South East Europe Infrastructure Study

Erin Ford, BP

Export Transit Team Manager

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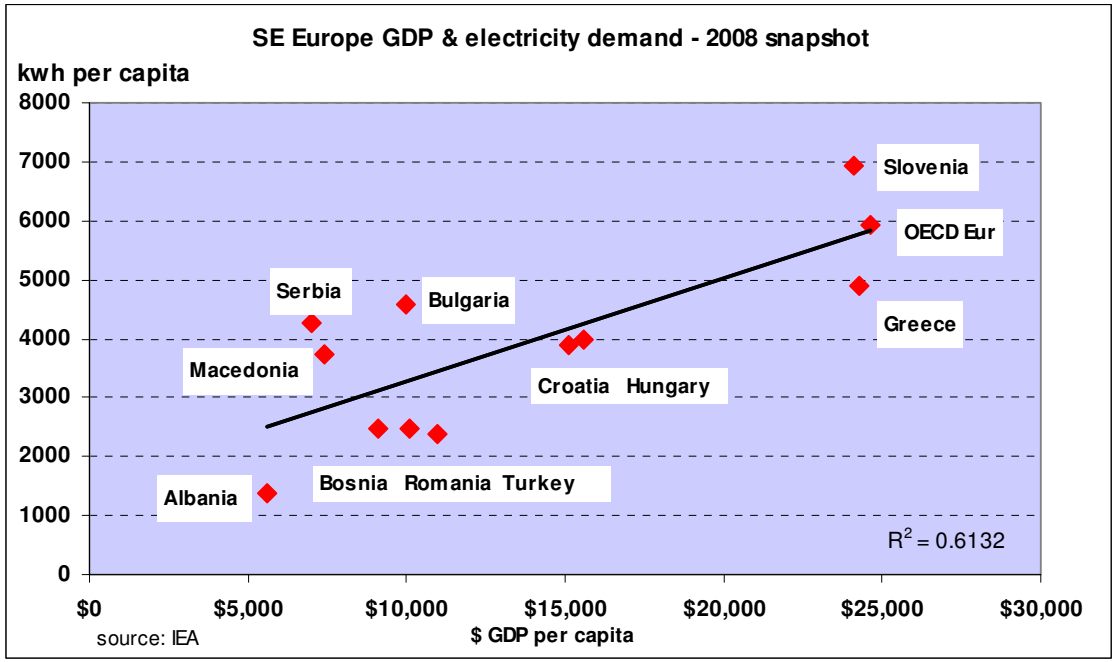
Agenda

- **Introduction: Caspian Gas Route to Market**
  - Review of options for the supply of Caspian Gas into South East Europe (SEE)
- **Power Development Opportunities**
  - Focus on the potential importance of the Large Combustion Plant Directive in SEE
- **Potential for Combined Cycle Gas Turbine Power Plants**
  - The potential role of the power sector in anchoring regional gas demand
- **Potential Routes for Supply**
  - Interconnection via planned major pipeline projects (Nabucco, TAP, IGI, etc)
- **Summary**

Caspian Gas Route to Market – Potential Infrastructure

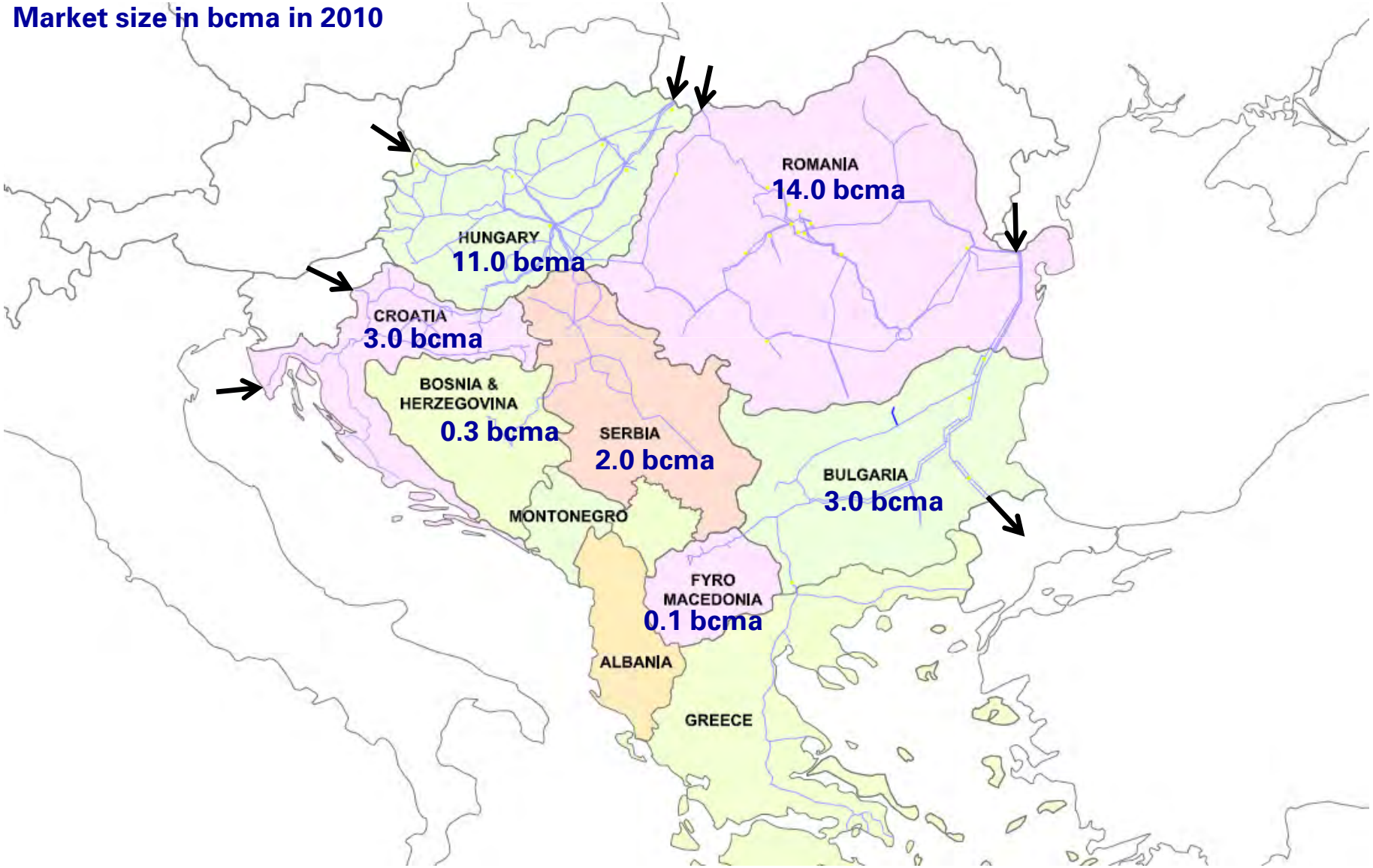
Gas Demand Growth Drivers

- Gas grid expansion – capturing more consumers
- GDP & electricity – strong relationship between GDP and electricity demand
- Environmental - Large combustion plant directive (LCPD)
- Fuel substitution



