THE ROLE OF LOCAL ENERGY PLANNING IN THE ACHIEVEMENTS OF REGIONAL AND NATIONAL SUSTAINABILITY TARGETS: AN ITALIAN CASE STUDY

Vittoria Battaglia
PhD fellow – University of Naples ‘Parthenope’
Outline

• Introduction
• Purpose of the study
• Methodology
• Case study presentation
• Reference scenario
• Validation
• Future scenario with updated targets
• Results
• Conclusions and further developments
Objective: investigation on the role of the local energy plans in the achievement of the regional and national sustainability goals
Methodology

- Data collection and elaboration
  - Electricity
  - Households
  - Industry
  - Transport

Energy demand and supply evaluation

Scenario definition
- Reference scenario
- Future scenario

- Electric energy covered by RES
  - PES
  - CO₂

Environmental and energy analysis
# Case study presentation

## Climatic Zone Operating Season Daily Working Hours

<table>
<thead>
<tr>
<th>Zone</th>
<th>Season</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1/12– 15/03</td>
<td>6</td>
</tr>
<tr>
<td>B</td>
<td>1/12– 31/03</td>
<td>8</td>
</tr>
<tr>
<td>C</td>
<td>15/11– 31/03</td>
<td>10</td>
</tr>
<tr>
<td>D</td>
<td>1/11– 15/04</td>
<td>12</td>
</tr>
<tr>
<td>E</td>
<td>15/10 – 15/03</td>
<td>14</td>
</tr>
<tr>
<td>F</td>
<td>No limitation</td>
<td>No limitation</td>
</tr>
</tbody>
</table>

Map showing the location of Napoli within the Campania Region in Italy.
Reference scenario

Demand side data collection and elaboration

Electricity

<table>
<thead>
<tr>
<th>Input data</th>
<th>Availability</th>
<th>Estimation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual demand</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Annual hourly distribution</td>
<td>Share of the hourly distribution of southern Italian grid</td>
<td></td>
</tr>
</tbody>
</table>
Reference scenario

Demand side data collection and elaboration

**Heating and Domestic Hot Water**

<table>
<thead>
<tr>
<th>Input data</th>
<th>Availability</th>
<th>Estimation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual consumption per type of fuel</td>
<td>X</td>
<td>Based on the type of plants used</td>
</tr>
<tr>
<td>Type of plants used</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Efficiency of the plants</td>
<td></td>
<td>Plausible values</td>
</tr>
<tr>
<td>Annual hourly distribution</td>
<td></td>
<td>Heating degree hours</td>
</tr>
</tbody>
</table>

**Cooling**

<table>
<thead>
<tr>
<th>Input data</th>
<th>Availability</th>
<th>Estimation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual consumption per type of fuel</td>
<td></td>
<td>Based on the type of plants used and share of the national consumption</td>
</tr>
<tr>
<td>Type of plants used</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Efficiency of the plants</td>
<td></td>
<td>Plausible values</td>
</tr>
<tr>
<td>Annual hourly distribution</td>
<td></td>
<td>Cooling degree hours</td>
</tr>
</tbody>
</table>
Reference scenario

Demand side data collection and elaboration

**Transport**

<table>
<thead>
<tr>
<th>Input data</th>
<th>Availability</th>
<th>Estimation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Transport</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual consumption per type of fuel</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Ngas and electricity load hourly distribution</td>
<td>not introduced</td>
<td></td>
</tr>
<tr>
<td>Private Transport</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual consumption per type of fuel</td>
<td></td>
<td>Based on share of vehicles</td>
</tr>
<tr>
<td>Ngas and electricity load hourly distribution</td>
<td>Based on traffic studies and vehicle stock determination</td>
<td></td>
</tr>
</tbody>
</table>

**Industry**

<table>
<thead>
<tr>
<th>Input data</th>
<th>Availability</th>
<th>Estimation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual consumption per type of fuel</td>
<td></td>
<td>Based on share of energy consuming companies</td>
</tr>
</tbody>
</table>
Reference scenario

