Nuclear Energy in South East Europe

The risk of completing Belene NPP

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Vienna International Nuclear Center Competence

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VINCC

International NGO with competences in Peaceful Use of Nuclear Energy

Policies, Strategies VINCC	Knowledge Management NKMI	Legal advisory INLA	Finance and Insurance EXPERTS
Configuration Management GCR - DAVID	EPC G C R, RAS	Project & Process Management RE, NKMI, RAS	IT Services IT Support KM-A, DAVID, GCR
Nuclear Engineering GCR, RTA,	Risk Management GCR, NKMi,	Design, Licensing, Commissioning RE,MEATEX	Management Systems NKMI
Waste Management EXPERTS	Seismic analysis GCR	Radiation measurement and Protection MEATEX, Healvita	Feasibility studies GCR, VINCC

VINCC Mission:
"Integrate and Share Competence of VINCC Members"

- Improved international visibility and reputation
- Synergies among cluster companies and partners
- Operating on the market with a wider portfolio
- Cooperation with scientific organizations
- Maintaining of high quality human resources
- Access to new nuclear programs in new countries
- Cross-selling (Health, Agriculture, Industry, etc.)
- Lobbying in the international community in Vienna
- Innovative approach to work with large, demanding clients (like Rosatom, EdF, CNNC, etc.)

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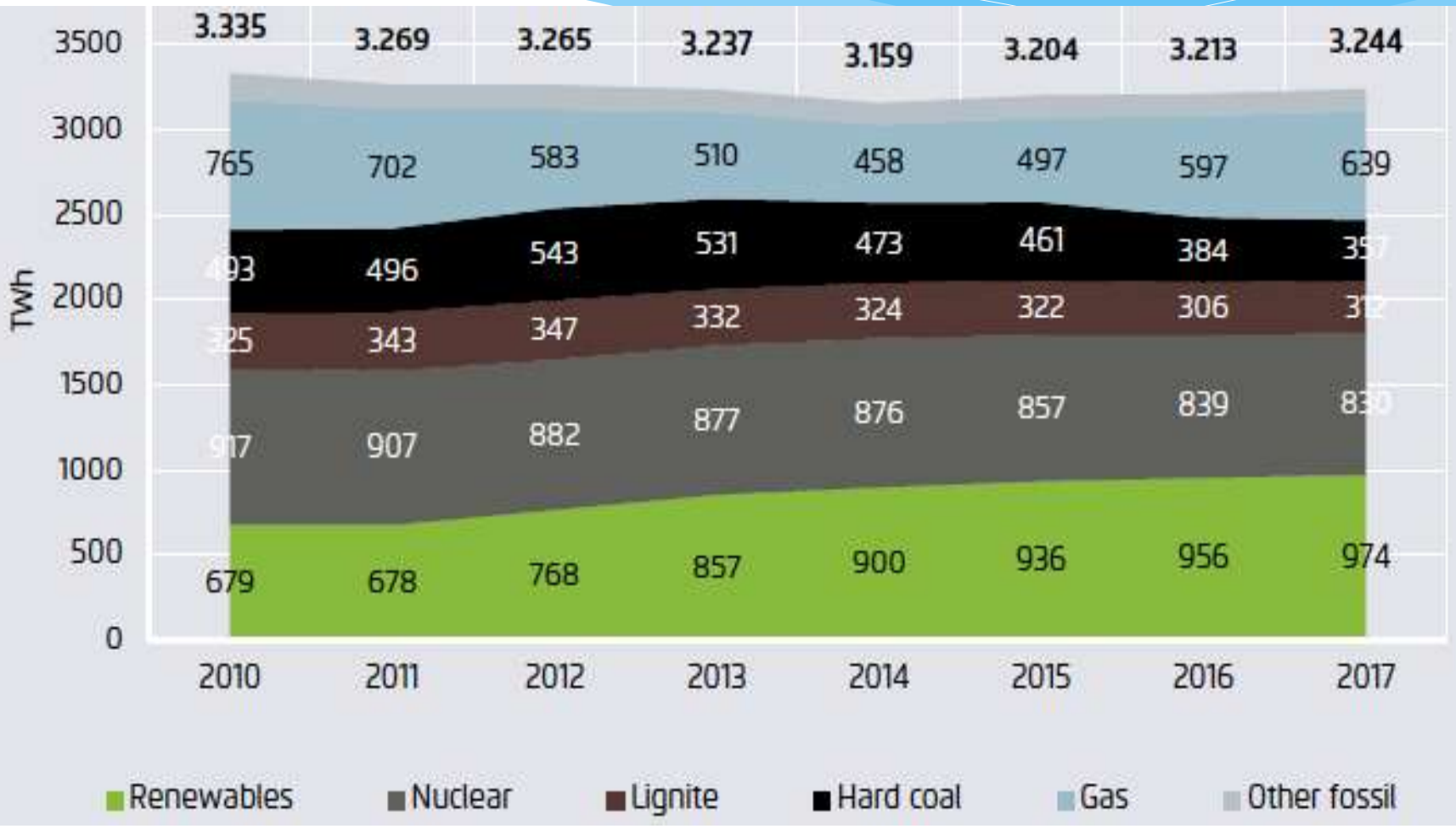
- Higher credibility and competiveness
- Expanded markets and opportunities
- Wider capacity to deliver services
- Consolidated excellence in safety and security
- Customer satisfaction and follow up