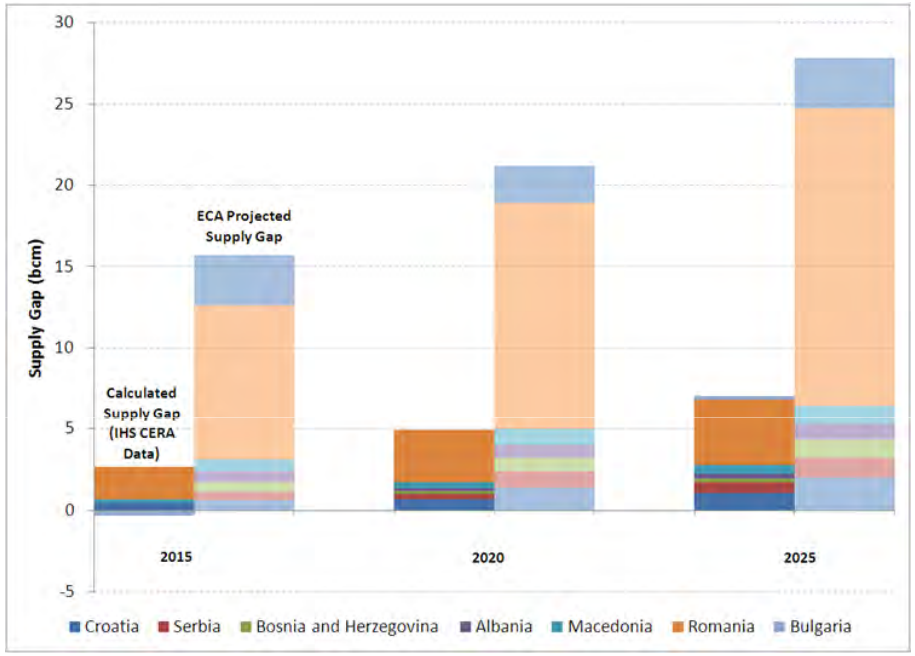
Source: International Energy Agency

South East Europe Infrastructure and Market Size



South East Europe Market Outlook

- Initial assessment of market supply and demand
- Supply gap of 5-13 bcma identified for the region in 2020
- Planned new pipelines likely to increase regional interconnectivity



- Gas delivery into the region may be via planned major pipeline (Nabucco, IGI, TAP, etc.) or from existing infrastructure

Power Sector – Possible Development Scenarios

- **Key study assumption that 1-3 bcma will be available to South East Europe**
  - Gas to be supplied via 4th Energy Corridor planned transit pipeline (Nabucco, TAP, IGI) and additional infrastructure as necessary

- **Gas to be used to diversify supply and support adherence to Large Combustion Plant Directive (LCPD)**
  - Assumption that new combined cycle gas turbine (CCGT) power stations will be used to anchor demand for gas
  - Indicative locations for new CCGT's identified and new infrastructure required specified (gas and electricity transmission)
  - Key milestones identified

- **Criteria for assessing supply examples:**
  - Current reliance on single gas supply source – lack of energy independence
  - Current energy mix biased towards 'dirty fuels' likely to contravene LCPD
  - Absolute size of current energy market

Identification of Example Markets

Country	2008 Primary Energy Consumption (mil. boe)[1]	Gas % of Primary Energy Consumption[1]	% Gas Dependent [2]
Albania	19.2	1.0%	-
Bosnia and Herzegovina	51.1	3.7%	100%
Bulgaria	143.7	13.5%	92%
Croatia	70.4	26.1%	54%
Former Yugoslav Republic of Macedonia (FYROM)	21.5	2.0%	100%
Montenegro	6.2	0.0%	-
Romania	289.1	33.2%	21%
Serbia	125.6	11.4%	92%

[1] Data sourced from US Energy Information Administration
[2] Gas Dependency defined as: Gas supplied from Russia / Total Demand (data from IHS CERA)

Identification of Example Markets

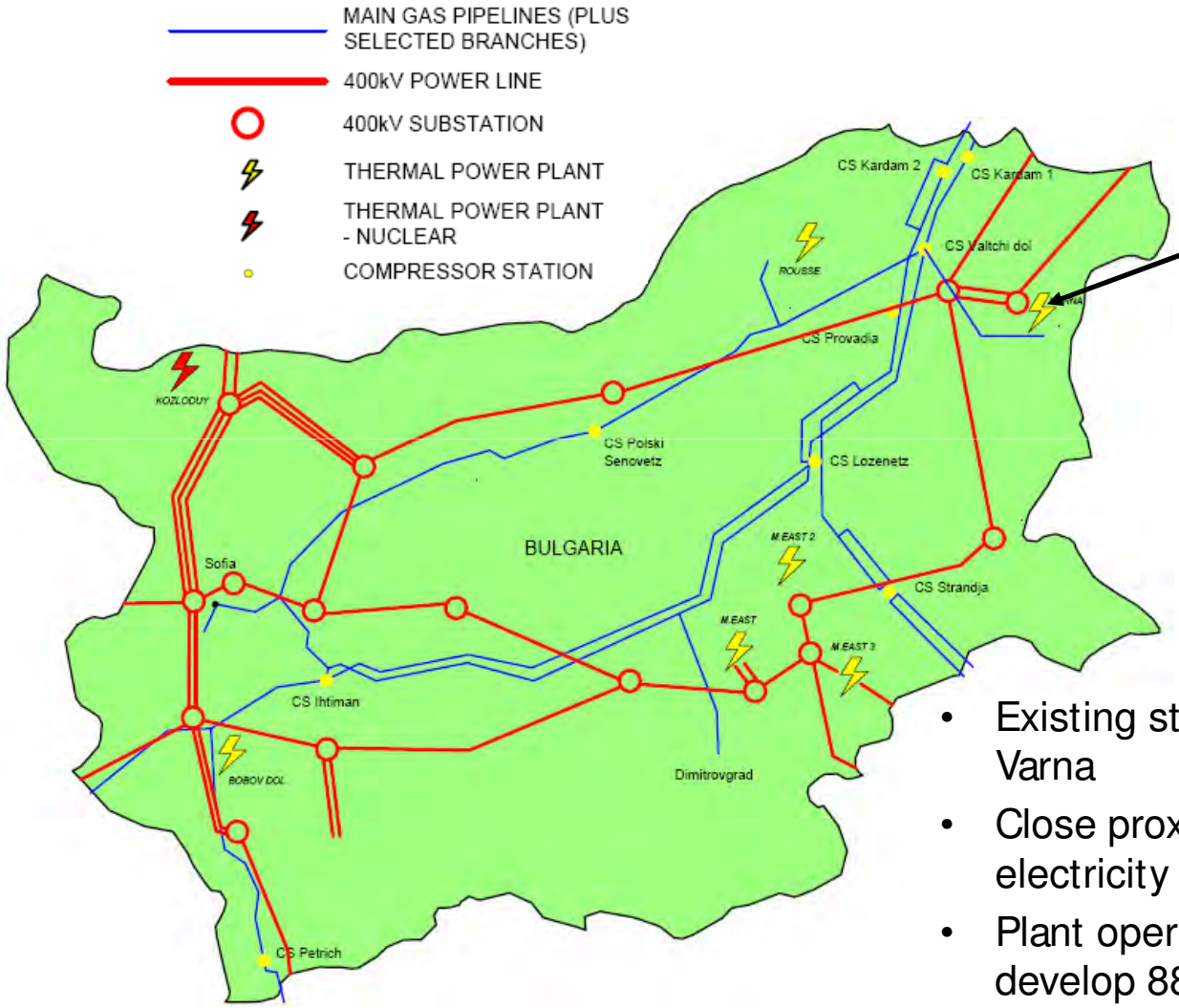
- **Example SEE markets identified as follows:**
  - Bulgaria
  - Serbia
  - FYROM / Bosnia and Herzegovina
  - Romania

