



# ENERGY EFFICIENCY IN THE SOUTH

## APPENDIX G

### STATE PROFILES OF ENERGY EFFICIENCY OPPORTUNITIES IN THE SOUTH: NORTH CAROLINA

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April 2010

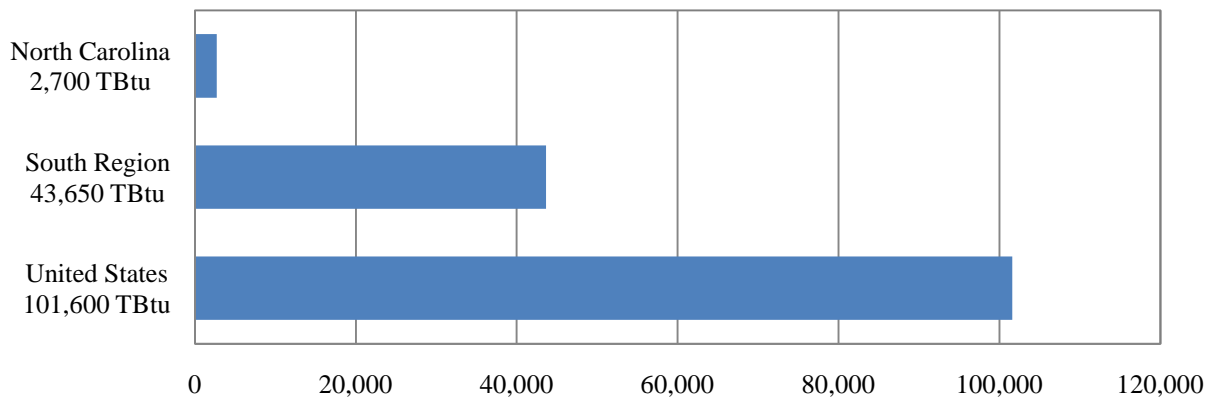
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## A Profile of Energy-Efficiency Opportunities in North Carolina

The economic recession, climate change concerns and rising electricity costs have motivated many states to embrace energy efficiency as a way to create new local jobs, lower energy bills and promote environmental sustainability. With this surge of interest in energy efficiency, policymakers are asking: “how much energy can be saved?” This profile addresses the opportunity for energy efficiency improvements in the residential, commercial and industrial sectors of North Carolina. It draws on the results of a study of *Energy Efficiency in the South* conducted by a team of researchers at the Georgia Institute of Technology and Duke University. The study presents primary and in-depth research of the potential for energy-efficiency improvements, using a modeling approach based on the EF-NEMS (National Energy Modeling System).<sup>1</sup>

With a population of 9.2 million people,<sup>2</sup> the State represents about 3.1% of the U.S. population, 2.9% of the nation’s Gross Domestic Product (GDP), and 2.7% of U.S. energy consumption (Figure 1).<sup>3</sup> Thus, compared to the rest of the nation, North Carolina has a lower than average level of energy intensity.<sup>i</sup>