EU Electricity generation



South-East Europe Energy

* Southeast Europe is headed for an energy crisis.

* The region has an energy infrastructure that is unreliable, inefficient, and unsustainable,

* At the same time it is faced with the need to reduce dependence on external sources and conform to EU climate and air quality regulations.

The Balkans

* The energy system in Southeast Europe – especially in the Balkan peninsula – has been suffering from chronic underinvestment since the dissolution of the Eastern Bloc and the breakup of the Yugoslav state.
* Now, a combination of geopolitical and environmental factors has made it extremely urgent to take measures to modernize the sector.

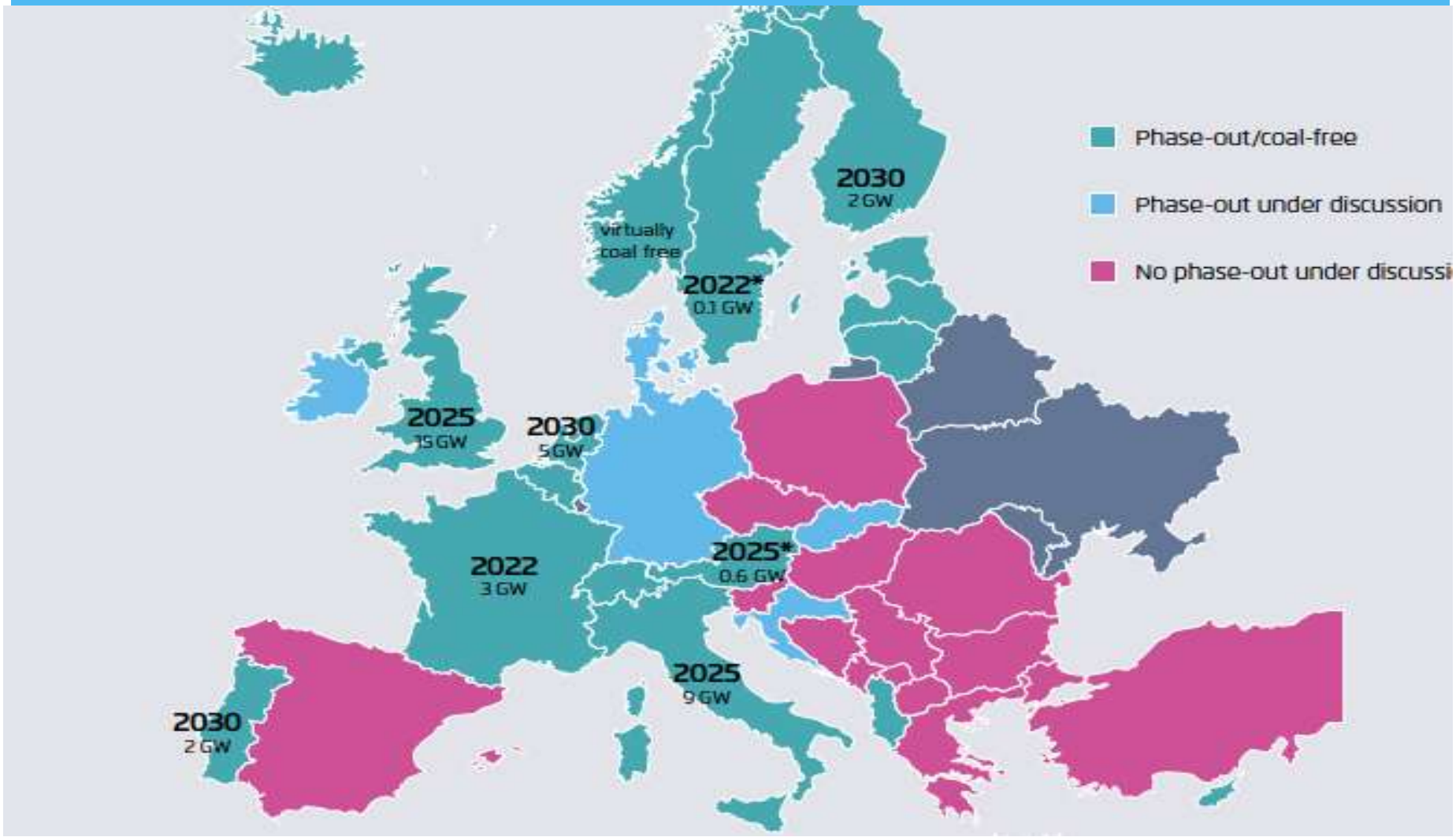
Geopolitics

* The Balkans have always been and currently are a target of major geopolitical interests especially when transport corridors, transmission lines and pipelines are potentially considered or eventually planned and built.
* The European Union, post-Paris Agreement, has adopted a raft of rigorous, binding environmental legislation, designed to reduce carbon emissions and enhance sustainability

Coal phase-out

* If EU accession is in part contingent upon the decommission of the region's oldest coal-fired thermal plants – over 11 GW of installed coal-fired capacity, commissioned before 1980 – this could occur as early as 2027.
* Reform to Phase 4 of the EU Emissions Trading Scheme (ETS) is another factor that will quicken the arrival of electricity deficits.
* The reinvigoration of the market stabilization reserve (MSR) in conjunction with an acceleration in the rate at which the total number of allowances is reduced will cause the price of a European Emission Allowance (EUA) to rise above its current depressed level.

Coal phase-out policies



Coal phase-out

* **The Impact of New Trends and Policies makes clear the necessity and urgency of radical action.**

* **Should governments fail to sufficiently expand generation capacity in the immediate future, Southeast Europe (Albania, Bosnia and Herzegovina, Bulgaria, Kosovo, Greece, Hungary, Macedonia FYR, Montenegro, Romania, and Serbia) could become a net importer of electricity as soon as the early-2030s.**

Electricity Import ?

* To import this deficit would be expensive.