- **Potential locations for CCGT plants selected in each country (note, these are indicative only and would need to be discussed with the relevant in-country organisations)**

- **Indicative locations sited in close proximity to existing heavy fuel fired station**
  - Proximity to existing gas and electricity infrastructure also considered
  - Size of indicative power station selected depending upon the absolute size of the energy market

- **Initial calculations suggest 800MW power station may require 1 bcma, 400 MW 0.5 bcma**
  - Could provide a demand anchor load to attract gas to the region

Bulgaria – Potential CCGT at Varna (800 MW)



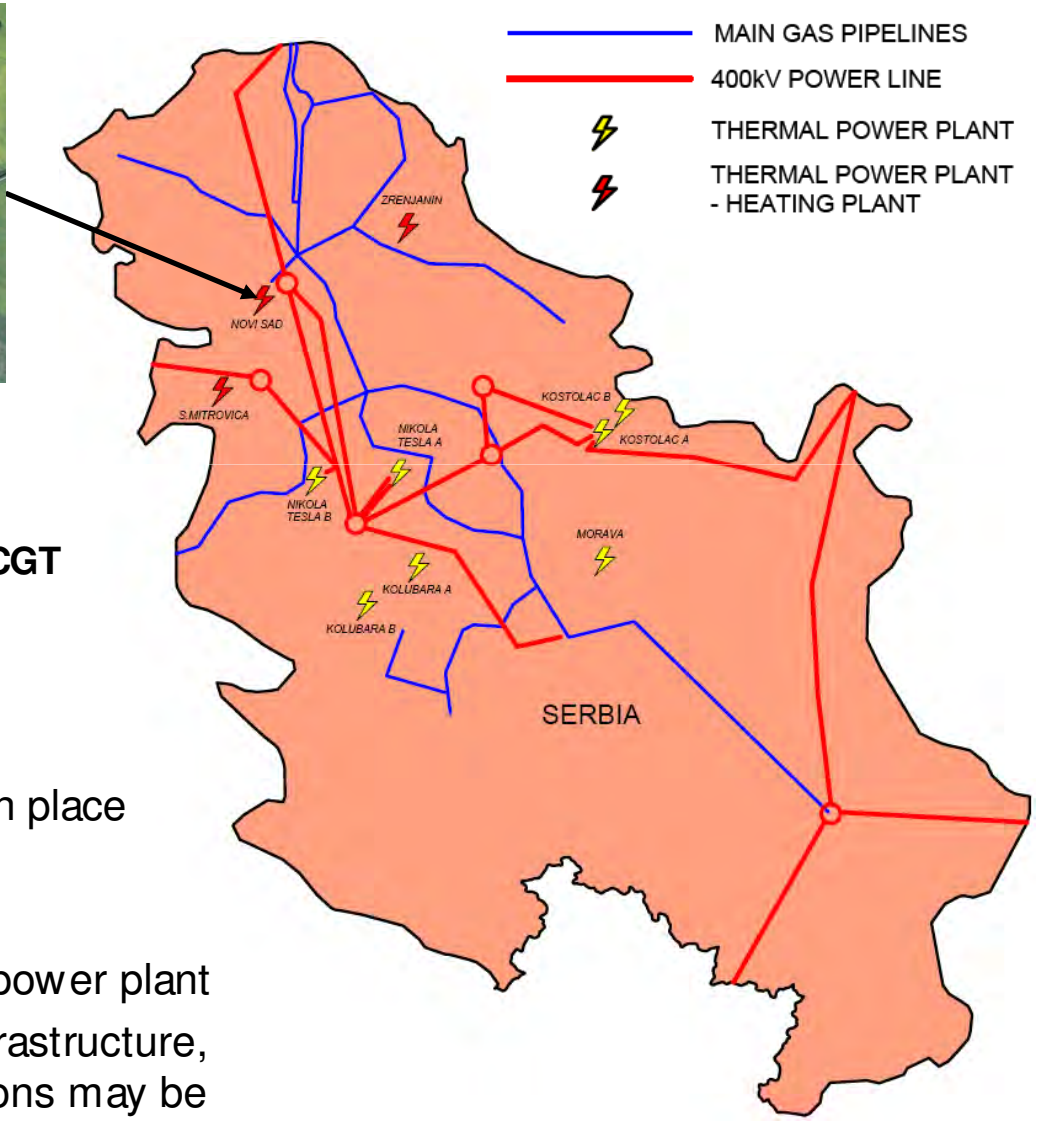
Existing Varna Thermal Power Station

- Existing station located 12km west of Varna
- Close proximity to current gas and electricity infrastructure
- Plant operator (CEZ) had planned to develop 880 MW CCGT, project currently on hold.

Serbia – Potential CCGT at Novi Sad (800 MW)