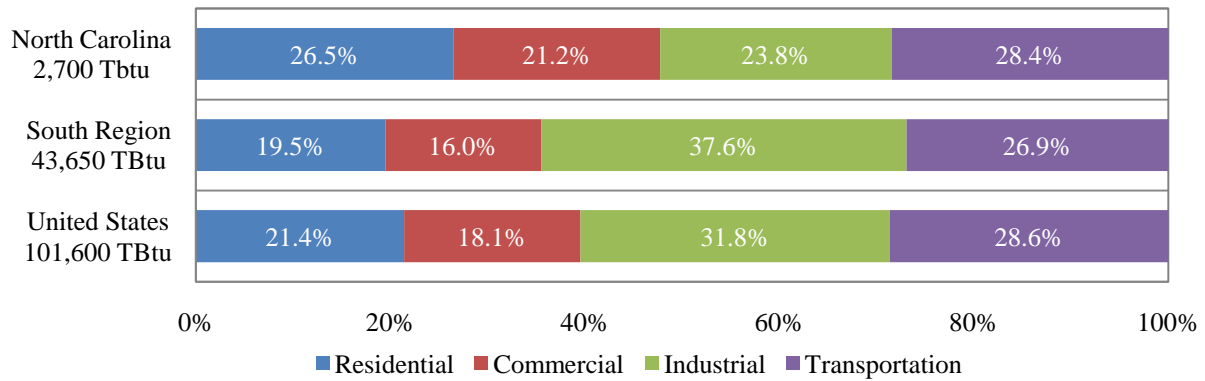


**Figure 1: Energy Consumption in North Carolina, the South, and the U.S., 2007<sup>3</sup>**

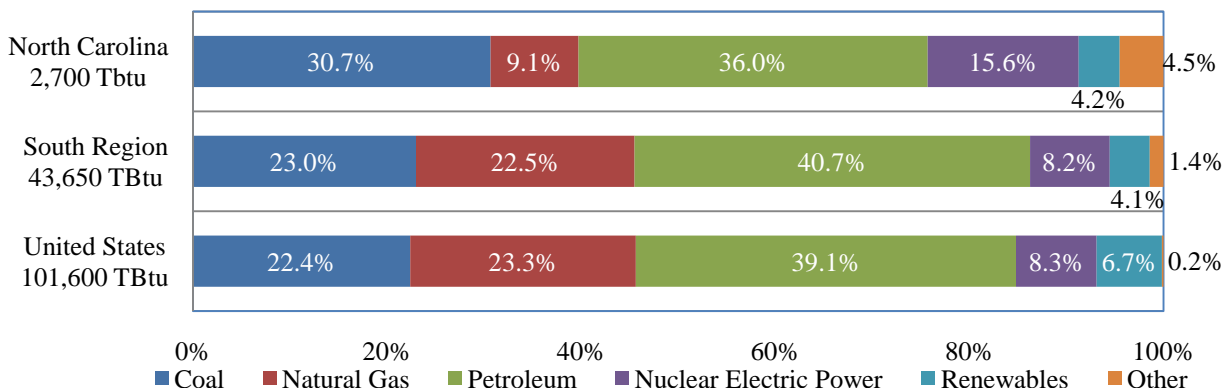
North Carolina’s use of residential energy as a percentage of its overall energy consumption exceeds that of the nation and the rest of the South. Alternatively, its industrial energy consumption is lower (Figure 2). North Carolina’s per capita energy consumption is ranked 39<sup>th</sup> nationally.<sup>3</sup>

North Carolina consumes more coal and nuclear energy than other states in the South. However, it consumes relatively less natural gas (Figure 3). The State produces its electricity largely from coal (60%), but it also is a leader in electricity produced from nuclear power. Hydroelectric power also supplies about 3% of the electricity consumed within the State.<sup>4</sup> North Carolina is a national leader in wind power capacity.

<sup>i</sup> Energy intensity is the ratio of the state’s energy consumption to its Gross State Product (GSP).



**Figure 2: Energy Consumption in North Carolina, the South, and the U.S. by Sector, 2007<sup>3</sup>**



**Figure 3: Energy Consumption in North Carolina, the South, and the U.S. by Fuel Type, 2007<sup>3</sup>**

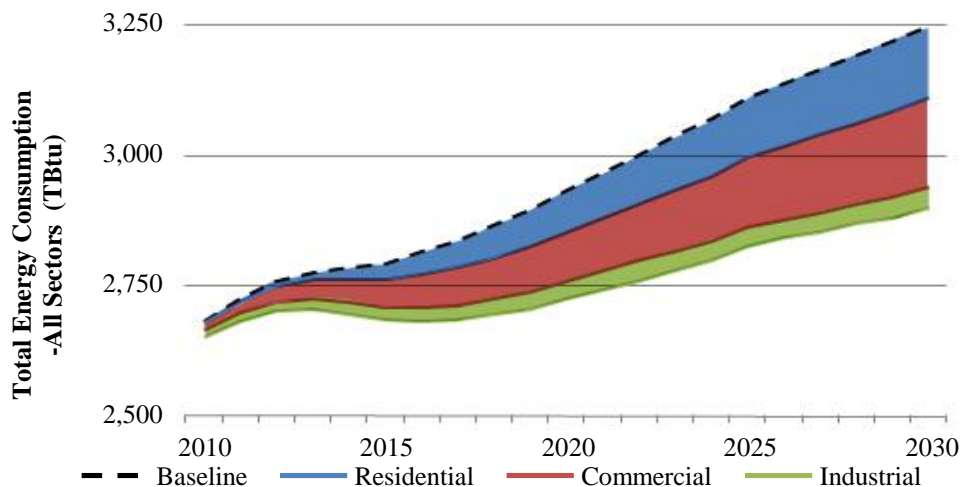
North Carolina’s Renewable Energy and Energy Efficiency Portfolio Standard (REPS) requires 12.5% of retail electricity in 2020 to be generated from renewables. The standard allows up to 25% of the requirement to be met through energy efficiency technologies up to 2020. Afterwards, energy efficiency may supply up to 40%.<sup>5</sup> Another state-wide initiative, the “Upgrade and Save” program, encourages manufactured home dealers to implement energy efficient heat pumps and pays for the measures. New homeowners can save up to \$700 per year from the efficiency measure without experiencing any costs associated with the upgrade.<sup>5</sup> More state initiatives are described in recent Southern States Energy Board and National Association of State Energy Officials publications.<sup>4, 6</sup>

