

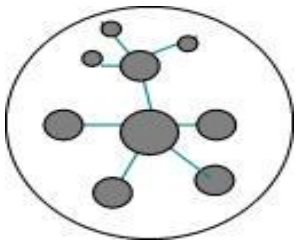
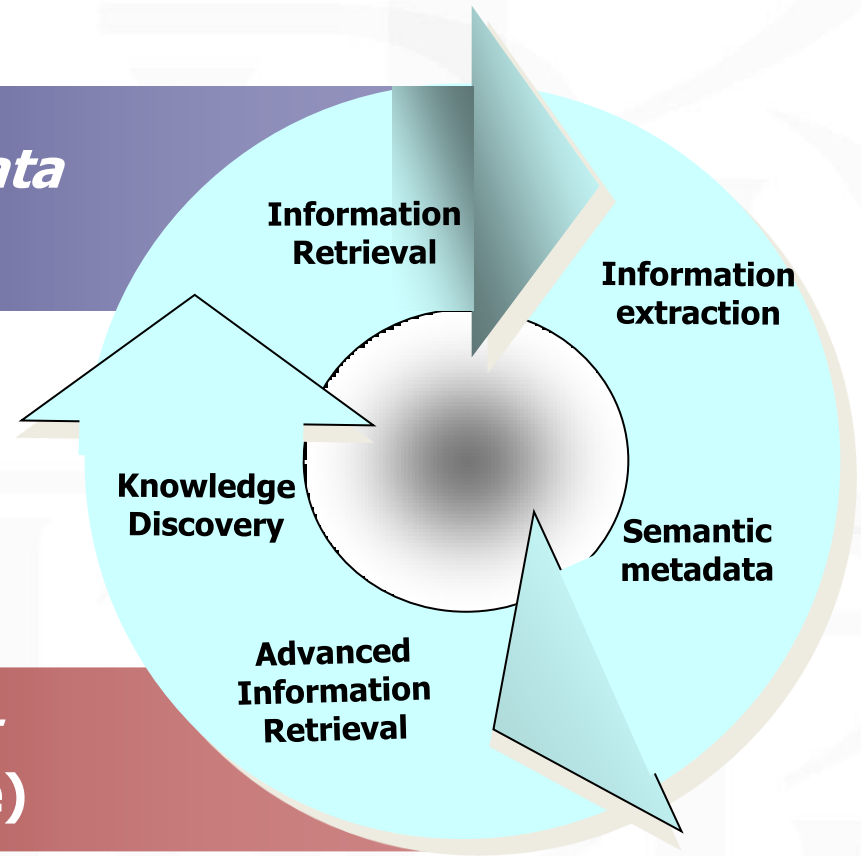
TechMining for Scenarios

Future of Sustainable Military Operations under Emerging Energy and Security Considerations

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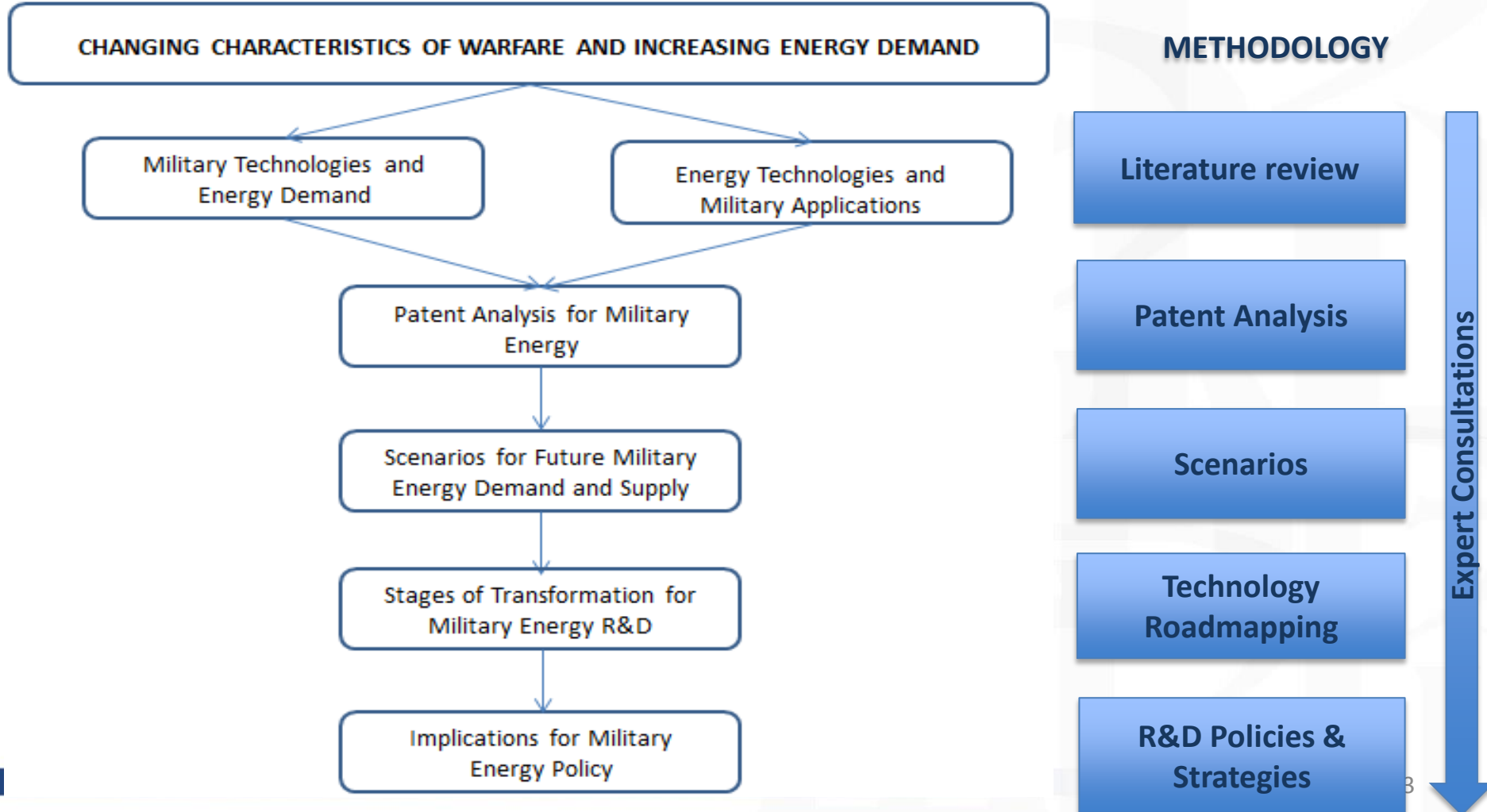