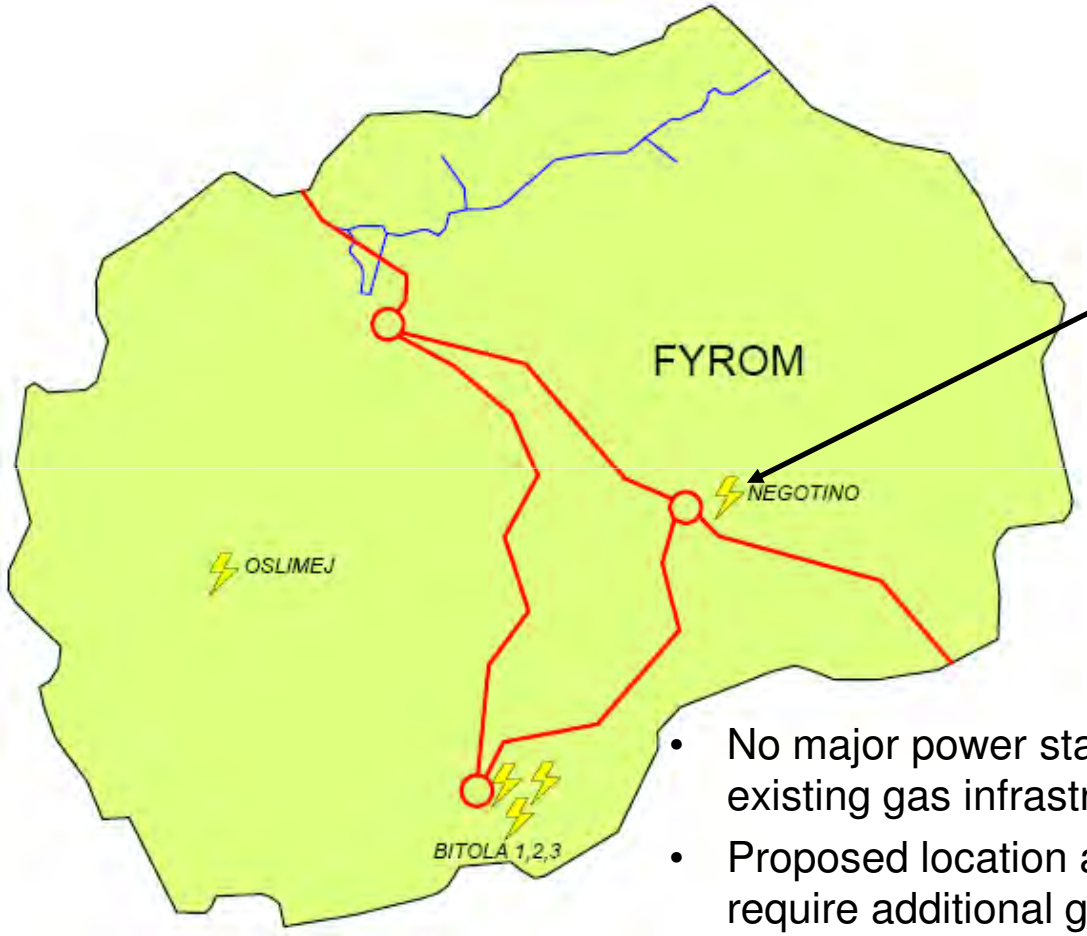
Existing Novi Sad Thermal Power Station

Prospective CCGT



- Proposals for developments already in place
- 800 MW installed power, consuming approximately 1 bcma of gas
- Close proximity to existing Novi Sad power plant
- Access to local gas and electricity infrastructure, expansions and further interconnections may be required

FYRO Macedonia – Potential CCGT Negotino (400 MW)

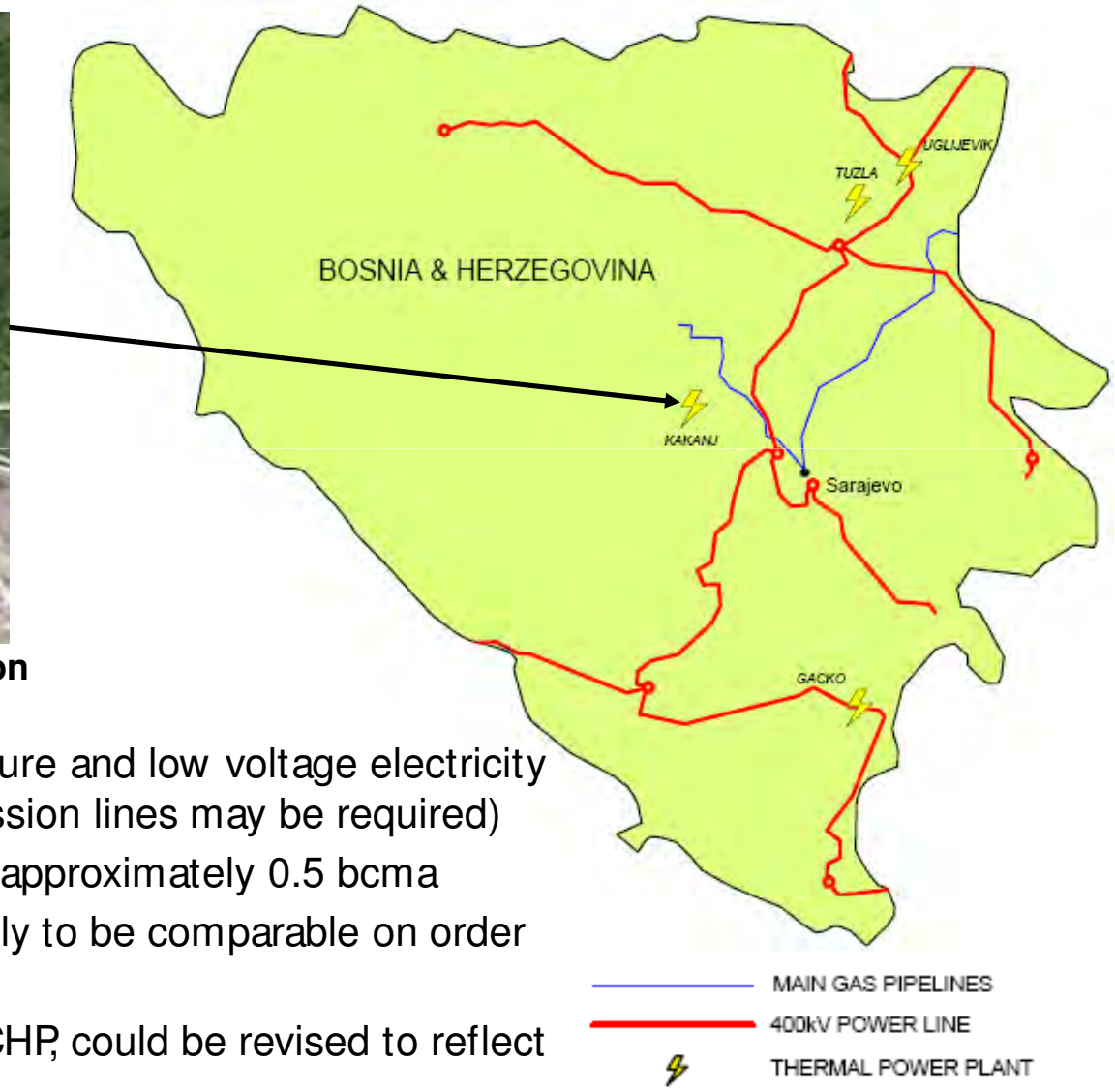


Existing Negotino Thermal Power Station

- No major power station in Macedonia located close to existing gas infrastructure
- Proposed location at existing Negotino power station would require additional gas connector
- Possibility of exporting surplus power to Greece via existing 400 kV interconnector
- Option for CCGT at a 'new' location not explored at this stage but could be favourable

Bosnia and Herzegovina – Potential CCGT at Kakanj (400 MW)

