

**Fiscal Note for
2020 State Electrical Code**

Agency: NC Building Code Council

Statute: G.S. 143-136; 143-138

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Impact:	Federal Government:	No
	State Government:	No
	Local Government:	No (minimal)
	Small Businesses:	No (minimal)
	Substantial Impact:	Yes
	Dwelling \$80.00 Increase	Yes

Purpose:

The 2020 edition of National Fire Protection Association (NFPA) 70, *National Electrical Code* (NEC) is a model code that regulates minimum electrical construction requirements for new buildings and installations. The *North Carolina State Electrical Code* is based on the NEC with North Carolina administrative and technical amendments. The State Electrical Code addresses minimum construction requirements for all aspects of electrical installations in both commercial and residential buildings.

The NC Building Code Council (BCC) plans to adopt the 2020 NEC as the new State Electrical Code with some changes in the form of State amendments. The proposed NC amendments to the 2020 NEC that the BCC plans to adopt are listed in Appendix A. The 2020 State Electrical Code major changes are identified in Appendix B. The 2020 NEC changes that may have an economic impact are presented in Appendix C. Appendix D includes a list of the members of the 2020 State Electrical Code Ad Hoc Committee who voted on the amendments to the 2020 NEC.

The purpose of the State Electrical Code is the practical safeguarding of persons and property from hazards arising from the use of electricity. The State Electrical Code is intended for use by code officials, contractors, and designers. The State Electrical Code is not intended as a design specification or an instruction manual for untrained persons. The State Electrical Code is organized by major content into nine chapters: General, Wiring and Protection, Wiring Methods and Materials, Equipment for General Use, Special Occupancies, Special Equipment, Special Conditions, Communications Systems, and Tables.

For example, before one constructs a building, the designer and contractor must determine the minimum electrical requirements for the building. Depending on whether the project includes

AC current or DC current; low-voltage or high-voltage equipment; residential use or commercial use; hazardous locations; the State Electrical Code sets forth minimum requirements for safe electrical power distribution.

Impact:

Federal Government: The US General Services Administration has adopted the technical requirements of the latest edition of the nationally recognized codes, including the current accumulative supplements, in effect at the time of design contract award. The 2020 NEC is the latest edition for electrical installations. Therefore, the 2020 State Electrical Code adoption would have no additional impact on federal buildings.

State Government: The North Carolina Legislature has ruled that all facilities constructed or renovated for the State, 20,000 GSF in area or larger, shall be designed based on life-cycle cost. The goal of this legislation is to ensure that designers maximize the long-term benefits to the State, within the confines of a specific capital appropriation, since it is obvious that the cost imposed on the State over the life of a building far exceeds the initial construction investment. The 2020 State Electrical Code adoption will have negligible impact.

Local Government: The impact to local government is based on the purchase of the 2020 NEC for code enforcement and is considered minimal. The major proposed changes noted below under “Business” are not likely to affect local government.

Business:

The proposed changes would have an impact (some costs and some savings) on developers. Developers may pass the additional cost on to their customers or the end property user. The increased safety and efficiency will be of benefit to the end-user of the building.

Below are descriptions and benefits of the major proposed changes to the code that would result in an impact:

- Revision to expand Ground-Fault Circuit-Interrupter (GFCI) protection to more receptacles and outdoor equipment. Expected to affect an unknown amount of receptacles and outdoor equipment.
- Revision to require surge protection on service equipment. Surge protection has an upfront cost to protect from expenditures associated with lightning damage in the future. Expected to affect only services where the utility does not provide protection.

There are additional changes noted in Appendix C that indicate minimal change in cost, and whether it is a decrease, increase. The discussion below, by code article, addresses the major proposed changes to the code that would result in an impact.

Impact Analysis:

The Committee initially reviewed and identified the changes in Appendix B that were either an increase to or a relief from the 2017 State Electrical Code requirements. Upon further review, the sections below were determined to have quantifiable costs and savings. The remaining changes identified in Appendix C were deemed minimal without measurable cost or savings.