Semi-structured Data
(implicit knowledge)



Structured content
(explicit knowledge)

Future of Sustainable Military Operations under Emerging Energy and Security Concerns





NATO tankers are parked near oil terminals in the port city of Karachi after Pakistani authorities shut vital NATO supply routes into Afghanistan (2011)

- **Energy Generation**

- Conventionals: Coal, Oil, Gas, Nuclear
- Renewables: Wind, Solar, Hydro, Geothermal
- New sources: Algae, Hydrogen, Waste



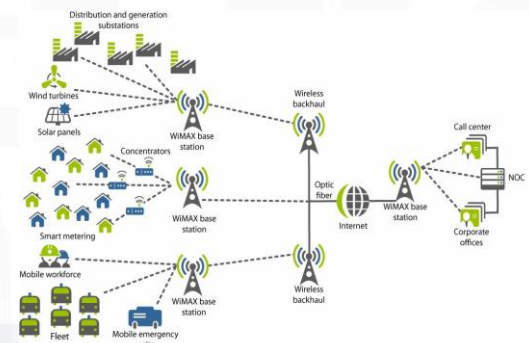
- **Energy Storage**

- Flywheel, battery, supercapacitor, hydrogen, pneumatic, pumped storage technologies



- **Energy Transfer**

- Smart and micro-grids, wireless



Evolution of technologies: Patent analysis

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Search

"military"
Example: recharg* lithium batter*

OR "energy"
Example: recharg* lithium batter*

OR "
Example: recharg* lithium batter*

Add Another Field >>

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- Timespan
 - All years (updated 2013-05-22)
 - From 1963-66 to 2013 (default is all years)
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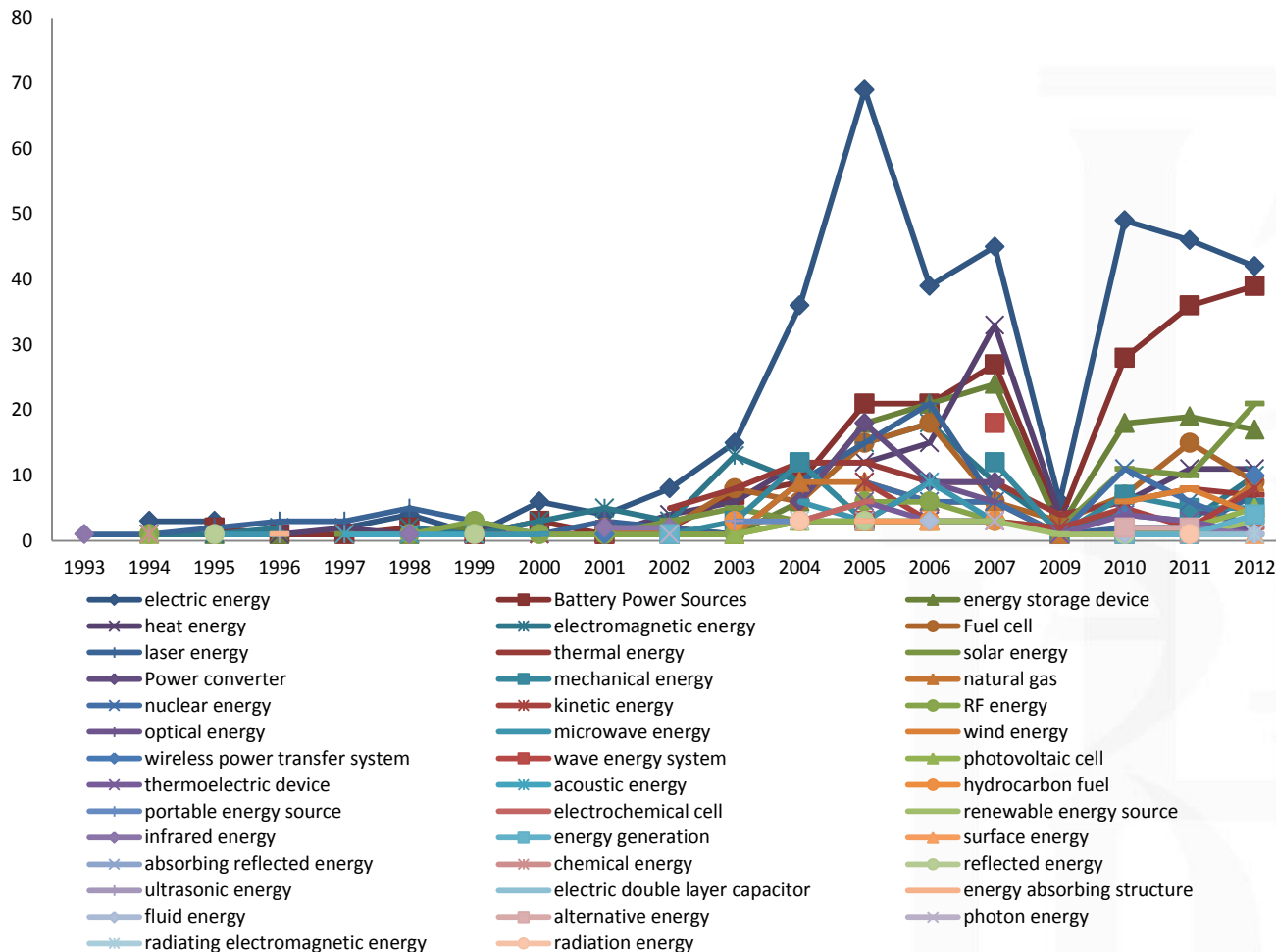
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- 3,000 patents (1962 to present)
