

DEPARTMENT OF THE AIR FORCE
REGIONAL CIVIL ENGINEER, WESTERN REGION (AFESC)
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ROES (Fraser, 556-8990)

Engineering Technical Letter WR (ETL 84-7), MCP Energy Conservation
Investment
Program (ECIP)

SPDED-PM NPDEN-TE WESTNAVPACEGCOM (Code 09A2A.26)

1. PURPOSE: The attached Engineering Technical Letter (ETL) revises
criteria
previously provided in ETL 82-4, dated 10 Nov 82.

2. IMPLEMENTATION: The guidance in this ETL is mandatory and applies
to ECIP
projects in the FY87 MCP and beyond and all previous fiscal year
projects that
have not reached 30% design by 30 July 84.

W., EDWARD FISCHER
Deputy Regional Civil Engineer

1 Atch
AFTEEL 84-7 dated 13 June 1984.

DEPARTMENT OF THE AIR FORCE
Headquarters United States Air Force
Washington, D.C. 20332

LEEEU

Engineering Technical Letter (ETL) 84-7: MCP Energy Conservation
Investment
Program (ECIP)

ALMAJCOM/DEE/DEM	AFRCE-WR	AFRCE-ER	AFRCE-CR
AFRCE-BMS	AFRCE-SAC	SARPMA/DEE	HQ AFCC/DEO
AFIT/DET/DEM	HQ USAFE/DER		

1. Purpose: This letter

- a. Pertains to Military Construction Program (MCP) ECIP projects.
- b. Supersedes ETL 82-4, dated 10 Nov 82.
- c. Implements the requirements of the National Policy Act, 92 Stat. 3275 as amended by Section 405 of the Energy Security Act, 94 Stat. 611.
- d. does not pertain to non-appropriated funded (NAF) facilities whose utilities are funded by NAF.
- e. Establishes a procedure that must be followed by the MAJCOM and AFRCE for designing projects.
- d. Does not pertain to non-appropriated funded (NAF) facilities whose utilities are funded by NAF.
- e. Establishes a procedure that must be followed and data that must be furnished by the designer.
- g. Establishes a requirement to input data into the new Program, Design, and Construction (PDC) System.
- h. Is effective for projects in the FY 87 program or earlier which have not reached the 30% design stage as of the date of this letter.
- i. Does not include requirements for design and construction of Energy Management Control Systems (EMCS). Reference ETL: EMCS.

2. Requirements

- a. General.
 - 1) Each discrete portion (each building and/or retrofit type) of each project must be life cycle cost effective or essential to the accomplishment

of the energy conserving portion of the project.

2) NAF type facilities whose utilities are paid with NAF funds will not be included in the MCP ECIP program. Otherwise, they will be designed IAW this ETL.

3) Projects with discounted paybacks greater than 10 years for permanent or semi permanent facilities or 5 years for temporary facilities as described in AFM 98-15, will not be included in the design program or will be considered for cancellation.

4) Projects or discrete portions of projects with Savings to Investment Ratios (SIR) less than one will not be included in the design program or will be considered for cancellation.

b. Energy Analyses.

1) General. Designs of alterations to existing buildings which will change the envelope of the building significantly (more or less insulation, window area, doors, shading, etc) or which will replace or alter significantly mechanical and lighting systems will include computer energy analyses.

2) Types of computer analyses - By the MAJCOM

a) Programs such as BLAST, TRACE, or similar, which perform transient thermal analyses will be used under the following conditions:

1. Buildings which are heated and mechanically cooled, or mechanically cooled only, and have an 8,000 SF minimum gross area, or

2. Buildings which are heated only and have an estimated minimum 20,000 SF gross area.

b) Where the project scope is less than paragraph

2) a) Above, the energy analyses or calculations can be based on mini or micro computer programs which take into account the constant changing temperatures, sun loads, occupancy, etc..... through a year's operation.

3) By the designer - Reference Para 3c.

c. Life Cycle Economic Analyses

1) life cycle economic analyses will follow the methodology described in the latest revision of the National Bureau of Standards (NBS) Handbook 135, "Life Cycle Cost Manual for the Federal Energy Management Program. Reference attachment one for a summary of the procedure.

2) All economic analyses shall be based on an economic life of
25
years or the expected life of the facility or the retrofit, whichever is
less. Reference Table D for acceptable economic lives.