The Committee members listed in Appendix D were appointed as industry experts and tasked with reviewing for technical and cost changes. Certain changes in the Code will both increase and decrease the cost of installation in various circumstances. There were no individual changes that the Committee believes will cause a substantial economic impact. There are changes that as a collective will cause a substantial economic impact in excess of \$1M per year. There was one section that the Committee believes may increase the cost of residential construction by more than \$80.00 in certain scenarios. All Electrical Code changes are individually considered by the Committee to be economically minimal.

210.8(A)(7) 125/250v Ranges within 6 ft from Sinks (GFCI Protection for Personnel)

- 2020 NEC Change: The new Code section requires that in dwellings where a 125/250v range receptacle is installed within 6 ft of a sink, the receptacle must be provided with GFCI protection. The current 2017 State Electrical Code does not require a range receptacle is installed within 6 ft of a sink, to be provided with GFCI protection. Expected to affect approximately %75 of range receptacles installed in residential kitchens.
- 2017 NEC Requirement: Current typical installation practices suggest that to achieve Code compliance under the proposed 2020 State Electrical Code where section 210.8(A)(7) is applicable to 125/250v range receptacles is for a GFCI-type breaker to be installed in lieu of a standard-type breaker that protects the branch-circuit and receptacle of the range.
- Analysis: Because the typical range breaker is a 50-amp Standard 2-Pole Breaker, the following analysis was performed:
50-amp Standard 2-Pole Breaker – Average Cost – \$10.37
50-amp GFCI 2-Pole Breaker – Average Cost – \$94.55
Increase of \$84.18
- Justification of Analysis: Performed using Home Depot - North Durham <https://www.homedepot.com/> and an average cost from Eaton, GE, Siemens, and Square D Homeline manufacturer's online prices. The Committee stresses that this increase will not apply to all dwelling units, only those where the design requires the range receptacle (not range itself) be located within 6 ft of any sink.
- Proposed State Electrical Code Change: Adopt the 2020 NEC language.
- Necessity: This requirement is to address all receptacles that are in a dwelling's kitchen area that are near a water source and may create a shock hazard to personnel.
- Estimated Impact: This will affect an unknown number of dwelling kitchen installations per year. Only designs that require the range receptacle be located within 6 ft of the kitchen sink will anticipated an average cost increase of \$84.18 per installation.

210.8(A)(10) 125/250v Clothes Dryers (GFCI Protection for Personnel)

- 2020 NEC Change: The new Code section requires that in dwellings where a 125/250v clothes dryer receptacle is installed, the receptacle must be provided with GFCI

protection. The current 2017 State Electrical Code does not require a clothes dryer receptacle to be provided with GFCI protection. Expected to affect approximately %90 of dwellings when adjusting for 125v and gas-type clothes dryers.

- 2017 NEC Requirement: Current typical installation practices suggest that to achieve Code compliance under the proposed 2020 State Electrical Code where section 210.8(A)(10) is applicable to 125/250v clothes dryer receptacles is for a GFCI-type breaker to be installed in lieu of a standard-type breaker that protects the branch-circuit and receptacle of the clothes dryer.
- Analysis: Because the typical clothes dryer breaker is a 30-amp Standard 2-Pole Breaker, the following analysis was performed:
30-amp Standard 2-Pole Breaker – Average Cost – \$10.01
30-amp GFCI 2-Pole Breaker – Average Cost – \$87.70
Increase of \$75.69
- Justification of Analysis: Performed using Home Depot - North Durham <https://www.homedepot.com/> and an average cost from Eaton, GE, Siemens, and Square D Homeline manufacturer's online prices.
- Proposed State Electrical Code Change: Adopt the 2020 NEC language.
- Necessity: This requirement is to address all receptacles that are in a dwelling's laundry area that are near a water source and may create a shock hazard to personnel.
- Estimated Impact: This will affect an unknown number of dwelling laundry area installations per year. Only designs that require a 125/250v clothes dryer receptacle will anticipate an average cost increase of \$75.69 per installation.