* The EU Reference Scenario 2016 (EURS16) indicates that the EU-wide electricity price could reach €165 per MW/h (2013 prices) by 2035, substantially in excess of what nations in the regions are forecast to pay (€148 and €144 in Romania and Bulgaria in 2040 respectively).

Renewable energy and integration cost

* In it is expected in 2040, more than half (61%) of installed capacity and 44% of actual electricity generation in southeast Europe to be powered by renewable energy sources.
* The EU's Energy roadmap 2050 projects that the latter figure will rise to 55% by 2050.
* The levelised cost of electricity (LCOE) – of renewable energy source generation and has approached the generation cost of fossil fuel fired power generation cost in some regions of the world.

Economic barriers

* Recently Potsdam Institute of Climate Impact Research has shown that the integration cost – the sum of grid, balancing, and interaction costs – of renewable energy increases as its share of final electricity generation expands.
* For example, an increase in the final electricity share held by wind power from 10% to 30% leads to an increase in system cost – the sum of generation and integration costs – of €20 per MWh.
* System LCOE and integration costs will significantly increase with [variable renewable energy] penetration and can thus become an economic barrier to further deployment of wind and solar power."

New Nuclear capacity

* Therefore, it seems clear that significant investment in new nuclear capacity must be seriously considered.

* At present, nuclear capacity in Southeast Europe slightly exceeds 5,000 MW, with Bulgaria, Hungary, and Romania accounting for 36%, 37%, and 27% of regional capacity respectively (EURS16).

* In the region, this capacity currently accounts for 13% of total electricity generation.
* Nuclear investment requires potential knowledge infrastructure!

Nuclear Capacity Forecast

* Capacity is forecasted to rise to 8,440 MW by 2040 (EURS16), an increase of 3,164 MW, split between Romania (1,414 MW) and Hungary (1,732 MW).
* Romania plans to add two new 720 MW reactors to the nuclear power plant in Cherna Voda (to be operational in the early 2020s).
* In Hungary, two 1,200 MW units are to be added to the Paks plant and connected to the grid by 2030 (net capacity expansion is only 1,732 MW due to the planned retirement of existing Paks units).