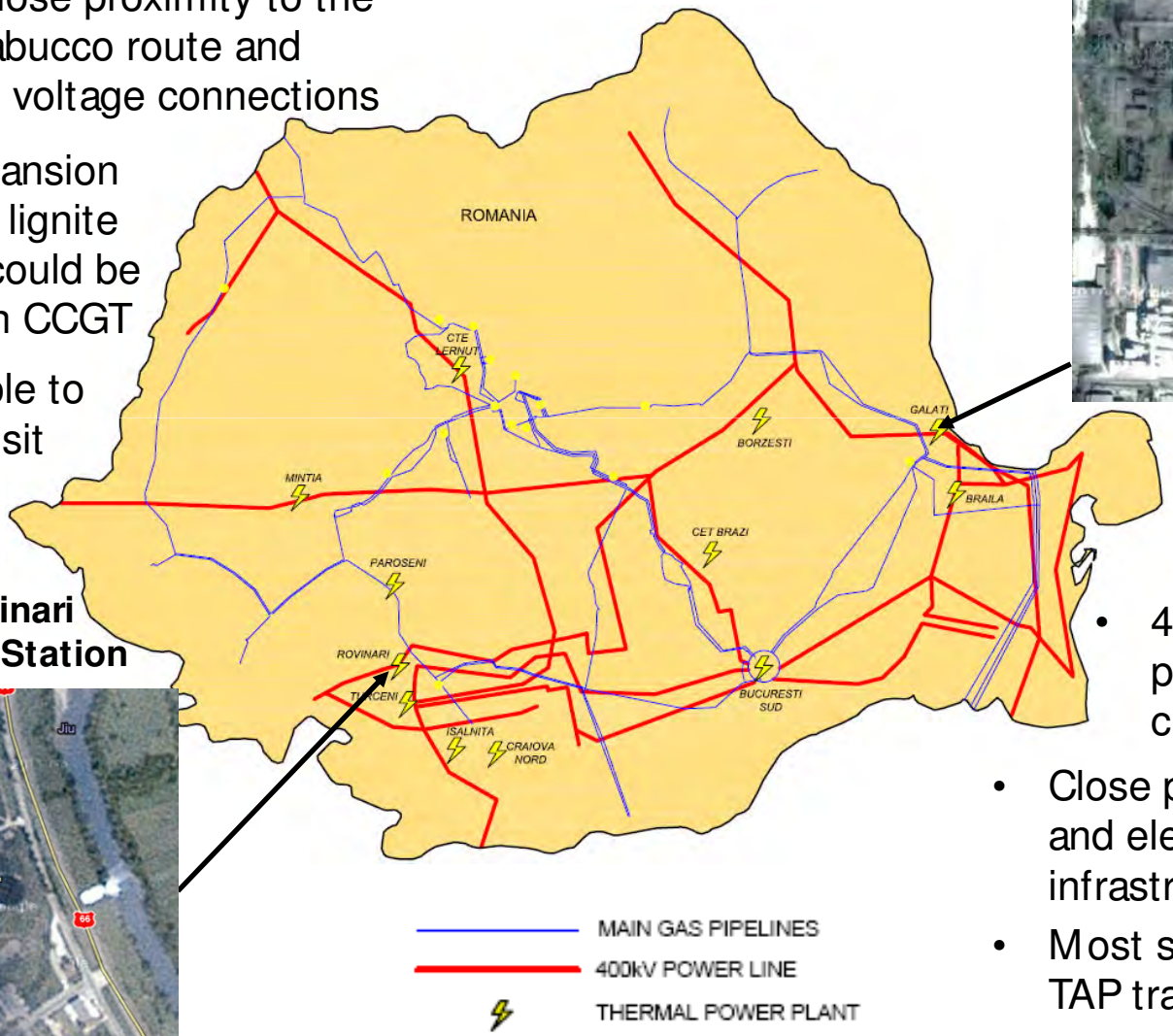
Existing Kakanj Thermal Power Station



- Site connected to gas infrastructure and low voltage electricity (110 kV – higher voltage transmission lines may be required)
- 400 MW CCGT would consume approximately 0.5 bcma
- Alternative location at Tuzla – likely to be comparable on order of magnitude cost basis
- Proposals in place for 100 MW CHP, could be revised to reflect larger CCGT

Romania - Potential CCGT in Galati (400 MW) and Rovinari (500 MW)

- Situated in close proximity to the proposed Nabucco route and existing high voltage connections
- Plans for expansion (500 MW) of lignite fired power could be replaced with CCGT
- Only applicable to Nabucco transit scenario

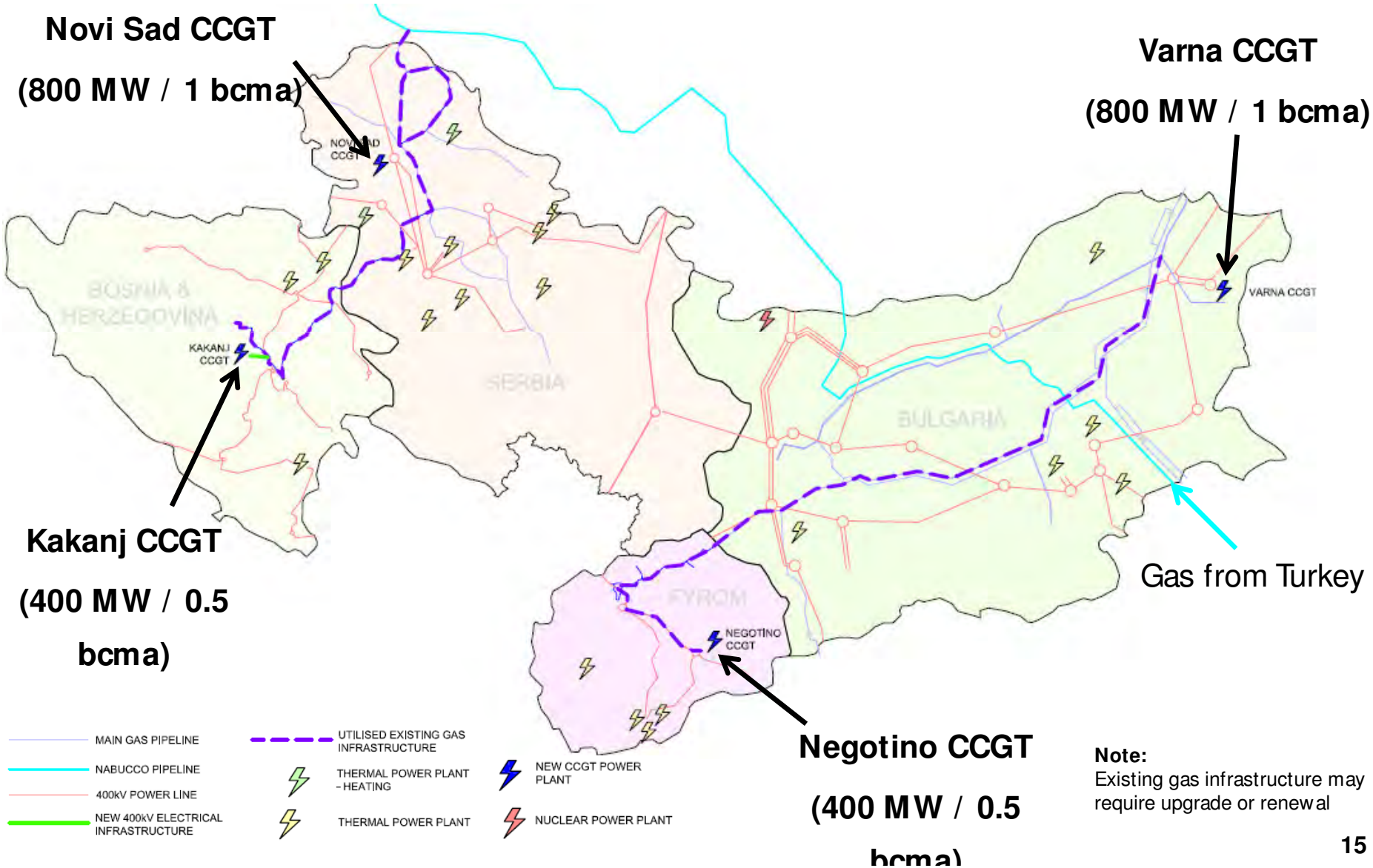


Existing Galati Thermal Power Station

- 400 MW CCGT proposed but currently on hold
- Close proximity to gas and electricity infrastructure
- Most suited to IGI or TAP transit scenario