210.8(D) Dishwasher (GFCI Protection for Personnel)

- 2020 NEC Change: The new Code section requires that in dwellings where a dishwasher is installed, the dishwasher must be provided with GFCI protection. The current 2017 State Electrical Code does not require a dishwasher to be provided with GFCI protection. Expected to affect approximately %95 dwellings constructed without dishwashers installed.
- 2017 NEC Requirement: Current typical installation practices suggest that to achieve Code compliance under the proposed 2020 State Electrical Code where section 210.8(D) is applicable to dishwashers is for a GFCI-type breaker to be installed in lieu of a standard-type breaker that protects the branch-circuit and dishwasher.
- Analysis: Because the typical dishwasher breaker is a 20-amp Standard 1-Pole Breaker, the following analysis was performed:
20-amp Standard 1-Pole Breaker – Average Cost – \$4.38
20-amp AFCI/GFCI 1-Pole Breaker – Average Cost – \$47.48
Increase of \$43.10
- Justification of Analysis: Performed using Home Depot - North Durham <https://www.homedepot.com/> and an average cost from Eaton, GE, Siemens, and Square D Homeline manufacturer's online prices.

- Proposed State Electrical Code Change: Adopt the 2020 NEC language.
- Necessity: This requirement is to address dishwashers that are in a dwelling's kitchen area that are near a water source and may create a shock hazard to personnel.
- Estimated Impact: This will affect an unknown number of dishwasher installations per year. Only designs that require a dishwasher installation will anticipate an average cost increase of \$43.10 per installation.

210.8(F) Outdoor Air Conditioners (GFCI Protection for Personnel)

- 2020 NEC Change: The new Code section requires that for dwellings where an outdoor air conditioner is installed, the air conditioner must be provided with GFCI protection. The current 2017 State Electrical Code does not require an outdoor air conditioner to be provided with GFCI protection. Expected to affect approximately %95 of dwellings when adjusting for dwellings constructed without outdoor type air conditioners or with gas type air conditioners.
- 2017 NEC Requirement: Current typical installation practices suggest that to achieve Code compliance under the proposed 2020 State Electrical Code where section 210.8(F) is applicable to air conditioners is for a GFCI-type breaker to be installed in lieu of a standard-type breaker that protects the branch-circuit and air conditioner.
- Analysis: Because the typical outdoor air conditioner breaker is a 30-amp Standard 2-Pole Breaker, the following analysis was performed:
 30-amp Standard 2-Pole Breaker – Average Cost – \$10.01
 30-amp GFCI 2-Pole Breaker – Average Cost – \$85.70
 Increase of \$75.69
- Justification of Analysis: Performed using Home Depot - North Durham <https://www.homedepot.com/> and an average cost from Eaton, GE, Siemens, and Square D Homeline manufacturer's online prices.
- Proposed State Electrical Code Change: Adopt the 2020 NEC language.
- Necessity: This requirement is to address dwelling outdoor air conditioners subjected to rain and other outdoor elements that may create a shock hazard to personnel.
- Estimated Impact: This will affect an unknown number of outdoor air conditioner installations per year. Only designs that require an outdoor air conditioner installation will anticipate an average cost increase of \$75.69 per installation.

210.12(A) Laundry Area Outlets (AFCI Protection)

- 2020 NEC Change: The new Code section requires that for dwellings, the laundry area outlet branch circuits must be provided with AFCI protection. The current 2017 State Electrical Code does not require laundry area outlet branch circuits to be provided with AFCI protection. Expected to affect approximately %100 of laundry area outlet branch circuits.
- 2017 NEC Requirement: Current typical installation practices suggest that to achieve Code compliance under the proposed 2020 State Electrical Code where section 210.12(A) is applicable to laundry area outlet branch circuits is for an AFCI/GFCI-type

breaker to be installed in lieu of a standard-type breaker that protects the branch-circuit. Because the AFCI/GFCI breaker also satisfies the GFCI receptacle requirement, the standard receptacle will be installed in lieu of a GFCI-type receptacle.

- Analysis: Because the typical laundry area outlet branch circuit is a GFCI Receptacle on a 20-amp Standard 1-Pole Breaker, the following analysis was performed:
GFCI Receptacle on a 20-amp Standard 1-Pole Breaker – Average Cost – \$24.35
20-amp AFCI/GFCI 2-Pole Breaker – Average Cost – \$47.48
Increase of \$23.13
- Justification of Analysis: Performed using Home Depot - North Durham <https://www.homedepot.com/> and an average cost from Eaton, GE, Siemens, and Square D Homeline manufacturer's online prices.
- Proposed State Electrical Code Change: Adopt the 2020 NEC language.
- Necessity: This requirement is to address dwelling laundry area outlet branch circuits that may create an arc hazard.
- Estimated Impact: All dwellings are required to have at least one laundry area receptacle outlet. This will affect all dwelling laundry area outlet branch circuits installations per year. All dwelling designs will anticipate an average cost increase of \$23.13 per installation of laundry area outlet branch circuits.