- 3) A 7% discount factor will be used for present worth discounting.
- 4) Actual costs for energy consumed at the facility will be used.
- 5) Use only the latest Air Force approved, DOE regional energy cost escalation (industrial) rates for projecting future energy costs and for developing appropriate present worth values of future energy savings. The industrial rates of NBS Handbook 135 dated May 1982 will be used until amended by a revised Air Force ETL or other HQ USAF/LEEE correspondence.
- 6) Two SIRs (SIR1 and SIR2) will be provided. These are:
 - a) SIR1: 75% of the discounted savings shall consist of energy (BTU) savings. The other 25% can be attributed to savings other than from direct energy (BTU) savings. If SIR1 is less than 1.0, the project will not be designed or will be considered for cancellation. SIR 1 corresponds to "SIT" in HQ AFESC/DEB's LCCA.
 - b) SIR2: The discounted savings will include all savings including energy, maintenance and/or any other cost avoidance savings. This value will be reported to the Congress. SIR 2 corresponds to "SIR" in HQ AFESC/DEB's LCCA.
- 7) The Energy to Cost Ratio (E/C) will be provided. However, this ratio will not be used to determine whether or not a project will stay in the program. E/C is MBTUs of energy saved yearly per thousand dollars of current working estimate investment.
- 8) The discounted payback will be derived from the simple payback using the nomogram in NBS Handbook 135, appendix F. This is provided for your information on atch 6.

3. Implementation

a. MAJCOM Responsibilities

- 1) Copies of DD Form 1391s will be provided to HQ USAF/LEEP/LEEE/LEEC, the appropriate AFRCE and HQ AFESC/DEB.
- 2) If a project costs \$200K (includes the sum of all subline items at one base) or less initially, it will not be included in the MCP, but accomplished with O&M funds.

3) An abbreviated PB will be submitted for each project to HQ USAF/LEEC/LEEE, the appropriate AFRCE and HQ AFESC/DEB. The abbreviated PB consists of the following:

- a) Project Bookcover

b) Tab A - Project Description. It is essential that each facility be identified by name. A statement will be included which reads, "The utilities of these facilities are not funded form NAF". Also include a summary of the life cycle cost analyses.

c) Tab J - Project Cost Estimate Worksheet.

d) It should define the work definition and cost to permit rapid accomplishment of a complete PB if required. The AFRCE will determine if a complete PB is required to define the project. All coordination are expected in the PB or abbreviated PB.

4) The energy analyses to validate the ECIP project for inclusion in the MCP program will be performed by the MAJCOM and provided to the design AE firm for his information and validation.

5) The following must be verified by the MAJCOM prior to the pre-design conference:

a) Project work is not based on out dated surveys. Buildings could be scheduled for demolition, or building functions may have changed by the time the ECIP project is ready for construction.

b) Project work has not been accomplished or is being accomplished via O&M or in - house efforts.

c) The cost estimate should include a cost for the degree of difficulty the contractor will experience in performing the work around existing equipment and utilities. The cost estimate should also include a cost for contract delays due to the temporary relocation of existing functions, where applicable.

d) Associated O&M repair work must be performed before the MCP ECIP contractor arrives on site or the work combined into an O&M/MCP project.

e) When applicable the cost estimate should also include a cost for retrofitting secured areas. The contractor may experience delays in gaining access to these areas.

f) Sprinkler heads or fire detector locations should be identified. Additional insulation in the ceiling could cau se them to be ineffective if they are not relocated.

6) Reference attachments 7 and 8. The MAJCOM is responsible for

updating the Program Design and Construction (PDC) screen ECISUPDC
"Design
Start Information" for each project prior to design start.

7) The MAJCOM is responsible for validating selected ECIP projects for energy savings through some form of measurements. The results are to be reported to HQ AFESC/DEB one year after BOD.

b. Design Manager Responsibilities.

1) LEEC and LEEE must be notified if a project is not cost effective. If the project has not been submitted to the Congress, it will be cancelled. If the project has been submitted to the Congress and funds have not expired, the MAJCOM will be allowed to submit another ECIP project from the same base with the same type of work (insulation, lighting, HVAC alteration, etc..) and PA.