- 55,305 phrases
- Cleaning, NLP and expert consultations: 264 phrases
- Clustering with Principal Components Decomposition: 104 phrases
- Further cleaning and consultations: 42 phrases (representing 42% of all patents)

Key phrases identified

	Energy Phrases	Number of Instances
1	electric energy	379
2	Battery Power Sources	204
3	energy storage device	133
4	heat energy	121
5	electromagnetic energy	101
6	Fuel cell	92
7	laser energy	88
8	thermal energy	82
9	solar energy	68
10	Power converter	50
11	mechanical energy	49
12	natural gas	46
13	nuclear energy	43
14	kinetic energy	38
15	RF energy	33
16	optical energy	30
17	microwave energy	26
18	wind energy	25
19	wireless power transfer system	24
20	wave energy system	22

21	photovoltaic cell	19
22	thermoelectric device	18
23	acoustic energy	16
24	hydrocarbon fuel	14
25	portable energy source	14
26	electrochemical cell	12
27	renewable energy source	12
28	infrared energy	11
29	surface energy	7
30	absorbing reflected energy	6
31	chemical energy	6
32	reflected energy	6
33	ultrasonic energy	6
34	electric double layer capacitor	5
35	energy absorbing structure	5
36	fluid energy	5
37	alternative energy	4
38	photon energy	4
39	radiating electromagnetic energy	4
40	radiation energy	4