210.12(A) Microwave Outlets (AFCI Protection)

- 2020 NEC Change: The new Code section requires that for dwellings, the microwave outlet branch circuit must be provided with AFCI protection. The current 2017 State Electrical Code does not require the microwave outlet branch circuit to be provided with AFCI protection. Expected to affect approximately %95 of dwellings when adjusting for dwellings without microwaves installed.
- 2017 NEC Requirement: Current typical installation practices suggest that to achieve Code compliance under the proposed 2020 State Electrical Code where section 210.12(A) is applicable to microwave outlet branch circuits is for an AFCI/GFCI-type breaker to be installed in lieu of a standard-type breaker that protects the branch-circuit.
- Analysis: Because the typical microwave outlet branch circuit breaker is a 20-amp Standard 1-Pole Breaker, the following analysis was performed:
20-amp Standard 1-Pole Breaker – Average Cost – \$4.38
20-amp AFCI/GFCI 2-Pole Breaker – Average Cost – \$47.48
Increase of \$43.10
- Justification of Analysis: Performed using Home Depot - North Durham <https://www.homedepot.com/> and an average cost from Eaton, GE, Siemens, and Square D Homeline manufacturer's online prices.
- Proposed State Electrical Code Change: Adopt the 2020 NEC language.
- Necessity: This requirement is to address dwelling microwave outlet branch circuits that may create an arc hazard.

- Estimated Impact: This will affect all microwave outlet branch circuits installations per year. All dwelling designs with a microwave outlet branch circuit will anticipate an average cost increase of \$43.10.

210.12(A) Refrigerator Outlets (AFCI Protection)

- 2020 NEC Change: The new Code section requires that for dwellings, the refrigerator outlet branch circuit must be provided with AFCI protection. The current 2017 State Electrical Code does not require the refrigerator outlet branch circuit to be provided with AFCI protection. Expected to affect approximately %100 of dwellings.
- 2017 NEC Requirement: Current typical installation practices suggest that to achieve Code compliance under the proposed 2020 State Electrical Code where section 210.12(A) is applicable to refrigerator outlet branch circuits is for an AFCI/GFCI-type breaker to be installed in lieu of a standard-type breaker that protects the branch-circuit.
- Analysis: Because the typical refrigerator outlet branch circuit is a GFCI Receptacle on a 20-amp Standard 1-Pole Breaker, the following analysis was performed:
 GFCI Receptacle on a 20-amp Standard 1-Pole Breaker – Average Cost – \$24.35
 20-amp AFCI/GFCI 2-Pole Breaker – Average Cost – \$47.48
 Increase of \$23.13
- Justification of Analysis: Performed using Home Depot - North Durham <https://www.homedepot.com/> and an average cost from Eaton, GE, Siemens, and Square D Homeline manufacturer's online prices.
- Proposed State Electrical Code Change: Adopt the 2020 NEC language.
- Necessity: This requirement is to address dwelling refrigerator outlet branch circuits that may create an arc hazard.
- Estimated Impact: This will affect all dwelling refrigerator outlet branch circuits installations per year. All dwelling designs with a refrigerator branch circuit will anticipate an average cost increase of \$23.13.