2) If a project current working estimate (CWE) falls below \$200K and the project has not been submitted to Congress, it will be deleted from the MCP ECIP program for accomplishment under O&M. However, if the project has been submitted to/approved by Congress, the project will stay in the MCP program, if cost effective.

3) The Design Manager will update PDC screen ECIDUPDC, (35% Design Information). Reference attachments 7 and 9. This information is vital because it will be included in the congressional submittal.

4) The decision whether or not to cancel a project based on payback will be based on the discounted payback, not on simple payback.

5) conflicts. The A-E analysis will prevail if there is a conflict with any other analysis. However, if a project is to be cancelled because of the A-E analysis, the AFRCE must provide details of the analysis to the MAJCOM of their review and comments.

6) The MAJCOM will be allowed to substitute the same type of work on a project only after the project has been proven not cost effective and only if Congress has approved the project. Otherwise the project will be cancelled.

c. Designer Responsibilities

1) In addition to site investigations the designer is responsible for an energy analysis using BIN, Modified BIN (reference ASHRAE Book of Fundamentals), or any other similar method which takes into account the constant changing temperatures, sunloads, occupancy, etc. through a

year's operation. Minin or micro computer calculations will be acceptable. An analysis similar to BLAST, TRACE, etc is not required.

2) The designer will use the results of his energy analysis in the life cycle cost study per the required economic analysis method of Para 2c.

3) At the 30% design stage, the designer will provide the SIR1, SIR2, Discounted Payback, Simple Payback, E/C Ratio, and Annual Dollar Savings.

d. Construction Manager Responsibilities.

At time of award, the construction manager will provide updated information to PDC screen ECICUPDC "Time of Award Information". Reference attachments 7 and 10. This information is vital because it will be used by HQ AFESC/DEB in its annual report submittal to OSD.

FOR THE CHIEF OF STAFF

G. HAMMOND MYERS, III
Chief, Utilities Branch
Engineering Construction Division
Directorate of Engineering & Services

NOTE: ATCH 1 thru 10 ARE AVAILABLE FROM
YOUR ASSIGNED PROJECT MANAGER
SHOULD YOU DESIRE THEM.

Summary
FACTORS
FACTORS

- 10 Atch
- 1. LCC Analysis
- 2. TABLE A: UPW
- 3. TABLE B: SPW
- 4. TABLE C
- 5. TABLE D
- 6. nomogram
- 7. PDC Control File
- 8. ECISUPDC Screen
- 9. ECIDUPDC Screen
- 10. ECICUPDC Screen

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Engineering Technical Letter (ETL) 87-4: Energy Budget Figures (EBFs) for Facilities in the Military Construction Program.

ALMAJCOM/DEE/DEP	AFRCE-WR	AFRCE-CR	AFRCE-ER
AFRCE-BMS	AAFRCE-SAC	AFIT/DET/DEM	HQ
AFCC/DEM			
NAVFAC Code 04/05	1100 ABG/DE	DAEN-ECE-S	HQ
AFESC/DEM			

1. Purpose: This ETL:

* a. Supersedes ETL 86-1 dated 03 Feb 86 and identifies the changes

with an
asterisk*.

* b. Extends the requirements of Executive Order 12003 beyond 1985 per OSD Memorandum, "FY 1986-1995 Department of Defense Energy Program Management Goals," 12 Dec 1985, and establishes an Air Force requirement to design and build new facilities which consume 10 percent or less energy than similar buildings designed in 1985.

* c. Complies with Congressional directives to conserve "fossil-fuel-derived energy" in new facilities and major renovations of existing facilities (Military Construction Codification Act-Public Law 97-214; 96 State 172).

* d. Explains EBFs and their usage in energy analyses. Basically, EBFs are quantities of energy consumed in BTU per sq ft of building space for heating, cooling, ventilation, lighting, and heating of domestic hot water (DHW). Different category type buildings consume varying amounts of energy over eleven weather zones. The Air Force EBFs that are provided in this ETL represent an energy consumption of 55 percent less than for similar facilities designed in 1975. All Air Force buildings must be designed within the required Air Force EBFs.

* e. Establishes reporting requirements for the Design Manager and MAJCOM in the Programming, Design, and Construction (PDC) system.