Bulgarian Nuclear Power Project

- **Project status**
  - Waits for decision of parliament
  - Site licensed
  - Equipment on site
  - Investors' interest reported
  - Expenditures to date → 1.5 billion Euros
- **Legal status**
  - Project owner - NEC
  - Serious legal analysis still needed depending on model
    - Who owns what
    - Which permissions are valid or need renewal

Project Issues and Considerations

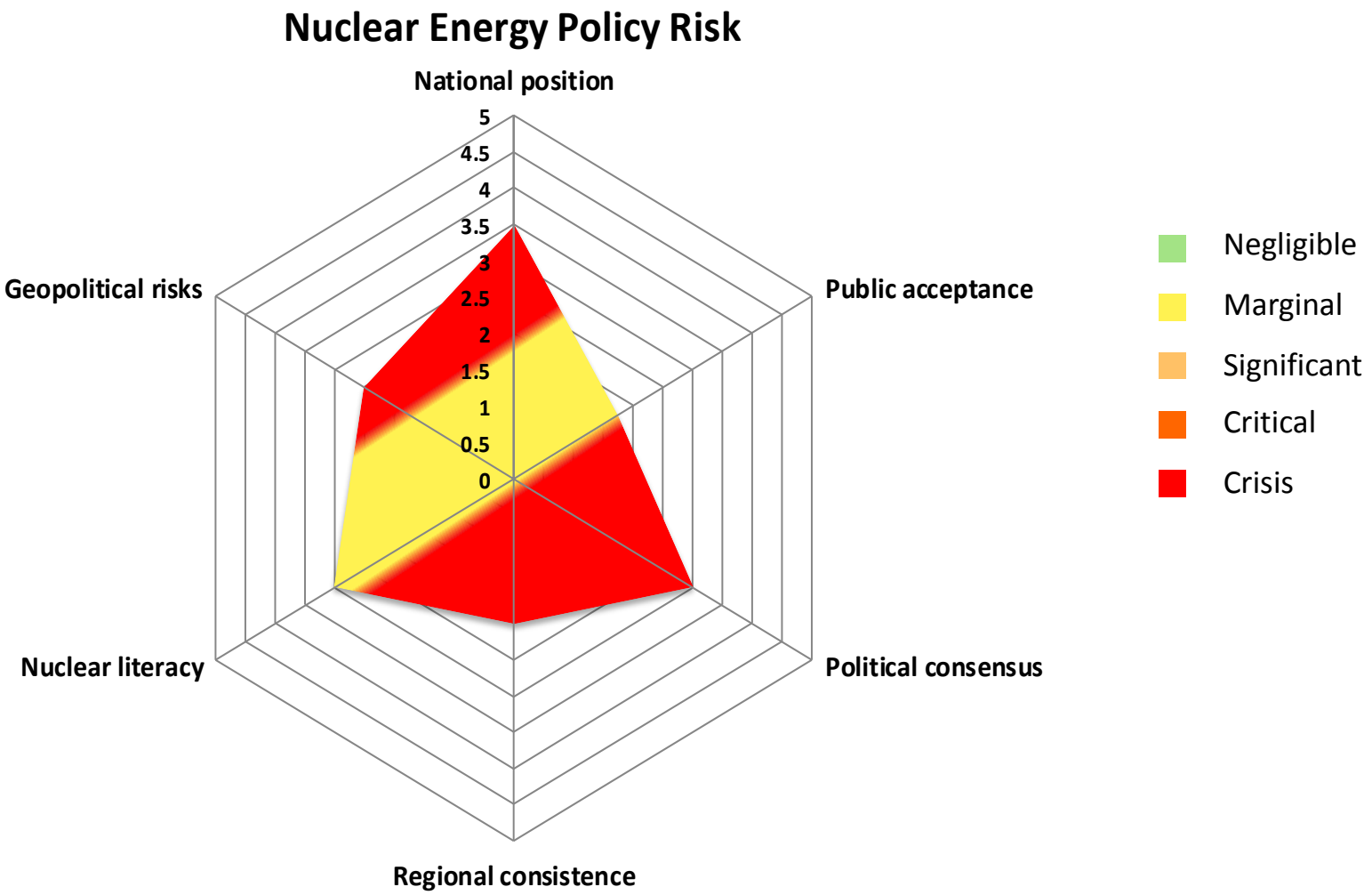
- **Energy security**
  - Adequate national electricity generating capacity
  - Adequate fuel access
  - Affordable and reliable electricity services
- **Environment & Maritsa East**
  - Compliance with EU air quality directives
  - BG's nationally determined contribution (NDC) under the Paris Agreement
- **Future of Kozloduy Units 5 & 6 after 40?**
- **Temporal scope (NPP project needs around 10 years)**
- **Completion cost uncertainty**
  - EPC
  - Finance conditions