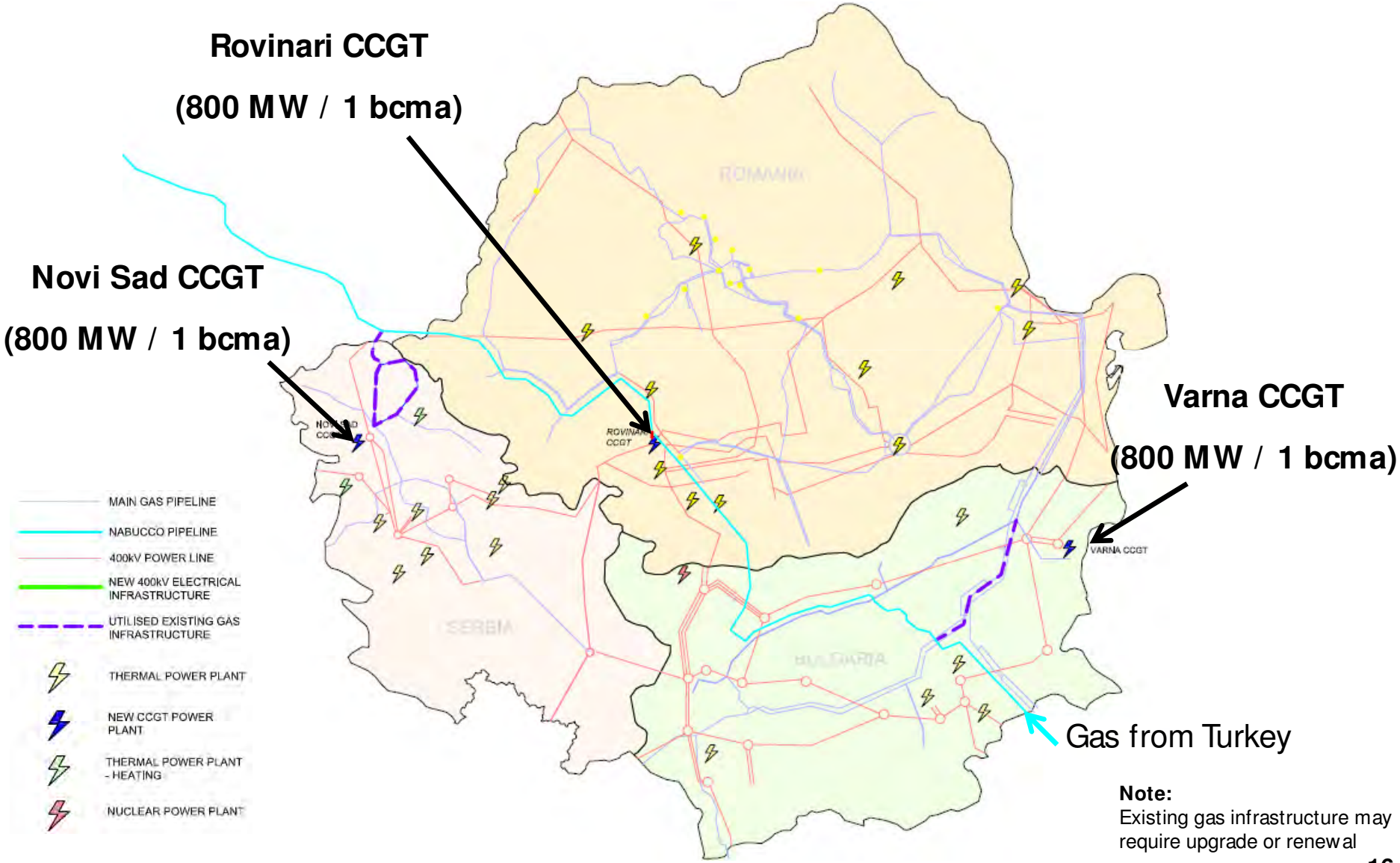
Existing Rovinari Thermal Power Station

Indicative Scenario from Nabucco



Note:
Existing gas infrastructure may require upgrade or renewal

Indicative Scenario from Nabucco (Romania)



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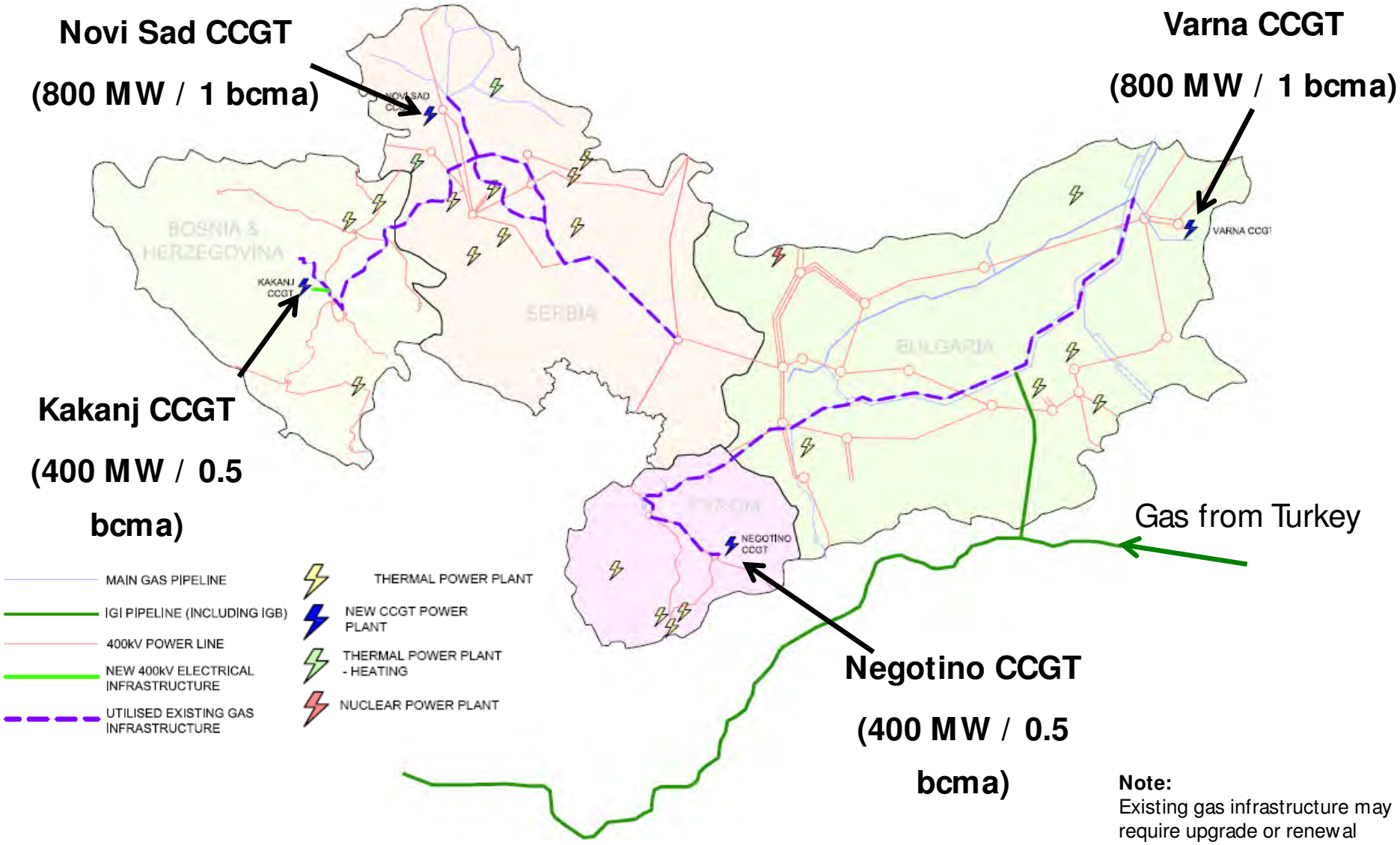
Indicative Scenario from IGI