Nevertheless, the *2009 State Energy Efficiency Scorecard* from the American Council for an Energy Efficient Economy (and other studies of the State and region) suggests that additional policy initiatives could be implemented in the State to encourage households, businesses, and industries to utilize energy more effectively. Specifically, the ACEEE study rated North Carolina 26th of the 50 states and DC for its adoption and implementation of energy-efficiency policies. This score is based on the state’s performance in six energy efficiency policy areas: utility and public benefits, transportation, building energy codes, combined heat and power, state government initiatives, and appliance efficiency standards.<sup>7</sup>

In the *Meta-Review of Efficiency Potential Studies and Their Implications for the South*, Chandler and Brown (2009) reviewed eight energy-efficiency studies that covered North Carolina. Estimates of “maximum achievable” electricity savings potential range from 8-27%. The total energy saved could exceed this potential. North Carolina’s energy-efficiency potential would be higher than this range with the implementation of all cost-effective opportunities, but the number of studies with such estimates is limited.<sup>8</sup> An ACEEE study examined energy efficiency, transportation, and water savings in the State. Through the energy efficiency policies it examined, North Carolina could realize 37,830 GWh of electricity savings in 2025 or about 24% of the projected consumption.<sup>9</sup>

### Energy Efficiency Potential by Sector

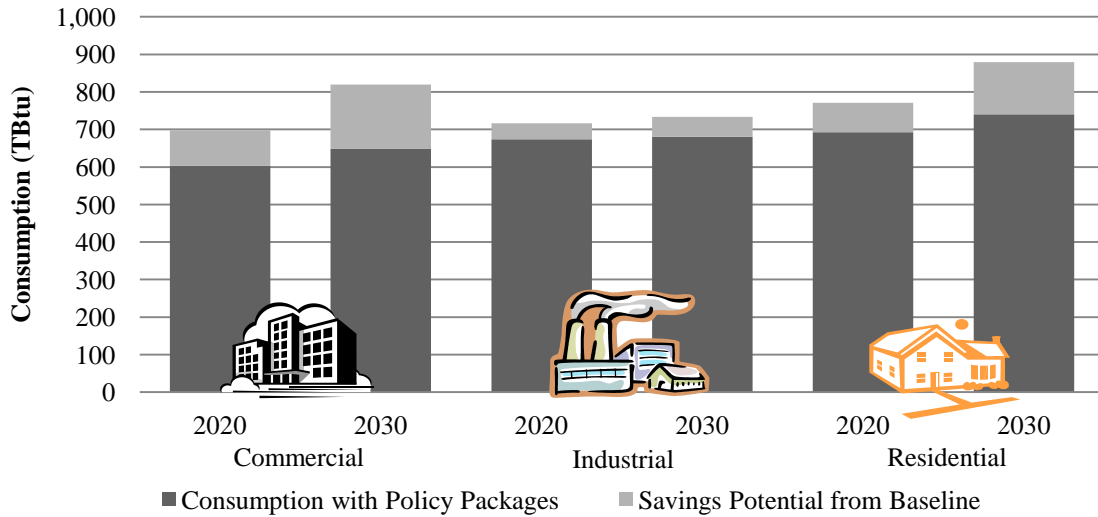
The State’s total energy consumption (residential, commercial, industrial, and transportation sectors) is projected to increase 22% from 2010 to 2030. This profile describes the ability of nine energy policies to curb this growth in energy use by accelerating the adoption of cost-effective energy-efficient technologies in the residential, commercial, and industrial sectors of North Carolina. Altogether, these policies offer the potential to reduce North Carolina’s energy consumption by approximately 13% of the energy consumed by the State in 2007 (360 TBtu in 2030) (Figure 4). With these policies, North Carolina’s energy consumption could remain relatively stable over the next two decades. For complete policy descriptions, refer to *Energy Efficiency in the South* by Brown et al. (2010).