Risk Categories

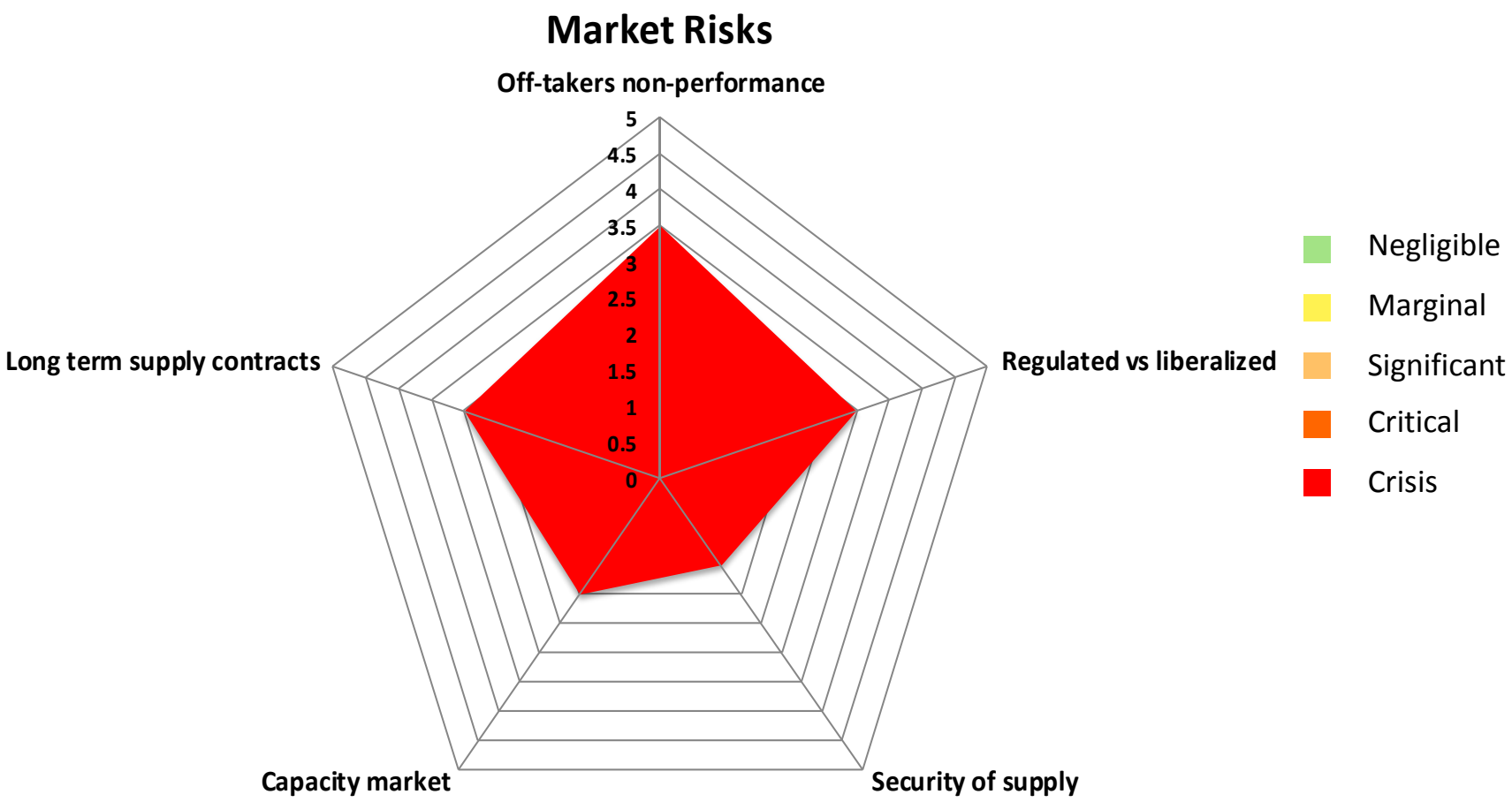
US DOE RISK MATRIX

Consequence	1	2	3	4	5
	Negligible	Marginal	Significant	Critical	Crisis
Cost	Minimal or no consequence. No impact to Project cost.	Small increase in meeting objectives. Marginally increases costs.	Significant degradation in meeting objectives significantly increases cost; fee is at risk.	Goals and objectives are not achievable. Additional funding may be required; loss of fee and/or fines and penalties imposed.	Project stopped. Funding withdrawal; withdrawal of scope, or severe contractor cost performance issues.
Schedule	Minimal or no consequence. No impact to Project schedule.	Small increase in meeting objectives. Marginally impacts schedule.	Significant degradation in meeting objectives, significantly impacts schedule.	Goals and objectives are not achievable. Additional time may need to be allocated. Missed incentivized and/or regulatory milestones.	Project stopped. Withdrawal of scope or severe contractor schedule performance issues.
Probability					
Very High >90%	Low	Moderate	High	High	High
High 75% to 90%	Low	Moderate	Moderate	High	High
Moderate 26% to 74%	Low	Low	Moderate	Moderate	High
Low 10% to 25%	Low	Low	Low	Moderate	Moderate
Very Low <10%	Low	Low	Low	Low	Moderate