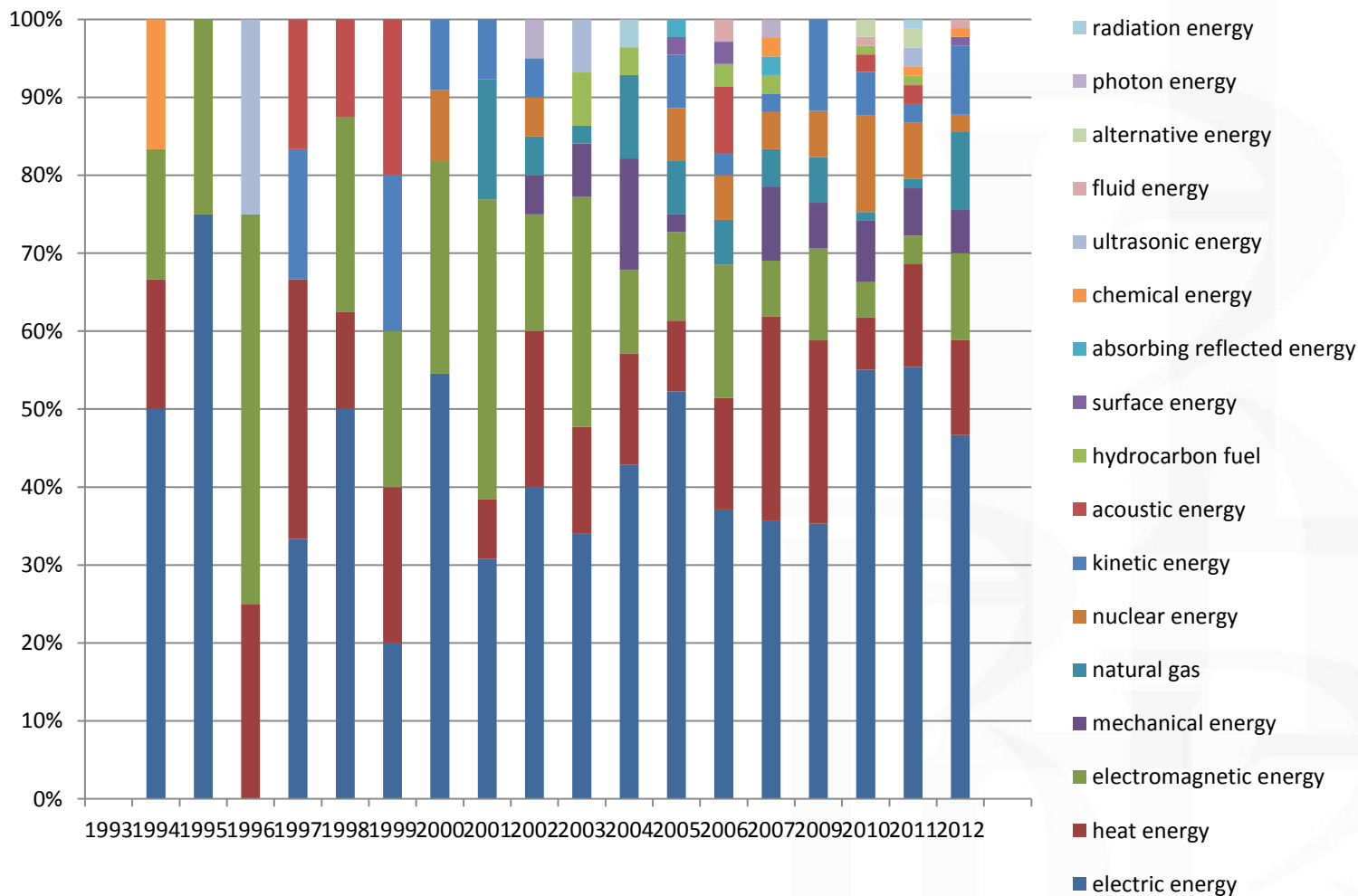
Clusters

1. Energy generation

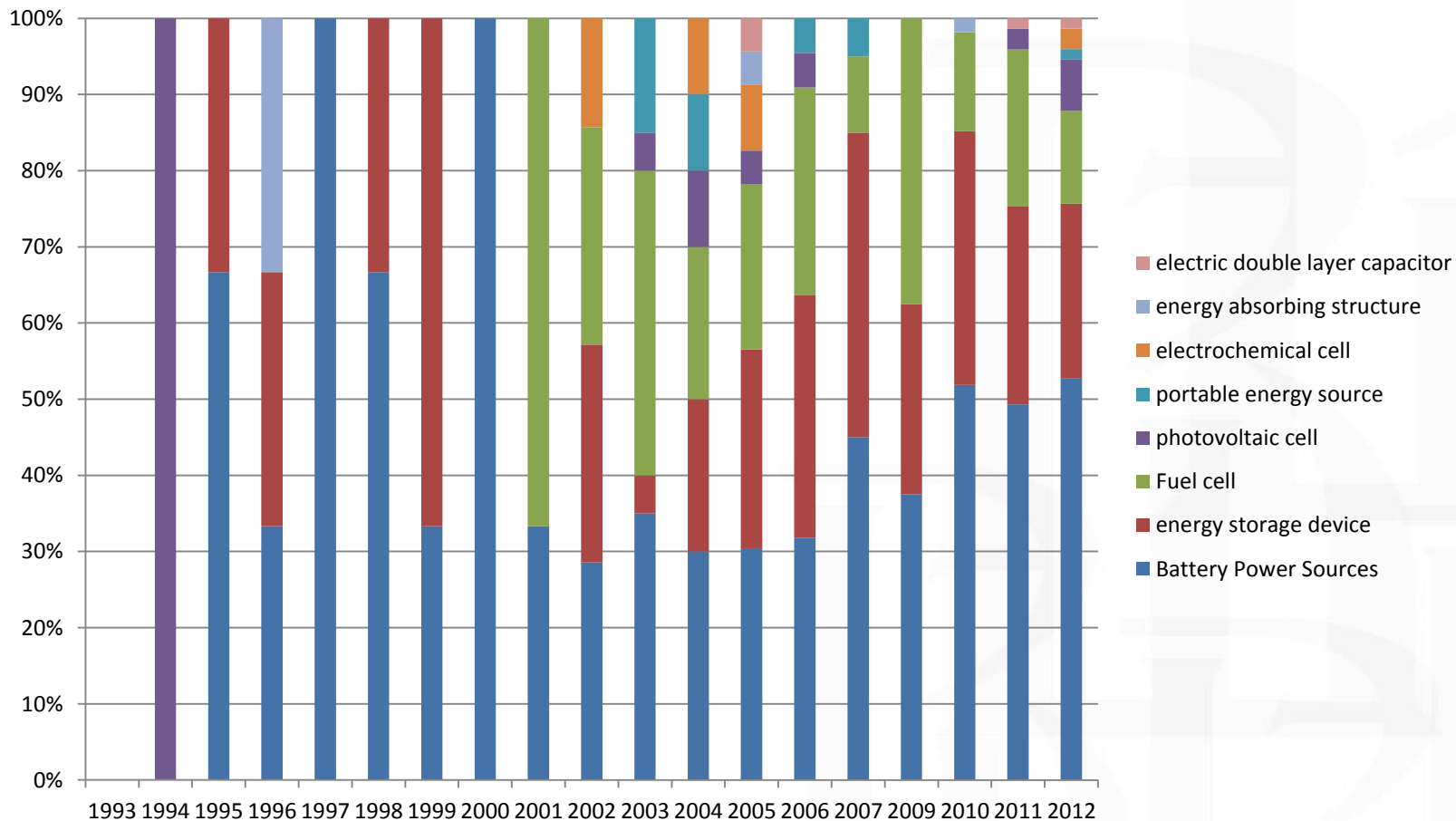
2. Energy storage

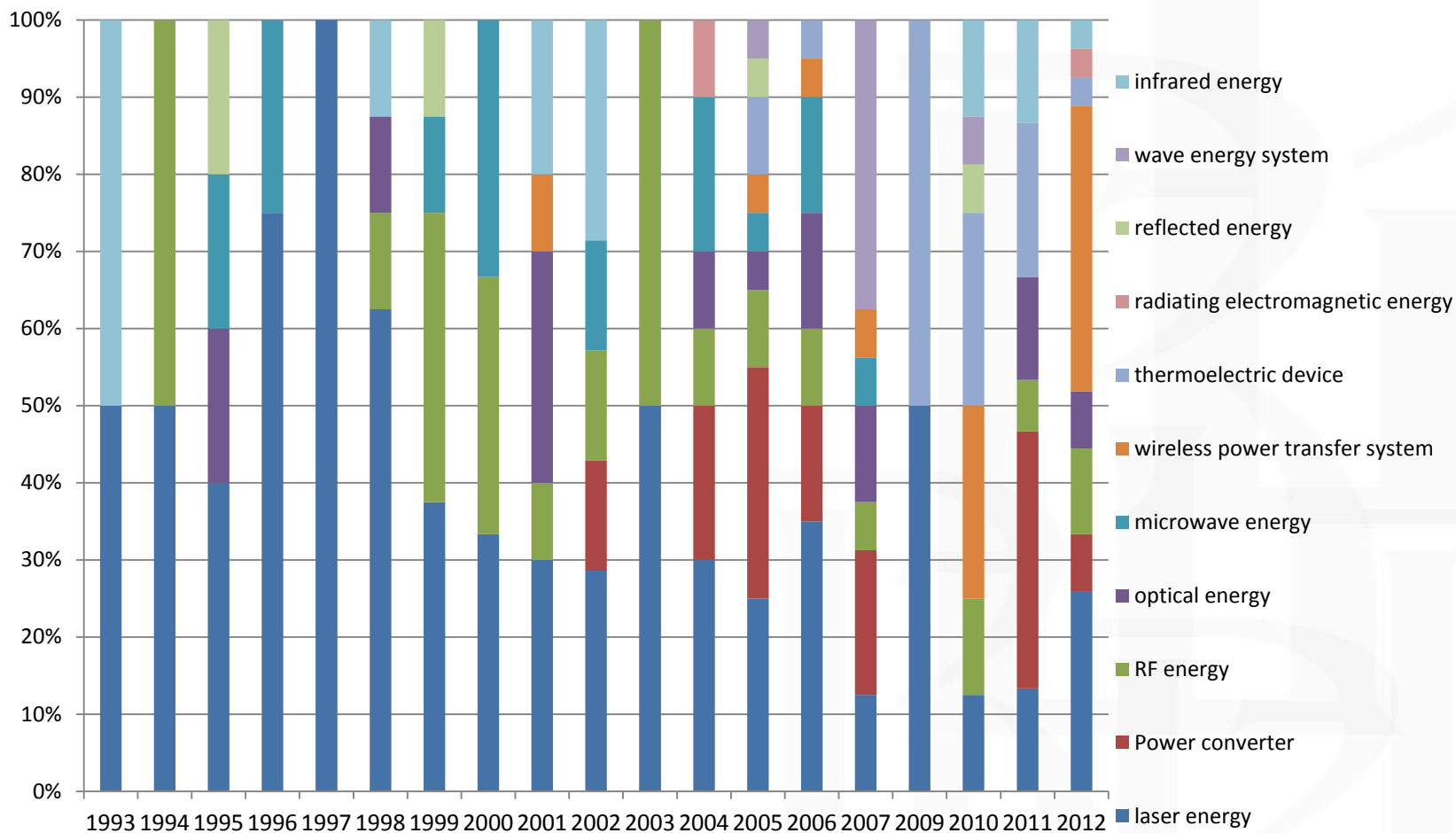
3. Energy transfer

Energy generation technologies

