellow highlighted items are key results presented in Sections 6.1 and 6.2.
- For incremental gas submetering in buildings already installing electric submetering, shared data communications systems will reduce the installation costs (from $650 to $200 per apartment), and meter reading costs (from $2.50 to $0.50/month/meter)
- Rebate options were reduced in half ($50 and $100 per apartment vs. $100 and $200 per apartment) for stand-alone gas submetering

Appendix C. Utility Data Collection

Data Fields provided to DNV GL by utilities for use in MD PSC HB 1491 Project

	Key information highlighted		
WGL	**BGE**	**PEPCo/Delmarva**	**Potomac Edison**
Billing Class	Customer_Name	***First Transmittal (List only)***	PREM_NUM
With Submeters (Y/N)	ADDRESS	Expr1 (PEPCo or Delmarva)	ACCT_NUM
Arrears 61-90 days	CITY	Address	CUSTOMER_NAME
Over 90 Days In Arrears	POSTAL	City	PREM_TYPE_CD (House, Apt, Condo)
Period Start	Class1 (Res or Comm)	State	ACCOUNT_CLASS (Res, NonRes)
Period End	Past due Balance	Zip	SER_NUM
Annual Therm Usage	Source (Gas or Elec)		REGISTER_GROUP
Installation			CONSTRUCTION_CLASS_DESC
Region	*Monthly Consumption:*		Voltage Level
Rate Category (Heat/Non-Heat, Master	Oct'17		Description
Installation Premise	Nov		RATE_CD
Contract Installation	Dec'17		SERV_ADDR4
Contract Account Number	Jan'18		SERV_ADDR5
Move In Date	Feb		MOVE_IN_DATE
Move Out Date	Mar		Annual KWH Usage
Connecion Object	Apr	***Second Transmittal (Billing)***	
Premise	May	Business Partner	
Business Partner Number	Jun	Contract Account	
Functional Location	Jul	0 - 30 Days	
Customer Number	Aug	31 - 60 Days	
Customer Name	Sep'18	61 - 90 Days	
FIRST NAME	Notes	91 - 120 Days	
LAST NAME	Annual	121 - 150 Days	
ADRC Address Number		151+ Days	
House Number 1		Balance	
Street		Aged Ar 31 days >	
		Arrearages greater than 60	
House NUmber Supplement		days yes no (false = no)	
City		2018 Usage (kwh)	
Region			
Postal Code			
BUT000 Address Number			
ALIAS Address Number			
Telephone			
Email			

Notes
Dunning code used to help identify master-metered accounts and 11 submetered accounts were identified.

Notes
Energy Efficiency Program tracking Databases used to identify Master-metered accounts; Second transmittal cross-referenced billing records for usage and arrears

Notes
Separate file identifying 2 accounts in arrears

ABOUT DNV GL ENERGY INSIGHTS

Driven by our purpose of safeguarding life, property and the environment, DNV GL Energy Insights enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16,000 professionals are dedicated to helping our customers make the world safer, smarter and greener.