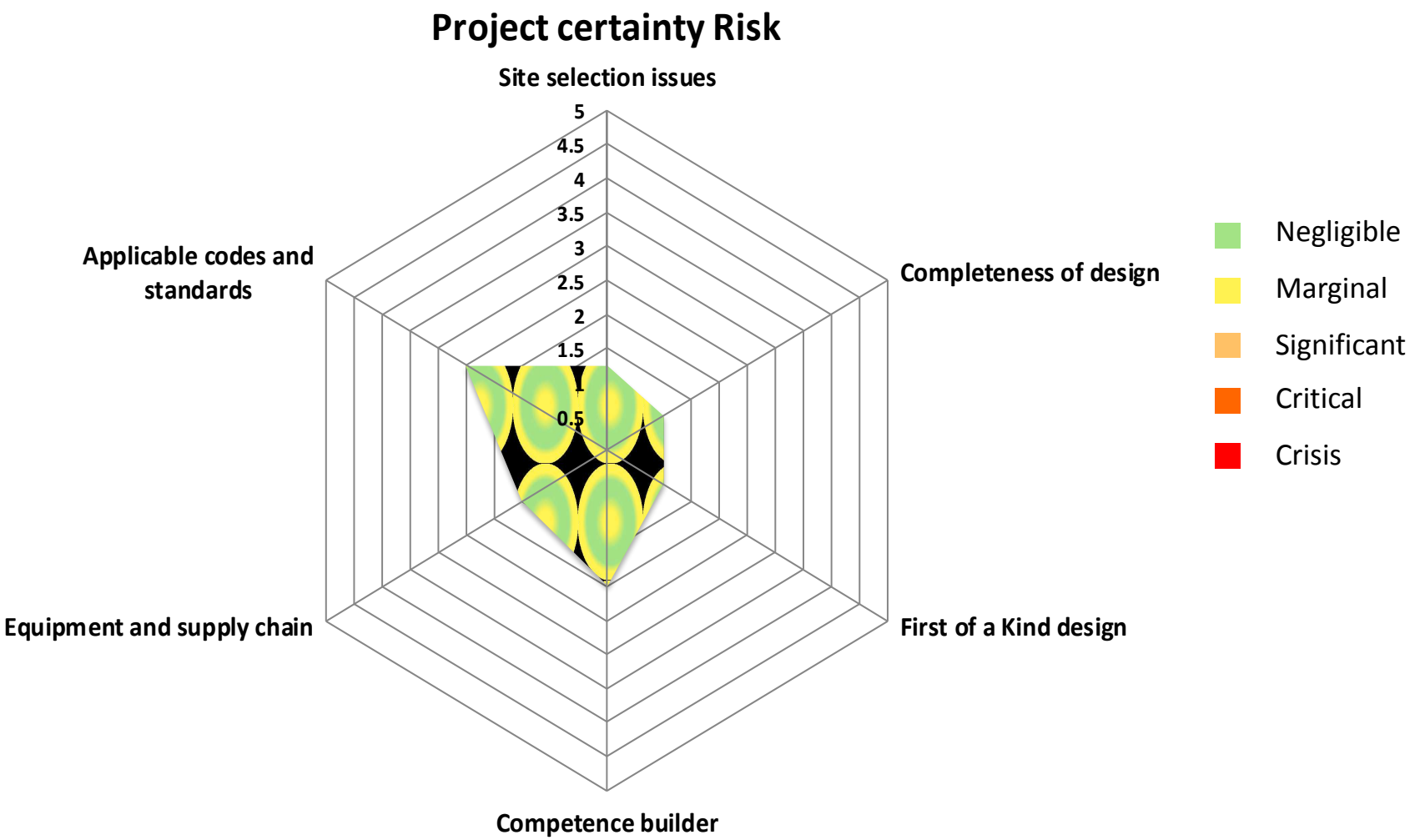
Project Risks Assessment



Project Risks Assessment