**Figure 4: Energy Efficiency Potential in North Carolina**

(Note: The baseline includes projected transportation sector consumption, as well as residential, commercial and industrial consumption.)

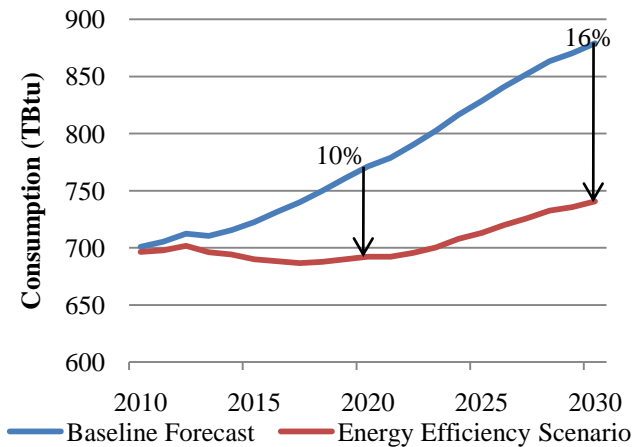
The commercial and residential sectors offer the greatest energy efficiency potential in North Carolina (Figure 5). In 2020, savings from all three sectors is about 8% (220 TBtu) of the total energy consumed by the State in 2007. Electricity savings constitute 190 TBtu of this amount. With these policies, the electricity generated by six 500-MW power plants in 2020 and about eleven such power plants in 2030 could be avoided.<sup>10</sup>



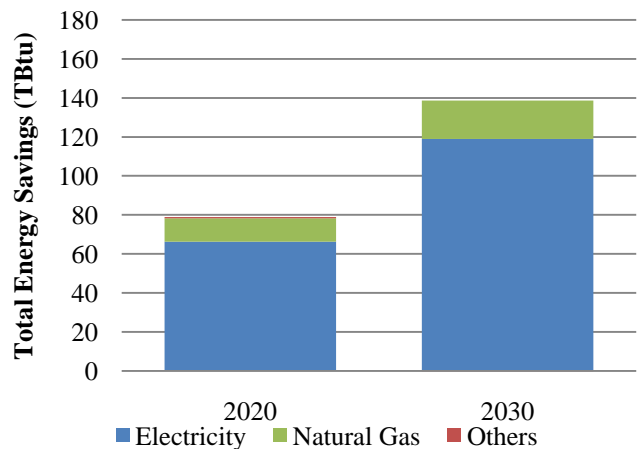
**Figure 5: Energy-Efficiency Potential by Sector in North Carolina, 2020 and 2030**

***Residential Sector***

Four residential energy efficiency policies were examined: more stringent building codes with third party verification, improved appliance standards and incentives, an expanded Weatherization Assistance Program, and retrofit incentives with increased equipment standards. Their implementation could reduce North Carolina’s projected residential consumption by about 10% (79 TBtu) in 2020 and 16% (140 TBtu) in 2030 (Figure 6). In 2020, the residential energy required by about 390,000 North Carolinian households could be avoided or about \$320 per household.



**Figure 6: Residential Sector Savings**



**Figure 7: Residential Sector Savings by Fuel Type**

The principal energy savings are from electricity, but significant natural gas savings could also occur (Figure 7). With these policies, growth in residential energy consumption could be dramatically slowed.

### Commercial Sector

The implementation of appliance standards and retrofit policies in North Carolina’s commercial sector could reduce projected energy consumption in 2020 by approximately 14%, and by 21% in 2030 (Figure 8). In 2020, the commercial sector could save about 95 TBtu, which is equivalent to the amount of energy that 2,700 Wal-Mart stores spend a year. Each business in North Carolina could save \$65,000 on average.<sup>11</sup> The principal energy savings are from electricity, with natural gas and other fuels providing additional savings (Figure 9). The rapid growth of commercial energy consumption forecast for North Carolina could be constrained to only modest growth with these two energy efficiency policies.