* f. Provides a revised EBF table which includes EBFs for bases in extreme Heating Degree Days (HDD) or Cooling Degree Days (CDD) regions, and a listing of the Air Force bases in each weather region. Reference Atch 1.

* g. Establishes criteria for new facilities and additions or alterations to existing facilities.

2. Effective Date: Is effective starting with those projects which have not reached the 10 percent design concept stage as of the date of this letter.

*3. Referenced Publications: This ETL is authorized in accordance with AFR 8-7, Air Force Engineering Technical Letters (ETL) dated 9 January 1986, which is directive in nature and requires compliance with ETL's.

4. Description/Implementation: Definitions: Following definitions explain the terms used in this ETL:

a. Energy Budget Figure (EBF): the energy (BTU) that is consumed within the five foot line of a building-per SF per year over a 24-hour/day, 365-day/year period and specified operating hours. Thinks energy consists of space heating, space cooling, domestic hot water heating, ventilation and lighting loads, excluding process loads.

* b. Process Loads: All non-real property installed equipment or user equipment loads (typewriters, copier, merchandise display cases, computer systems, industrial equipment, training systems, etc.) and their cooling requirements. Hot water heating requirements for gymnasiums, cafeterias and commissaries will be considered process loads. Specialized ventilation systems, such as chemical exhaust hoods or those required by OSHA/AFOSH standards, will not be included in the calculation of the EBF. People are not considered process loads. Therefore their contribution to the EBF will be included in the energy calculations and will be based on expected or actual operating times (Atch 2). They will be combined with the other EBF elements which are calculated at the expected or actual operating times to provide the Total EBF (TEBF).

c. Total Design EBF (TDEBF): This is the sum of EBFs for heating, cooling, ventilation, domestic hot water (DHW), and lighting, which the A-E must calculate as part of his design. The PDC will automatically sum these figures after the A-E will make his EBF computations based on the specified operating hours in the attached table (Atch 1) and over a period of one year.

* d. Total (TEBF): This EBF is similar to the design EBF except it

is
based on expected or actual operating hours over a one year period. It
not
only includes the sum of five energy consumption components, heating,
cooling,
lighting, ventilation and domestic hot water, but also the process load
EBF.
This figure will be input by the design manager into the PDC screen
ZPENRTC.

* e. Air Force EBF (AFEBF): This is the target EBF given in the attached table and represents the maximum allowable energy consumption in BTU/SF/YR over a 24-hr/day, 365-day/yr period with the operating hours specified in the table. The AFEBFs are derived from the DOD EBFs. Reference Atch 1.

* f. Energy Budget Figure (EBF) Screen: PDC screen ZPENRIJC will be used by the Air Staff to provide the required AFEBFs and their corresponding operating times; by the Design Manager to provide the A-E calculated EBFs, their operating times, and any comments about these calculations; and by the host MAJCOM to provide the metered EBFs and actual operating times. Reference Atch 2.

g. DOD EBF: This is the EBF developed by DOE in the mid-70s and adjusted by the Air Force to represent a 10 percent reduction in BTU/SF/YR for all new facilities compared to similar ones designed in 1985. It is based on specific operating hours per day and days per week. The AFEBFs are derived from these figures.

h. Heating EBF: This is the A-E calculated EBF for heating the building environment and is based on the required operating time shown in the attached table. It's PDC name is ESBFHEAT. It includes the energy of the ventilation system when "heating" is on.

i. Cooling EBF: This is the A-E calculated EBF for cooling the building environment and is based on the required operating time shown in the attached table. It's PDC name is ESFBCOOL. It includes the energy of the ventilation system when "cooling" is on.

j. Ventilation EBF: This is the A-E calculated EBF for ventilating the building environment and is based on the required operating time shown in the attached table (Atch 1). It's PDC name is ESBFVENT. This figure is the fan energy for circulating air during the economizer cycle and conditioned air when the heating or cooling system is not on.

k. Lighting EBF: This the A-E calculated EBF for lighting the building and is based on the required operating time shown in the attached table (Atch 1). It's PDC name is ESBFLGHT.

1. Domestic Hot Water (DHW) EBF: This is the A-E calculated EBF for heating domestic hot water and is based on the operating hours in the attached table. This EBF does not include water used for process loads. It's PDC name is ESBFLGHT.