Project Risks Assessment



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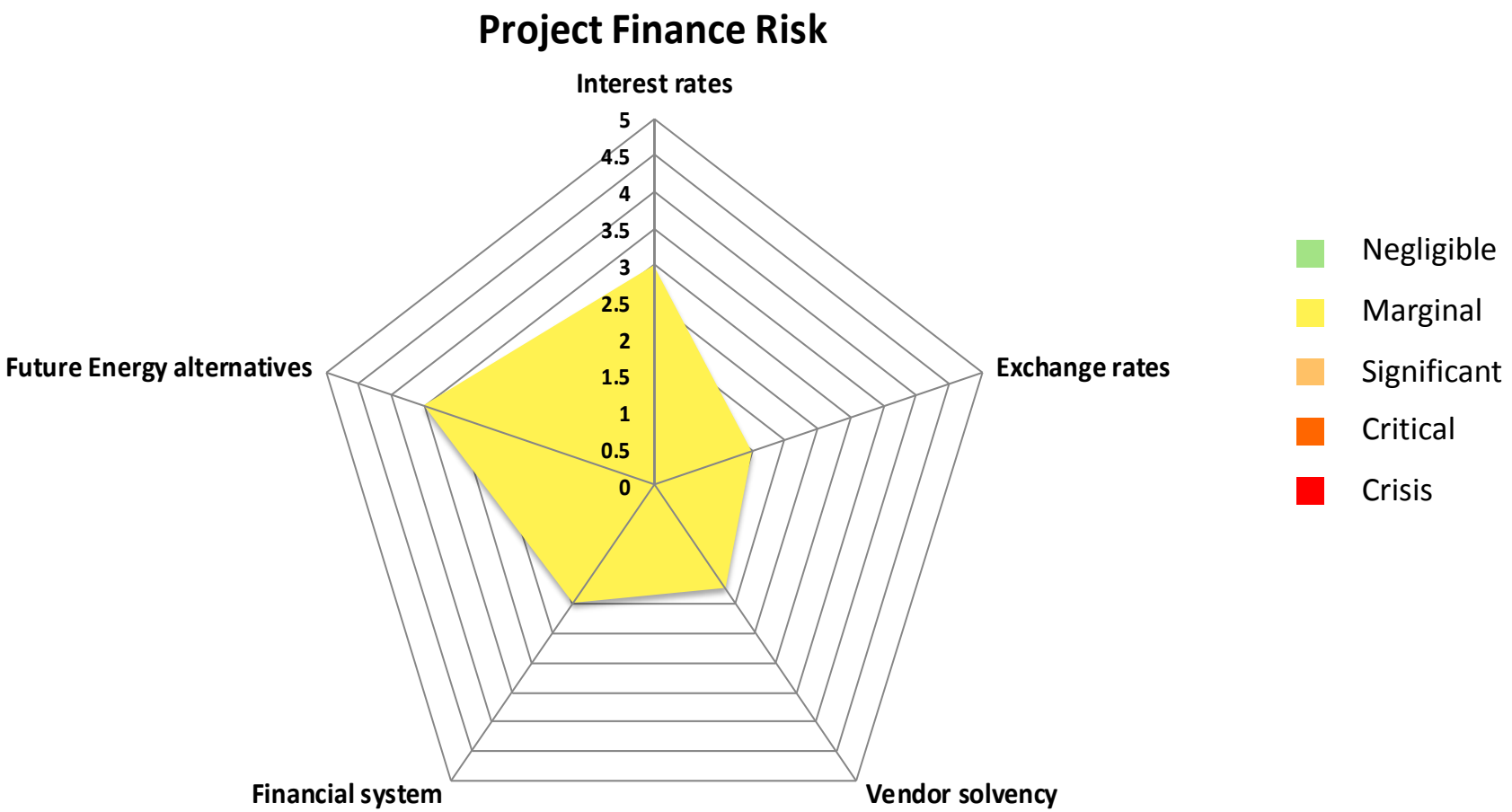