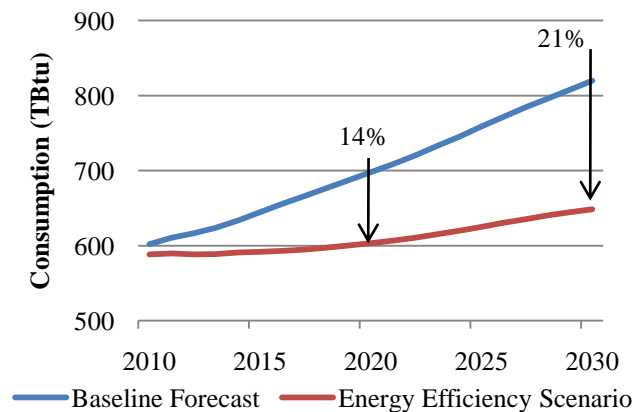


Figure 8: Commercial Sector Savings

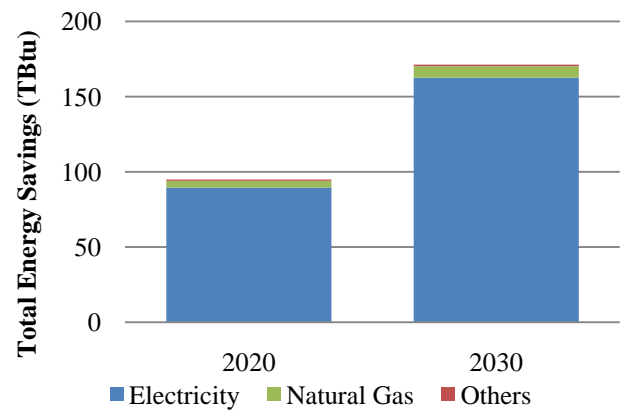


Figure 9: Commercial Sector Savings by Fuel Type

### Industrial Sector

The implementation of plant utility upgrades, process improvements, and combined heat and power policies in North Carolina’s industrial sector can reduce projected consumption by about 6% in 2020 (42 TBtu) and 2030 (53 TBtu) (Figure 10). The industrial energy required by about 61 average industrial facilities is avoided in 2020, or average annual bill savings of \$31,000 per industrial facility. The principal energy savings are from electricity, but natural gas savings could also occur, especially in 2020 (Figure 11). These three energy efficiency policies could significantly reduce the growing consumption of industrial energy projected over the next two decades.

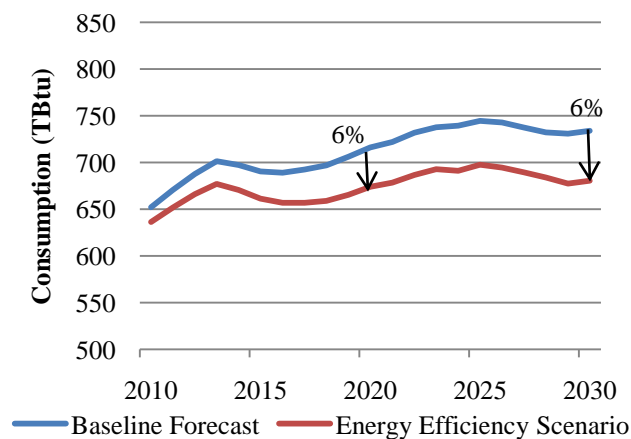


Figure 10: Industrial Sector Savings

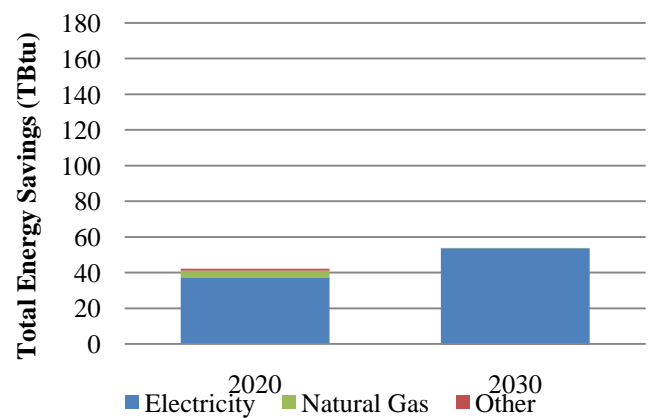


Figure 11: Industrial Sector Savings by Fuel Type

## **Efficient Technology Opportunities**

The projected energy-efficiency potential can be realized through an array of new and existing technologies. *Energy Efficiency in the South* describes a number of these.