210.12(A) Kitchen Small Appliance Circuits (AFCI Protection)

- 2020 NEC Change: The new Code section requires that for dwellings, the two required kitchen small appliance branch circuits must be provided with AFCI protection. The current 2017 State Electrical Code does not require the small appliance branch circuits to be provided with AFCI protection. Expected to affect approximately %100 of dwellings.
- 2017 NEC Requirement: Current typical installation practices suggest that to achieve Code compliance under the proposed 2020 State Electrical Code where section 210.12(A) is applicable to small appliance branch circuits is for an AFCI/GFCI-type breaker to be installed in lieu of a standard-type breaker that protects the branch-circuits.
- Analysis: Because the typical small appliance branch circuit is a GFCI Receptacle on a 20-amp Standard 1-Pole Breaker, the following analysis was performed:

GFCI Receptacle on a 20-amp Standard 1-Pole Breaker – Average Cost – \$24.35

20-amp AFCI/GFCI 2-Pole Breaker – Average Cost – \$47.48

Two Required at and increase of \$23.13 per circuit is a Total Increase of \$46.26

- Justification of Analysis: Performed using Home Depot - North Durham <https://www.homedepot.com/> and an average cost from Eaton, GE, Siemens, and Square D Homeline manufacturer’s online prices.
- Proposed State Electrical Code Change: Adopt the 2020 NEC language.
- Necessity: This requirement is to address kitchen dwelling small appliance branch circuits that may create an arc hazard.
- Estimated Impact: This will affect all dwelling small appliance branch circuits installations per year. All dwelling designs will anticipate an average cost increase of \$46.26.

230.67 Surge Protection to Services

- 2020 NEC Change: The new Code section requires that for dwellings, the service must be provided with surge protection. The current 2017 State Electrical Code does not require the surge protection at the service. Expected to affect approximately %100 of dwellings.
- 2017 NEC Requirement: Current typical installation practices suggest that to achieve Code compliance under the proposed 2020 State Electrical Code where section 230.67 is applicable is for a type one or two surge protection device to be installed at the service.
- Analysis: Because there is no requirement for a surge protective device to be installed under the 2017 NEC, the following analysis was performed:
No surge protective device – Average Cost – \$0.00
Whole home surge protector – Average Cost – \$57.37
Increase of \$57.37
- Justification of Analysis: Performed using Home Depot - North Durham <https://www.homedepot.com/> and an average cost from Eaton, GE, Siemens, and Square D Homeline manufacturer’s online prices.
- Proposed State Electrical Code Change: Adopt the 2020 NEC language.
- Necessity: This requirement is to prevent damage to the electrical system during lightning strikes and high voltage surges.
- Estimated Impact: This will affect all dwelling service installations per year. All dwelling designs will anticipate an average cost increase of \$57.37.

Table 1. Forecasted Number of Housing Completions and Estimated Added Cost

Year	2021	2022	2023	2024	2025	5-year NPV
Housing Completions, Total (Thousands) ¹	67.69	65.74	65.05	64.27	64.26	

210.8(A)(7) Range Outlets GFCI Protection Cost per House ²	\$84.18	\$84.18	\$84.18	\$84.18	\$84.18	
75% of Total, Affected (Thousands)	50.77	49.31	48.79	48.20	48.20	
Total Estimated Cost (\$M)	\$4.27	\$4.15	\$4.11	\$4.06	\$4.06	\$16.96
210.8(A)(10) Dryer Outlets GFCI Protection Cost per House ²	\$75.69	\$75.69	\$75.69	\$75.69	\$75.69	
90% of Total, Affected (Thousands)	60.92	59.17	58.55	57.84	57.83	
Total Estimated Cost (\$M)	\$ 4.61	\$4.48	\$4.43	\$4.38	\$4.38	\$18.30
210.8(D) Dishwasher GFCI Protection Cost per House ²	\$43.10	43.10	43.10	\$43.10	\$43.10	
95% of Total, Affected (Thousands)	64.31	62.45	61.80	61.06	61.05	
Total Estimated Cost (\$M)	\$2.77	\$2.69	\$2.66	\$2.63	\$2.63	\$10.99
210.8(F) Outdoor AC GFCI Protection Cost per House ²	\$75.69	\$75.69	\$75.69	\$75.69	\$75.69	
95% of Total, Affected (Thousands)	64.31	62.45	61.80	61.06	61.05	
Total Estimated Cost (\$M)	\$4.87	\$4.73	\$4.68	\$4.62	\$4.62	\$19.32
210.12(A) Laundry Outlet AFCI Protection Cost per House ²	\$23.13	\$23.13	\$23.13	\$23.13	\$23.13	
100% of Total, Affected (Thousands)	67.69	65.74	65.05	64.27	64.26	
Total Estimated Cost (\$M)	\$1.57	\$1.52	\$1.50	\$1.49	\$1.49	\$6.22
210.12(A) Microwave Outlet AFCI Protection Cost per House ²	\$43.10	\$43.10	\$43.10	\$43.10	\$43.10	
95% of Total, Affected (Thousands)	64.31	62.45	61.80	61.06	61.05	
Total Estimated Cost (\$M)	\$2.77	\$2.69	\$2.66	\$2.63	\$2.63	\$10.99
210.12(A) Refrigerator Outlet AFCI Protection Cost per House ²	\$23.13	\$23.13	\$23.13	\$23.13	\$23.13	
100% of Total, Affected (Thousands)	67.69	65.74	65.05	64.27	64.26	
Total Estimated Cost (\$M)	\$1.57	\$1.52	\$1.50	\$1.49	\$1.49	\$6.22
210.12(A) Two Small Appliance AFCI Protection Cost per House ²	\$46.13	\$46.13	\$46.13	\$46.13	\$46.13	
100% of Total, Affected (Thousands)	67.69	65.74	65.05	64.27	64.26	
Total Estimated Cost (\$M)	\$3.12	\$3.03	\$3.00	\$2.96	\$2.96	\$12.38
230.67 Surge Protection Cost per House ²	\$57.37	\$57.37	\$57.37	\$57.37	\$57.37	
100% of Total, Affected (Thousands)	67.69	65.74	65.05	64.27	64.26	
Total Estimated Cost (\$M)	\$3.88	\$3.77	\$3.73	\$3.69	\$3.69	\$15.41