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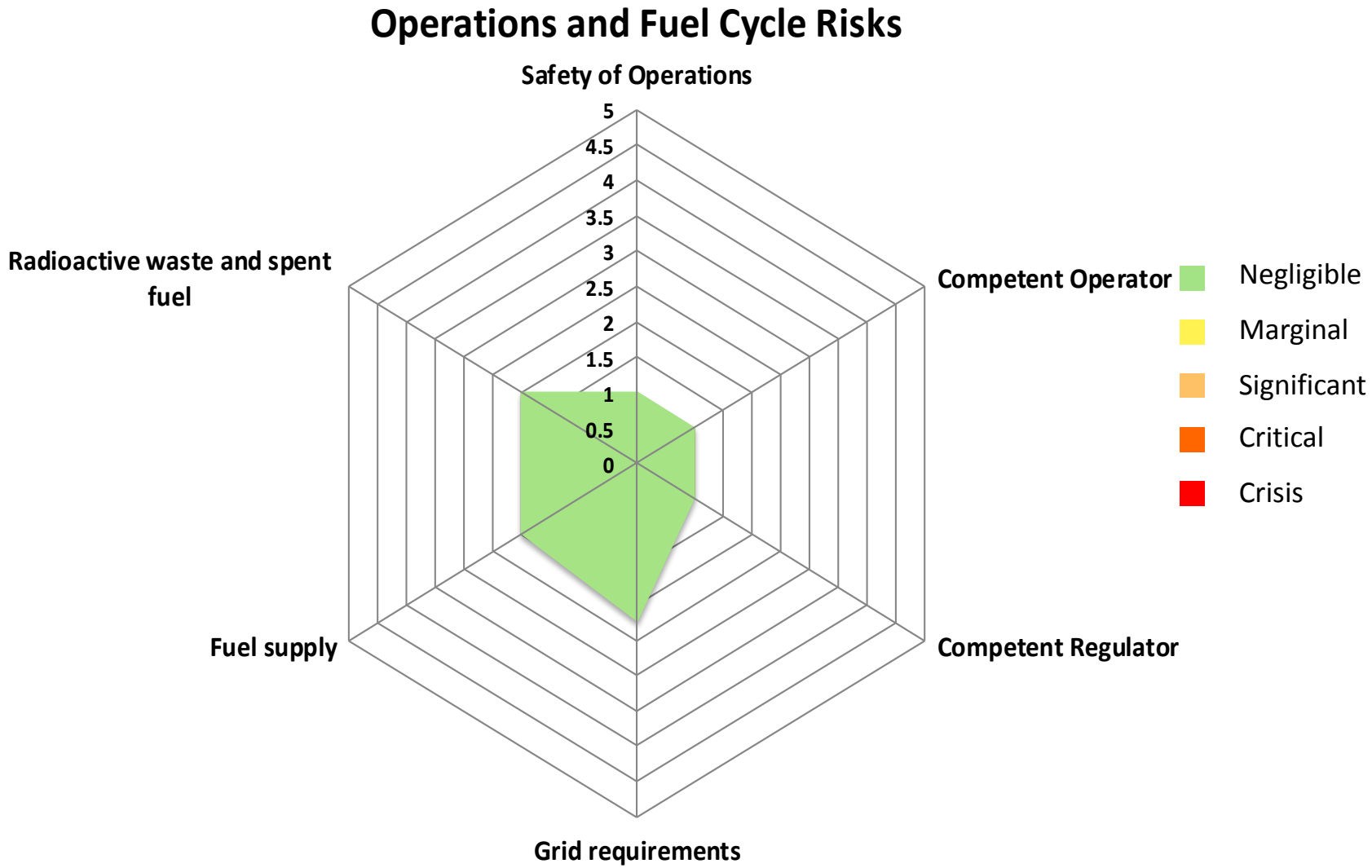

Conclusions

* Inadequate national and regional generating capacity very likely.
* Very likely environmental costs/penalties prohibitively expensive.
* Reliable baseload needed to supplement variable renewables.
* Against this backdrop Belene NPP carries relatively lower risks than most other NPP projects abroad
  * Proven design built and operated elsewhere
  * Heavy forging equipment on-site
  * Site practically prepared
  * Design already licensed and reviewed by EC
  * Public acceptance
  * Nuclear literate workforce
  * Finance currently available at attractive terms
* Highest risk for Belene NPP: Do nothing with uncertain future electricity supplies and costs

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Thank you

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