The purpose of the NCEC is the practical safeguarding of persons and property from hazards arising from the use of electricity. The NCEC is intended for use by code officials, contractors, and designers. The NCEC is not intended as a design specification or an instruction manual for untrained persons. The NCEC 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 NCEC 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 2017 NEC is the latest edition for electrical installations. Therefore, the 2017 NCEC 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 on the basis of 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 2017 NCEC adoption will have negligible impact.

**Local Government:** The impact to local government will be minimal and due to the purchase of the 2017 NEC for code enforcement. 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 protection to more receptacle voltage, phase, and current ratings. Expected to affect an unknown amount of receptacles primarily in commercial kitchens.

- New exception for bank and office occupancies permitting reduction of lighting load based on allowable load density prescribed by adopted energy codes. Expected to affect a limited number of large banks and office buildings.

- New requirement covering installation of heating cables under floor coverings. Expected to affect only houses that choose to install a floor heating system.

There are additional changes noted in Appendix B that indicate negligible change in cost, and whether it is a decrease, increase, or an unquantifiable change. The discussion below, by code article, addresses the major changes.
Impact Analysis:

The Committee members listed in Appendix C were appointed as industry experts and tasked with reviewing for technical and cost changes. The Committee initially reviewed and identified the changes in Appendix A that were either an increase to or a relief from the 2014 NCEC requirements. Upon further review, the Articles below were determined to have quantifiable costs and savings. The remaining changes identified in Appendix B were deemed minimal without measurable savings.  

210.8(B) Other Than Dwelling Units (GFCI Protection for Personnel)
- 2017 NEC Change: Revision to expand GFCI protection to more receptacle voltage, phase, and current ratings. Expected to affect an unknown amount of receptacles primarily in commercial kitchens.
- Proposed NCEC Change: Adopt the 2017 NEC language.
- Necessity: This requirement is to address receptacles that are in a commercial kitchen area that are near a water source and may create a shock hazard to personnel. It also applies to bathrooms and rooftops, but in much lower quantities.
- Estimated Impact: This will affect approximately 200 commercial kitchen installations per year. The anticipated cost is $1200 per installation. (+$240,000 annually)

220.12 Exception No. 2 Lighting Load for Specified Occupancies
- 2017 NEC Change: New exception for bank and office occupancies permitting reduction of lighting load based on allowable load density prescribed by adopted energy codes. Expected to affect a limited number of large banks and office buildings.
- Proposed NCEC Change: Adopt the 2017 NEC language.
- Necessity: The Energy Code prescribes more efficient lighting. This change allows a corresponding reduction in the electrical lighting design load.
- Estimated Impact: This will affect approximately 100 large bank and office buildings per year. The anticipated savings is $10,000 per large office building. (-$1,000,000 annually)

424.45 Installation of Cables Under Floor Coverings
- 2017 NEC Change: New requirement covering installation of heating cables under floor coverings. Expected to affect only houses that choose to install a floor heating system.
- Proposed NCEC Change: Adopt the 2017 NEC language.
- Necessity: This requirement is new to the NEC, but not to the electrical industry. Floor coverings vary, from ceramic tile to laminate and carpet. The heating cables must comply with the listing, product standard and manufacturer’s instruction for the application to reduce fire and shock hazards.
- Estimated Impact: This is an optional system that may affect 10% of new dwellings. The anticipated cost is $500 per installation. (+$3.2 - 3.5M annually)

1 Unless otherwise noted, the cost and savings estimates presented in this section represent the professional judgment of industry experts serving on the Ad Hoc Committee. The Committee considered the any additional changes to perform an install in accordance with these sections and the cost of equipment, if applicable.
The 2017 NEC, Article 424.45 requirement increases the cost of residential housing by more than $80/Dwelling. Based on the number of housing completions forecasted (see Table 1), the change described above would increase the cost per affected house by $500. The totality of this NCEC change would meet the $1 million threshold for the change to be identified as Substantial Economic Impact rule change. In reality, this change is industry-driven and the cost increase has already occurred without the rule change.

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

<table>
<thead>
<tr>
<th>Year</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>5-year NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing Completions, Total (Thousands)</td>
<td>64.0</td>
<td>65.5</td>
<td>67.8</td>
<td>69.9</td>
<td>70.9</td>
<td></td>
</tr>
<tr>
<td>10% of Total, Affected</td>
<td>6.4</td>
<td>6.5</td>
<td>6.8</td>
<td>7.0</td>
<td>7.1</td>
<td></td>
</tr>
<tr>
<td>424.45 Heating Cables under Floor Covering, Total Cost per House</td>
<td>$500</td>
<td>$500</td>
<td>$500</td>
<td>$500</td>
<td>$500</td>
<td></td>
</tr>
<tr>
<td><strong>Total Estimated Cost ($M)</strong></td>
<td>$3.2</td>
<td>$3.3</td>
<td>$3.4</td>
<td>$3.5</td>
<td>$3.5</td>
<td>$13.8³</td>
</tr>
</tbody>
</table>

1 Forecast data is from the IHS Connect Regional Database.
2 Heating cable costs have not been adjusted for future changes in construction and installation prices.
3 Calculated in 2017 dollars using a 7% discount rate.

**Alternatives:**
The options available are to:
(1) remain at the current level of protection provided by the 2014 NCEC,
(2) adopt the 2017 NEC without amendments, or
(3) adopt the 2017 NEC with North Carolina amendments.

The NEC is amended and published every 3-years through a consensus process. The 2014 NEC, with amendments, is the current NCEC. The risk in retaining the 2014 NCEC is that industry changes, such as more efficient lighting, will not be recognized. Further life-safety changes, such as GFCI expansions and Heat Cable installations, will not be implemented.

The 2017 NEC is the latest edition published by NFPA. This risk of adopting the 2017 NEC as the NCEC is that some changes will add cost increases to a limited number of buildings. There are also savings, such as more efficient lighting, associated with the 2017 NEC. Adopting the 2017 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. The Committee also gave more weight to the initial construction costs over the long-term savings.

The preferred option is to adopt the 2017 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 C.
**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 result 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:**
2017 NEC Proposed NC Amendments

**Appendix B:**
2017 NEC Summary of Impact

**Appendix C:**
2017 NEC Electrical Ad Hoc Committee Members