* m. Process load EBF: This is the A-E calculated EBF for process loads and is based on the actual or anticipated hours/day and days per week. It's PDC name is ESBFPRS.

* n. Operating hours: These are the hours of operation of the building when it will be opened for business. The PDC name is ESBFHRS when input by the DM and ESBFMHRS when input by the host MAJCOM. These are the actual or anticipated hours of operation. AF/LEEEU inputs ESBFDDW as the operating days related to the DOD required EBFs. These are the operating hours provided by DOD to calculate the Total Design EBFs.

* o. Operating dyas: These are the days of operation per week of the building, when it is open for business. The PDC name is ESBFDAY when input by the DM and ESBFMDAY when input by the host MAJCOM. These are the actual or anticipated days per week of operation. The PDC name is ESBFDDW when input by LEEUU and this is the DOD specified days of preration.

p. Metered EBF: This is the KBTU/SF/YR calculated from actual meter readings and it includes process loads.

5. Applications: This ETL applies to:

a. All new facilities whose process loads do not exceed 60 percent of the total energy consumed within the facility. All others will require optimizing of the envelope of the building (insulation, windows, etc.) for energy efficiency.

b. Additions to existing facilities where the addition is equal to or greater than the size of the existing facility or have a minimum 8000 SF.

c. Alterations to existing facilities where:

(1) The project will change significantly the envelope (exterior wall, and/or roof) of the building by more or less insulation, window area, coors, shading, etc., and/or

(2) The mechanical system will be replaced or altered to consume 15 percent more or less energy.

d. All owned facilities at Air Force installations and activities, and Air Force operated industrial plants and projects accomplished by either appropriated or non-appropriated funds, where part or all of the equipment maintenance and operating costs are funded from appropriated funds.

6. Requirements: This ETL requires the following:

a. Energy analyses which:

(1) Will be over a period of 365 days per year with the operating hours furnished in the attached table (Atch 1).

(2) Will be based on analyses per ETL 84-2: Computer Analyses, dated 27 March 1984,

(3) Will be performed including, as a minimum, all applicable least life cycle cost energy efficient alternatives in the building envelope and the HVAC system of the facility. Reference ETLs: Energy Efficient Equipment, Normal Passive Solar Applications, and Control Systems for HVAC.

(4) May have to provide a composite design EBF, such as for a multifunction, multi-story facility (hospital for example) which has different departments, each of which may have different operating hours per day and days per week and/or AFEBFs.

(5) Will be based on the expected number of personnel in the building.

(6) May have to be done separate from the energy analysis⁸s which sizes the HVAC equipment and which is based on actual operating hours and includes process loads.

(7) Will adjust the TDEBF components for space heating, cooling, etc. If energy will be recovered from process loads to heat or cool the building environment or to heat DHW.

(8) Will be performed using the following guidelines.

(a) AF EBFs apply only to building loads and to energy consumed within the five-foot line of a building, except for the following cases:

1. Where facilities as noted in a(1) above, serve two to four buildings, the energy requirements shall be prorated among the buildings. Where such facilities serve five or more buildings, these facilities shall be considered in the category of central plants.

2. Where facilities as noted in a(1) above, serve two to four buildings, the energy requirements shall be prorated among the buildings. Where such facilities serve five or more buildings, these facilities shall be considered in the category of central plants.

(b) Losses from steam, chilled water, high temp water or hot water distribution lines beyond the five-foot line are not chargeable to the building energy consumption except as provided in a(2) above.

(c) Exterior lighting beyond the five-foot line is not chargeable to the building energy consumption.

(d) EBFs relate to building gross area (SF). Gross area is the sum of all floor areas of a building including basements, cellars, mezzanines,

other intermediate floor tiers and penthouses. All measurements shall be from the exterior wall of the building or from the center line of party walls.

(e) For the purposes of calculating energy budget figures the following conversion factors will be used:

Electricity	3,413 BTU per kilowatt hour
Fuel Oil	138,700 BTU per gallon
Natural Gas	1,031,000 BTU per 1000 cu ft
Liquified Petroleum (Including Propane & Butane)	95,500 BTU per gallon
Anthracite Coal	28,300,000 BTU per short ton
Bituminous Coal	24,580,000 BTU per short ton
Purchase Steam or steam from central plant	1,000 BTU per pound
High Temperature or Medium Temperature Water from central plant	Use the heat value based on the water actually delivered at the building five-foot line.