Emerging residential products can provide greater energy savings without sacrificing performance. For instance, currently available heat pump water heaters can cut annual energy costs for water heating up to 62%.<sup>12</sup>

Opportunities for commercial energy efficiency may be obtained through technologies like the geothermal heat pump (ground-source heat pump), which can reduce energy consumption by up to 44% when compared to air-source heat pumps and by up to 72% when compared to electric resistance heating with standard air-conditioning equipment. Though the installation cost is higher, the long lifetime of 20-25 years ensures energy bill saving benefits over time.<sup>13</sup>

Super boilers, which represent over 95 percent fuel-to-steam efficiency, can be implemented in the industrial sector. This technology is able to improve heat transfer through the use of advanced firetubes with extended surfaces that help achieve a compact design through reducing size, weight, and footprint. The advanced heat recovery system combines compact economizers, a humidifying air heater, and a patented transport membrane condenser.<sup>14</sup>

These technologies are illustrative. Please refer to *Energy Efficiency in the South* by Brown et al. for additional technology descriptions and examples.<sup>1</sup>

## **Economic and Financial Impacts**

The nine energy efficiency policies evaluated in *Energy Efficiency in the South* could reduce energy costs for North Carolina consumers and could generate jobs in the State (Table 1). Residential, commercial and industrial consumers could benefit from total energy savings of \$3.8 billion in 2020 (\$2 billion of which is specific to electricity), and \$7.0 billion in total energy savings in 2030. In comparison, North Carolina spent \$10.3 billion on electricity in 2007.<sup>15</sup>

Using an input-output calculation method from ACEEE – with state-specific impact coefficients and accounting for declines in employment in the electricity and natural gas sectors – we estimated that North Carolina would experience a net gain of 30,800 jobs in 2020, growing to 42,100 in 2030. In comparison, there were about 500,000 unemployed residents of North Carolina at the end of 2009.<sup>16</sup>

While the South's economy would grow as a result of the energy-efficiency policies, North Carolina would experience first a small increase and then a small decline in Gross State Product, with an increase of \$1 million in 2020 and a decrease of \$33 million in 2030. This change is a small fraction of the North Carolina's \$395 billion economy; North Carolina has an average economic multiplier associated with energy-efficiency manufacturing and construction activities in North Carolina.<sup>17</sup>

<b>Table 1: Economic and Employment Impacts of Energy Efficiency</b>		
<b>Indicator</b>	<b>2020</b>	<b>2030</b>
Public Sector Policy Financial Incentives (in million \$2007)	872	1,318
Private Sector/Household Productive Investment (in million \$2007)	323	382
Change in Electricity Costs (in million \$2007)	-\$2,006	-\$3,846
Change in Natural Gas Costs (in million \$2007)	-\$313	-\$498
Annual Increased Employment (ACEEE Calculator)	30,800	42,100
Change in Gross State Product (in million \$2007)	1	-33

### **Conclusions**

The energy-efficiency policies described in this report could set North Carolina on a course toward a more sustainable and prosperous energy future. If utilized effectively, the State’s substantial energy-efficiency resources could reverse the long-term trend of ever-expanding energy consumption. With a sustained and concerted effort to use energy more wisely, North Carolina could create new job opportunities and reduce its environmental footprint.

For more information on the methodology used to derive this state profile, please see *Energy Efficiency in the South*.<sup>1</sup>

### **Acknowledgements**

This study project is funded with support from the Energy Foundation ([www.ef.org](http://www.ef.org)), the Kresge Foundation ([www.kresge.org](http://www.kresge.org)) and the Turner Foundation ([www.turnerfoundation.org](http://www.turnerfoundation.org)). The support of these three foundations is greatly appreciated.

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