Note:
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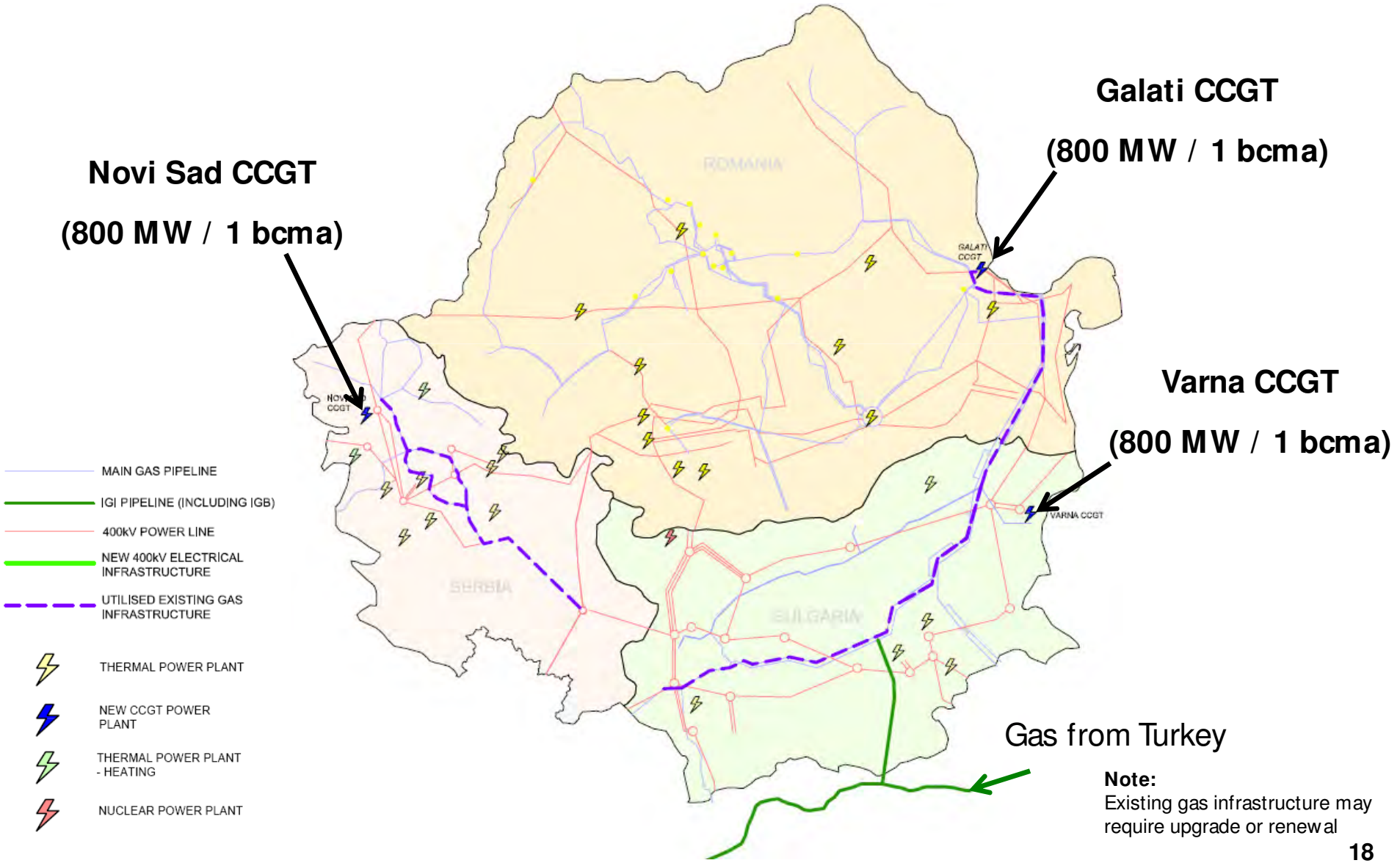
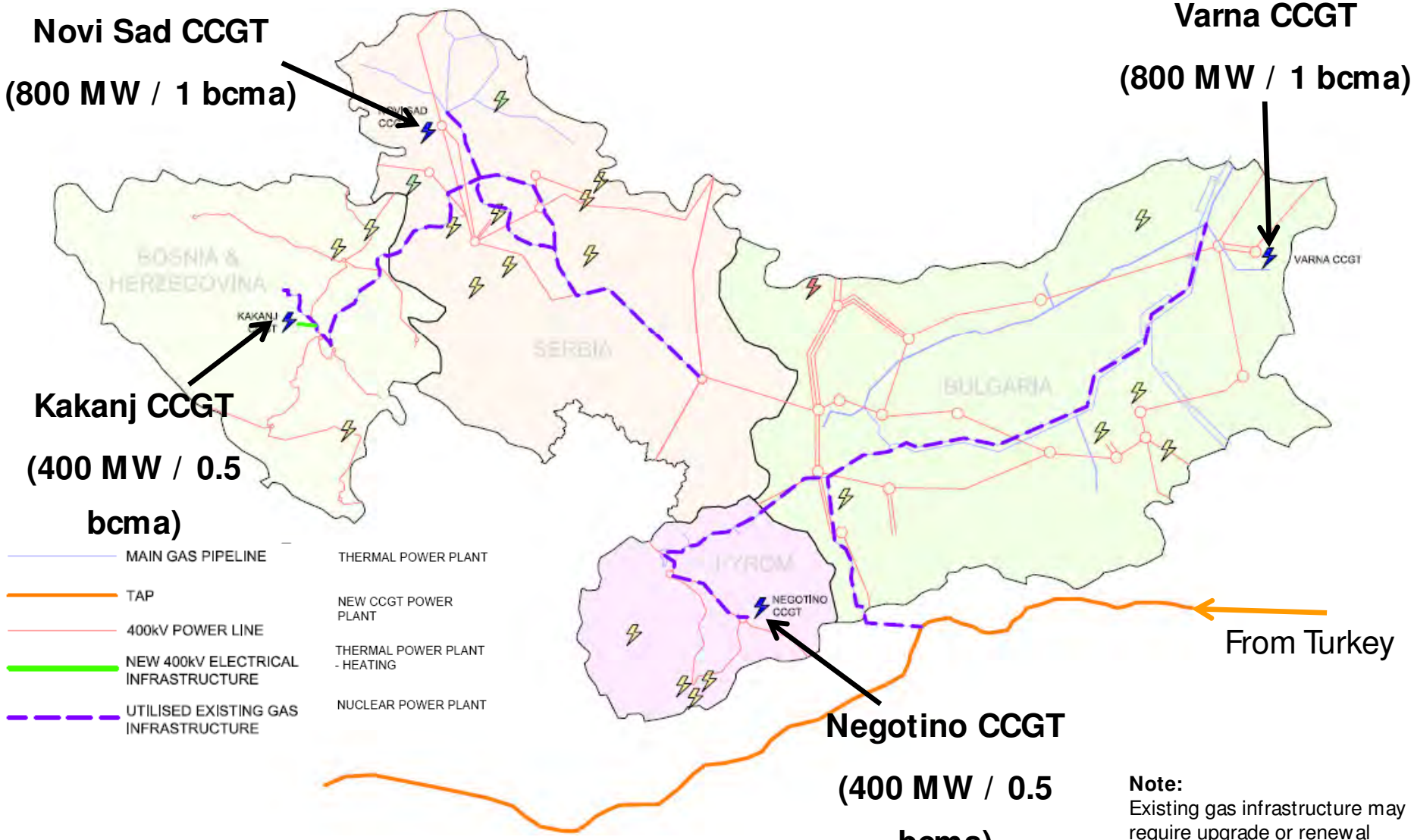
Indicative Scenario from IGI (Romania)