(f) At specific installations where the energy source BTU content varies significantly from the value presented in paragraph e above, then the local value may be used provided:

1. There is adequate data on permanent file covering a period of at least two years to support the different value, and
2. There is a fully documented basis to expect that different value to remain in effect for the foreseeable future with the documentation to remain in a permanent file.

(g) Energy in the form of steam, high temp water, medium temp water or chilled water which is supplied from a central plant, should be measured at the building boundary with proper credit given to the energy in the condensate return or water return. distribution line losses beyond the building five-foot line shall not be charged against the building consumption.

(h) Identify solar, geothermal, wind or other renewable energy source for any building and provide data as the KBTU per SF per year which can be expected from such sources. If a building has two or more such sources, identify the KBTU per SF per year for each source.

(i) Hot water requirements will be considered as process loads in gymnasiums, commissaries, and dining facilities. Therefore, they are not included in the AF's EBF requirements.

(j) Determination of the climatic region for each installation shall be obtained from AFM 88-29, "Engineering Weather Data" dated July

1,
1978. In cases where the manual does not provide the necessary
information,
local air weather service data can be used.

b. Architect-Engineer Requirements. The following information is required from the A-E:

* (1) The space heating, cooling, ventilation, lighting, and DHW EBFs based on the operating hours of Atch 1, plus the TEBF with process loads based on the actual or expected operating hours per day and days per week.

(2) Comments on the ease or difficulty of meeting the AFEBFs, if the TDEBF varies from the AFEBF by 10 to 14.9 percent (+ or -).

(3) A detailed summary (Atch 3) of the heat gain/loss analyses at the 30 percent design stage if the TDEBF exceeds the AFEBF by 15 percent or more.

(4) A revised TDEBF and a detailed summary (Atch 3) at the 60 percent design stage showing where and how he decreased the original TDEBF-if it was 15 percent or greater than the AFEBF at the 30 percent design stage.

(5) EBFs that are calculated after all optimized, cost effective and practicable energy efficient applications, or techniques are included in the envelope of the building and building non-process loads. The A-E will be expected to design a facility to an optimum EBF, and not consider the AFEBF as a convenient stopping point for determining the building energy efficiency. It is anticipated that the calculated design EBFs will be less and in some cases much less than the AFEBFs, depending on the incorporation of solar (active and/or passive), other forms of renewable energy, and/or other energy efficient applications.

c. Design Manager (DM). The DM will provide the following information:

(1) Update the following elements in PDC screen ZPENRJC (Atch 2):
ESBFHEAT, ESBFCOOL, ESBFVENT, ESBFLGHT, ESBFDHW, ESBFPRS, ESBFHRS,
ESBFDAY,
AND ESBFCOML1.

(2) Comments to the Design Agent about the detailed summary (Atch 3) provided by the A-E to help reduce the TDEBF. The results of the analysis will be input in ESBFCOM1, at the 30 percent or 60; stage, whichever is more current. Use the charts of Atch 4 for estimating the distribution of EBF among the five EBF components for the particular type facility being reviewed. Remember that these carts are just estimates and are to be

used

only if the A-E exceeds the AFEBF by 15 percent or more.

d. Host MAJCOM. The MAJCOM will be responsible for the following information:

(1) Input of actual meter reading EBFs and actual operating times in PDC Screen ZPENRJC (ESBFMES, ESBFMHRS, and ESBMDAY). This information is of special interest to the Congress who wants to know how good the A-E calculations are.

(2) Comments to the Design Manager about the detailed summary (Atch 3) provided by the A-E to help reduce the TDEBF. Use the charts of ATch 4 to help estimate the EBF distribution among the five EBF components for the particular type facility being reviewed.

e. Air Staff. AF/LEEEU will be responsible for updating the elements DODEBF (AFEBF) and the required operating times in PDC and for making an annual report to DOD on the results of the A-E EBF analyses.

FOR THE CHIEF OF STAFF

Atch

1. EBF Table
2. EBF PDC Screen
3. Detailed Summary
4. EBF Distribution Charts

NOTE: ATCH 1 THRU 4 CAN BE OBTAINED THRU YOUR ASSIGNED PROJECT MANAGER.