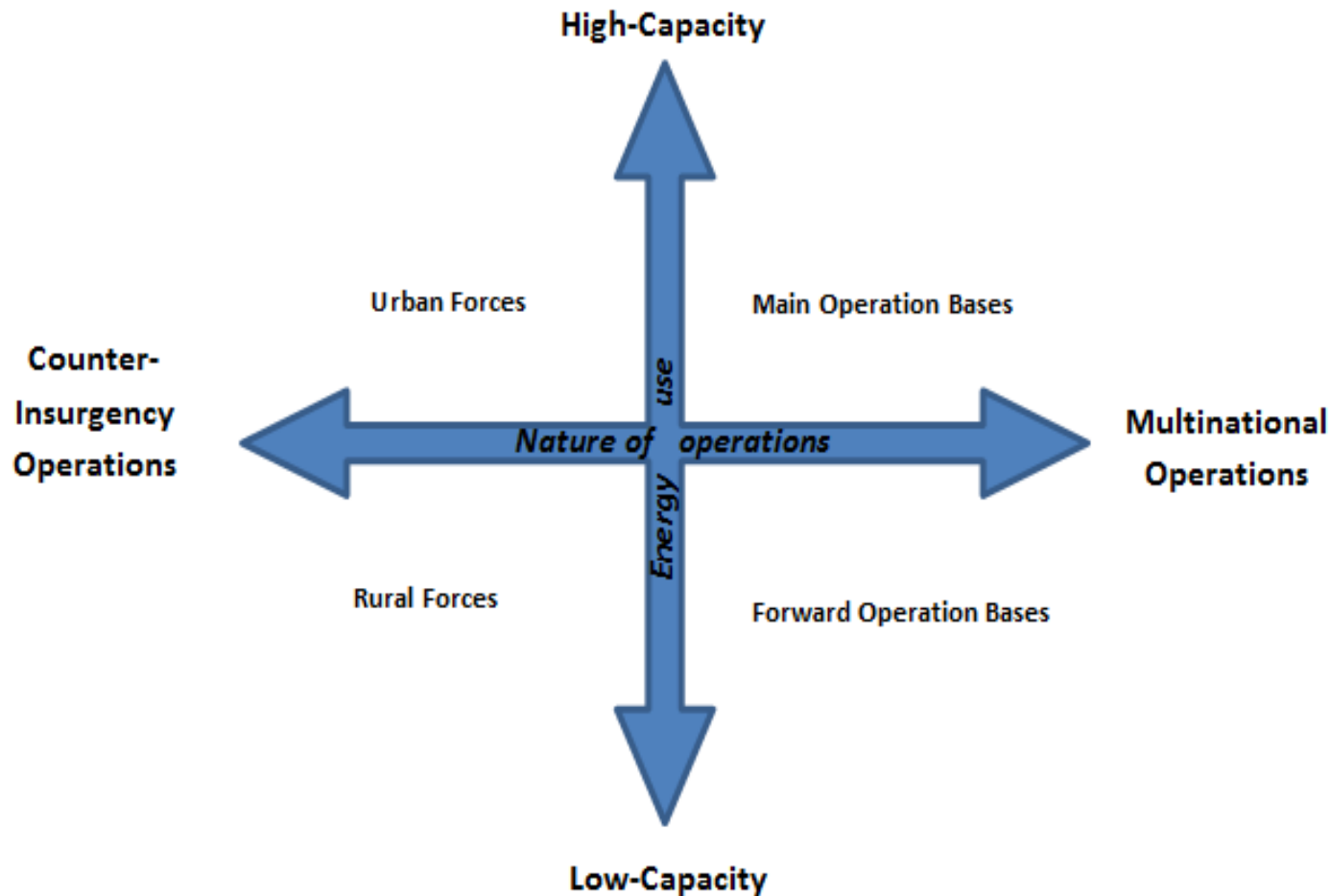


Energy storage technologies





Military Energy Scenarios



Future scenarios & priority technologies

Urban forces

On-demand energy supply systems

Base stations for energy transfer

Energy generation using urban networks

Small scale multiple use battery tech.s

Main operation bases

Solar, wind & waste energy generation

High altitude autonomous wind power systems

High capacity storage systems with "safety-stock"