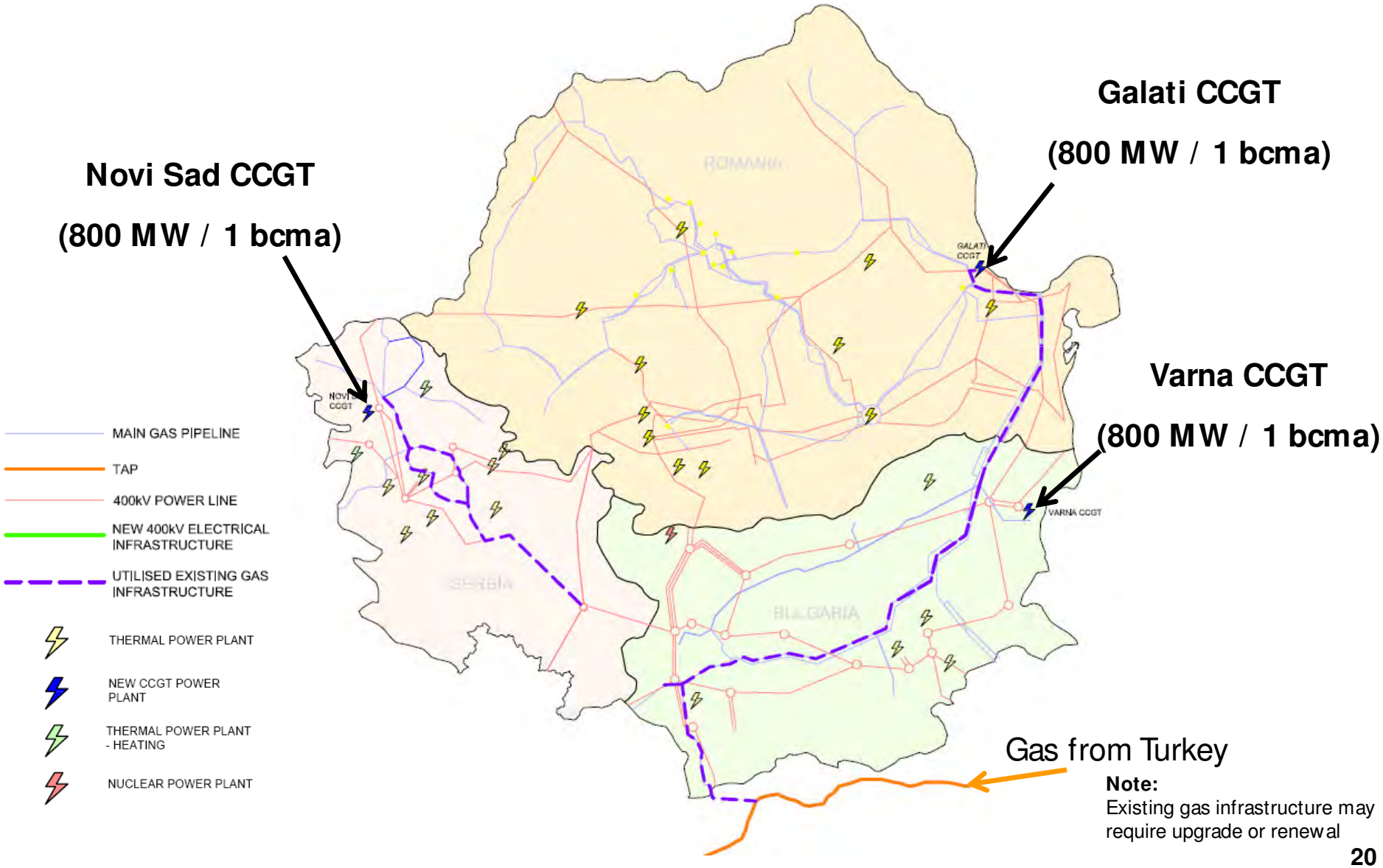
Note:
Existing gas infrastructure may require upgrade or renewal

Indicative Scenario from TAP



Note:
Existing gas infrastructure may require upgrade or renewal

Indicative Scenario from TAP (Romania)



Note:
Existing gas infrastructure may require upgrade or renewal

Summary

- **Opportunities**
  - Increase energy security of energy supply
  - Increased gasification for consumers and industry
  - Improved reliability of electricity supply
  - Environment benefits (including compliance with LCPD)
  - Could attract private investment

- **Challenges**
  - Needs commitment from countries
  - Must meet Energy Community requirements for electricity markets:
    - Market restructuring
    - LCPD closures / refurbishments
    - Cost reflective tariffs

- **...to attract private sector and financing**