Total Estimated Cost for all Increases (\$M)	\$29.43	\$28.58	\$28.28	\$27.95	\$27.94	\$116.80³
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¹ Forecast data is from the IHS Connect Regional Database.

² Costs have not been adjusted for future changes in construction and installation prices.

³ Calculated in 2020 dollars using a 7% discount rate.

Alternatives:

The options available are to:

- (1) remain at the current level of protection provided by the 2017 State Electrical Code,
- (2) adopt the 2020 NEC without State amendments, or
- (3) adopt the 2020 NEC with State amendments.

The NEC is amended and published every 3-years through a consensus process. The 2017 NEC, with State amendments, is the current State Electrical Code. The risk in retaining the 2017 State Electrical Code is that industry changes, such as more efficient lighting, will not be recognized. Further life-safety changes, such as GFCI expansions will not be implemented.

The 2020 NEC is the latest edition published by NFPA. This risk of adopting the 2020 NEC as the State Electrical Code is that the 2020 NEC without amendments restricts the State of North Carolina to a national standard without regard to the State’s additional codes and laws associated with construction. An example is the state amendment that removes GFCI protection from sewage lift pumps in order to comply with the North Carolina Department of Health’s septic regulations. There are also savings, such as an amendment to provide relief to expanding GFCI protection into finished basements as required by the 2020 NEC.

The preferred option is to adopt the 2020 NEC with the Appendix A amendments. This option captures the national industry and life-safety updates, while allowing input from interested groups represented by Ad Hoc Committee members listed in Appendix D.

Risks and Uncertainties:

There are several uncertainties related to this analysis, and most of them deal with assumptions made or lack of available data. First, the estimates of the total costs in the table above use the housing completions forecast. However, the changes to the Code would apply to any new installation, regardless of whether it is in an existing or new building. As a result, these numbers may be underestimating the potential cost.

Second, the BCC expects that several of the proposed changes to the Code would results in negligible costs or savings, and therefore did not quantify them. However, given that those changes could impact a significant number of installations, in aggregate they may have a significant positive or negative impact.

Third, given the lack of data, benefits are hard to estimate, therefore this analysis does not present the full impact of the changes. While some of the proposed changes would prevent fire and shock hazards, there is no reliable source for recent fires or shocks in North Carolina, or nationally, that could be attributed to an issue that the proposed changes would address. As a result, estimation of avoided fires, damages and shocks are difficult to estimate.

Appendix A:
2020 NEC Proposed NC Amendments

Appendix B:
2020 State Electrical Code Major Changes

Appendix C:
2020 State Electrical Code Summary of Fiscal Impact

Appendix D:
2020 NEC Ad Hoc Committee Members