**Supply side data collection and elaboration**

<table>
<thead>
<tr>
<th>Plant Description</th>
<th>Electric power capacity (MW)</th>
<th>Annual Ngas Consumption (average MSm³)</th>
<th>Operating hours (average)</th>
<th>Typology</th>
<th>Electric energy production (GWh/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Napoli Levante plant</td>
<td>400</td>
<td>259</td>
<td>5000</td>
<td>Combined cycle</td>
<td>1320</td>
</tr>
<tr>
<td>(2) Federico II Hospital CHP plant</td>
<td>5550</td>
<td>8500</td>
<td></td>
<td>Simple cycle gas turbine</td>
<td></td>
</tr>
<tr>
<td>(3) Biogas plant</td>
<td>2064</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plant Description</th>
<th>Service</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(2) Federico II Hospital CHP plant</td>
<td>Trigeneration plant for the Federico II Hospital</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plant Description</th>
<th>Electric power capacity (kW)</th>
<th>Thermal power capacity (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2) Federico II Hospital CHP plant</td>
<td>5550</td>
<td>8500</td>
</tr>
</tbody>
</table>

**Fluctuating RES**

<table>
<thead>
<tr>
<th>Plant Description</th>
<th>Electric power capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) PV plant installed capacity (MW)</td>
<td>12.4</td>
</tr>
</tbody>
</table>

**Annual hourly load distribution**

Dynamic simulation of a plausible commercial system (considering different expositions)

<table>
<thead>
<tr>
<th>Plant Description</th>
<th>Total ST plant installed surface (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2) Total ST plant installed surface (m²)</td>
<td>510</td>
</tr>
</tbody>
</table>

**Annual hourly load distribution**

Dynamic simulation of a plausible system (considering a storage and different expositions)

<table>
<thead>
<tr>
<th>Plant Description</th>
<th>Hydropower installed capacity (kW)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>(3) Hydropower installed capacity (kW)*</td>
<td>300</td>
</tr>
</tbody>
</table>

**Annual hourly load distribution**

Share of the southern Italian run off river production
Validation

SEAP target for the year 2020

Naples's energy balance 2019 and EnergyPLAN results:
- Electric energy
- Gas
- Biomass
- Oil
- RES electricity production
- Electricity import

Equivalent CO2 emissions from balance and from EnergyPLAN:
- Δ=4%

CO2 emission (kt) vs. Years
- 2005 to 2020
- CO2 emission decreases over time
2030 BAU scenario and SECAP target

**Demand recalibration**
- Electricity demand and cooling demand assumed to increase as the NECP evaluations;
- Thermal energy demand and industrial sector demand expected to decrease according to NECP estimation;
- Transport consumption recalibrated according to the trend provided by the NECP;

**Supply configuration with ongoing actions of the SEAP**
- PV panels for an increase in installed capacity of 22 MWe
- Hydroelectric plant of 400 kW

-40% reduction in GHG emissions by 2030
Results and conclusions

- **CO₂ emission (kt)**
  - 2005: 2900
  - 2010: 2700
  - 2015: 2500
  - 2020: 2300
  - 2025: 2100
  - 2030: SECAP GOAL

- **Years**
  - 2005
  - 2010
  - 2015
  - 2020
  - 2025
  - 2030

- **SECAP scenario**

- **RES action**
  - Technical potential
    - Wind
    - Solar
    - Biomass

- **Energy efficiency action**
  - Technical potential
    - Sustainable Mobility
    - Building stock renovation
    - CHP/DHC
Further developments

Scenario definition
- Reference scenario
- Future scenario

Environmental and energy analysis
- Electric energy covered by RES
  - PES
  - CO₂

Energy demand evaluation
- Data collection and elaboration
  - Electricity
  - Households
  - Industry
  - Transport

New actions
- Normalized Feasibility Comparison
- RES action
  - Technical potential
  - Wind
  - Solar
  - Biomass
- Energy efficiency action
  - Technical potential
- Sustainable Mobility
  - Building stock renovation
- CHP/DHC

Smart energy system in harmonized plan framework
THANK YOU!

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