Smart grid technologies

Rural forces

Energy harvesting from ambient sources

Energy absorbing paints & camouflage piezo-electric syst.s

Smaller-scale wireless energy transfer

Light-weight re-chargeble batteries

Forward operation bases

Space based solar panels

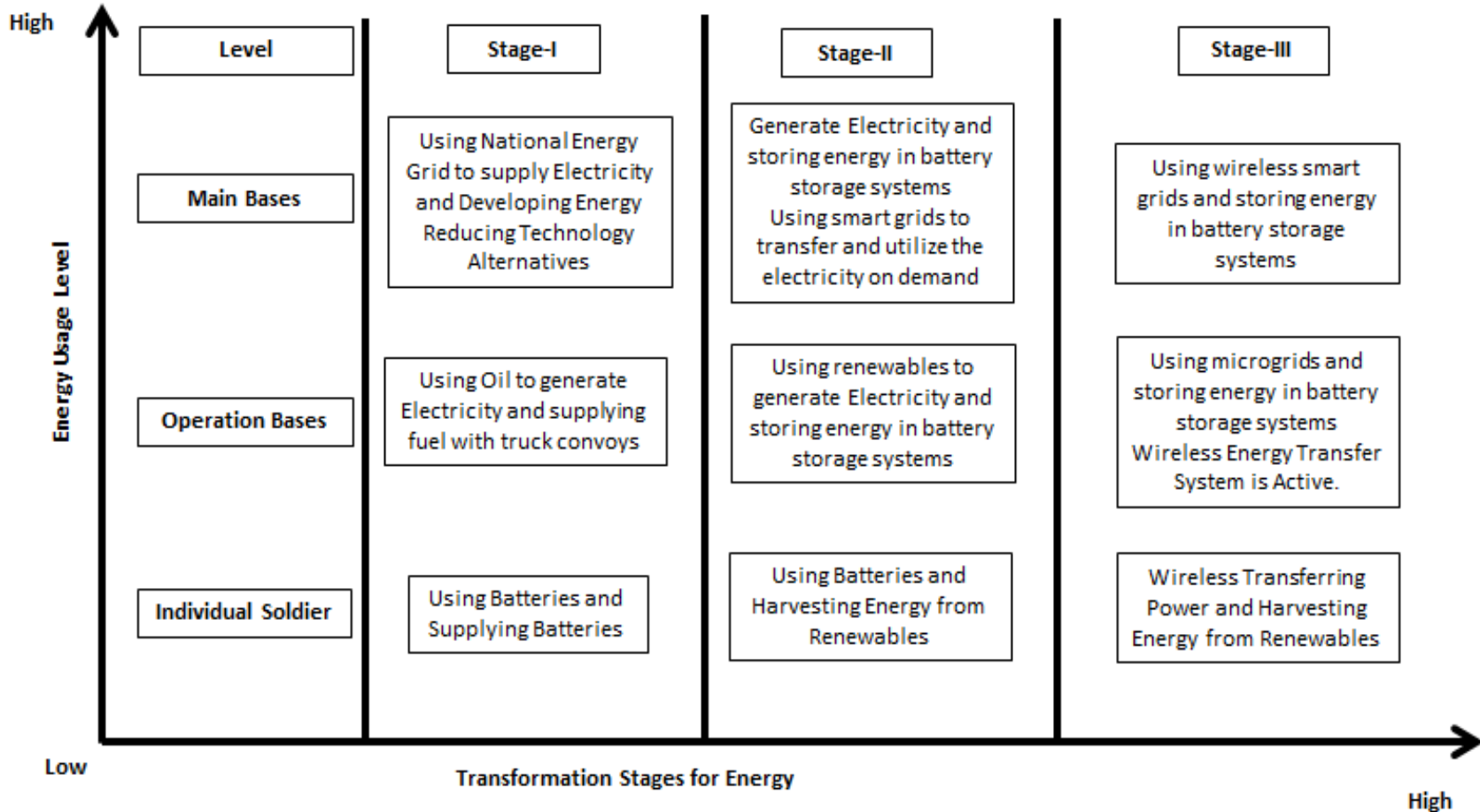
Wireless energy transfer

Energy on-demand

Autonomous UAV technologies

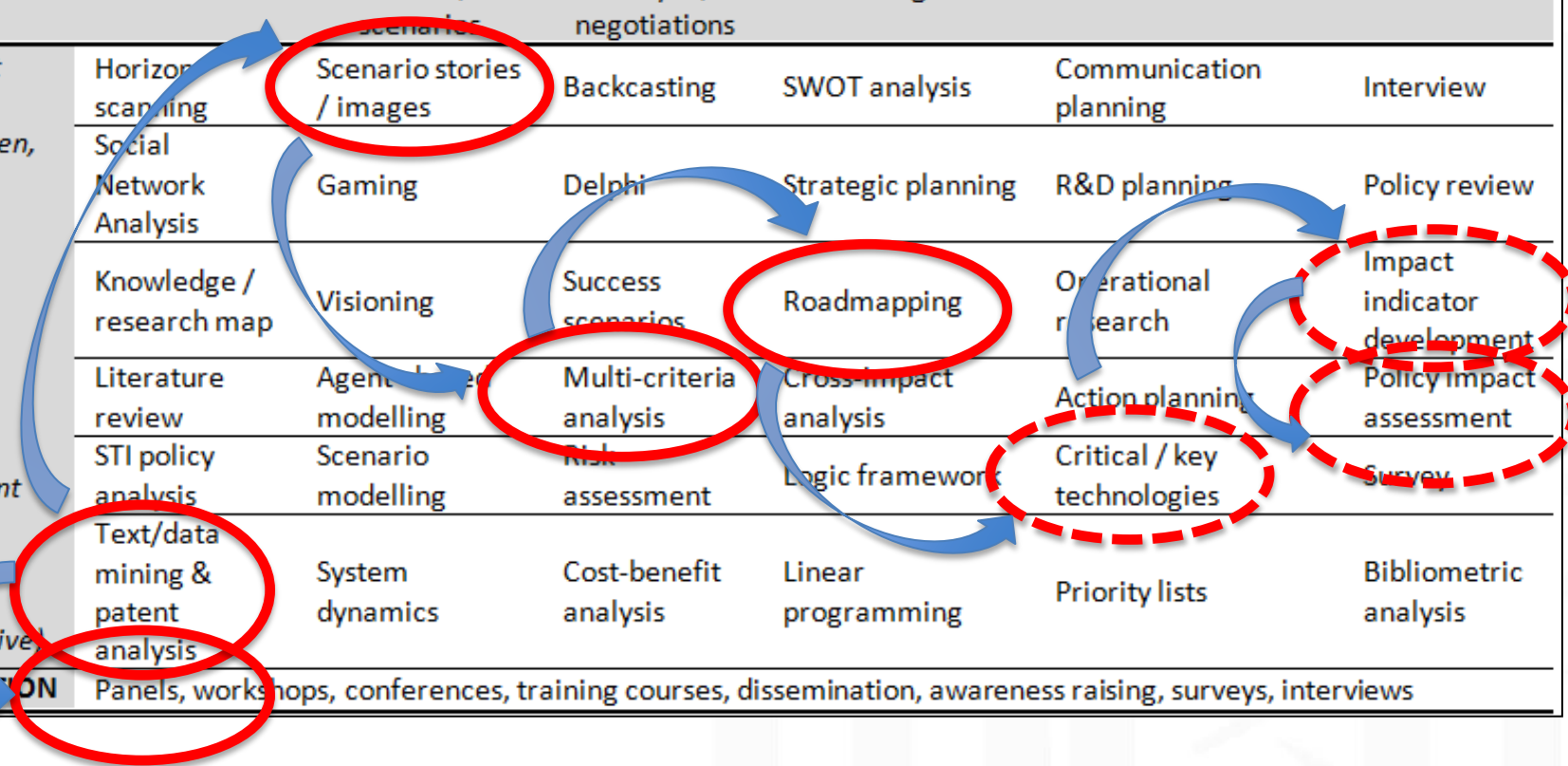
Medium capacity storage

Technology Roadmap for Military Energy R&D



Positioning Foresight methods

Phases	INTELLIGENCE	IMAGINATION	INTEGRATION	INTERPRETATION	INTERVENTION	IMPACT
Functions	Scoping / surveying	Creative phase	Ordering phase	Strategy phase	Action phase	Evaluation phase
Activities	Survey, scan, evidence	Concept model, visions, scenarios	Priorities, analysis, negotiations	Agendas, strategies	Plans, policies, actions	Review, revision, renewal
<i>Divergent Methods (more open, creative)</i>	Horizon scanning	Scenario stories / images	Backcasting	SWOT analysis	Communication planning	Interview
	Social Network Analysis	Gaming	Delphi	Strategic planning	R&D planning	Policy review
	Knowledge / research map	Visioning	Success scenarios	Roadmapping	Operational research	Impact indicator development
	Literature review	Agent-based modelling	Multi-criteria analysis	Cross-impact analysis	Action planning	Policy impact assessment
<i>Convergent methods (more specific, quantitative)</i>	STI policy analysis	Scenario modelling	Risk assessment	Logic framework	Critical / key technologies	Survey
	Text/data mining & patent analysis	System dynamics	Cost-benefit analysis	Linear programming	Priority lists	Bibliometric analysis
INTERVENTION	Panels, workshops, conferences, training courses, dissemination, awareness raising, surveys, interviews					





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Thank you
for your attention!

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