



# Global exploration until 2025 a European perspective

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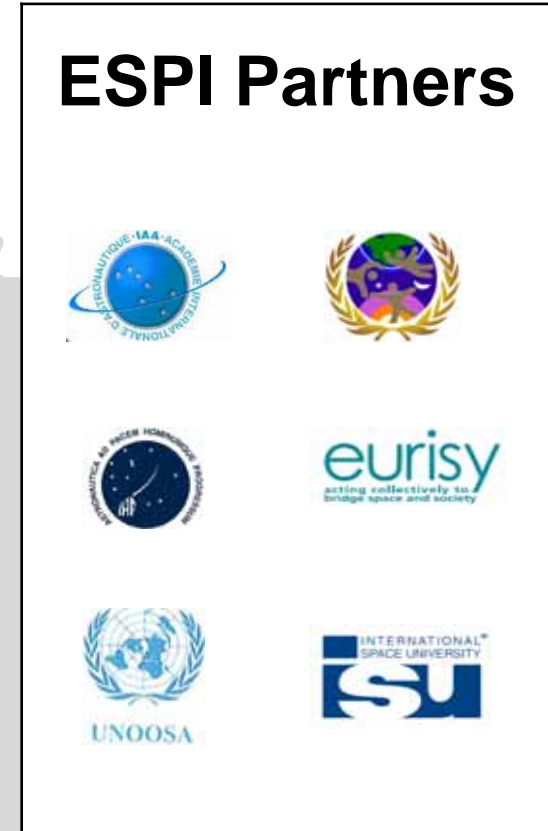
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# Outline

- Global Developments until 2025
  - Space Exploration Trends
  - The Way Forward
- 



# Introduction

# Introduction

- **6 months** study on **space exploration** (1st half 2008)
- Objectives of the study
  - Contribute to **strategic policy-making** at **European-level**
  - Analyse **space exploration** activities in a **broader geopolitical context** and in a **dynamic view** of the **future**

## **SPACE EXPLORATION 2025: GLOBAL PERSPECTIVES AND OPTIONS FOR EUROPE**

[http://www.espi.or.at/images/stories/dokumente/studies/espi\\_report\\_14.pdf](http://www.espi.or.at/images/stories/dokumente/studies/espi_report_14.pdf)



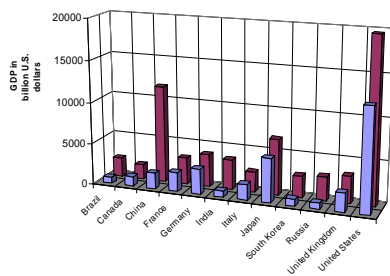


# Global Developments until 2025

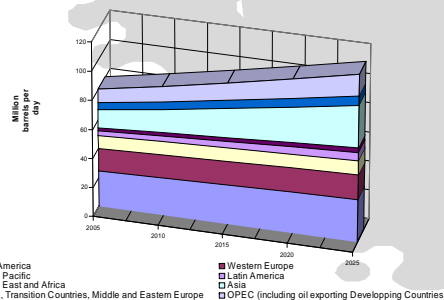
# Global Developments until 2025

## ➤ Methodology

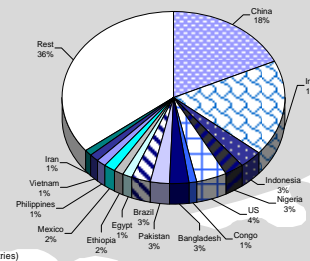
- Foresight study using **exploratory method**
  - No **scenario method** - focus on **factors** and **actors**
- Objective to form a **robust and comprehensive base** to generate a **picture of the world until 2025**
  - Analysis of **5 long-term meta-trends + geopolitical drivers**



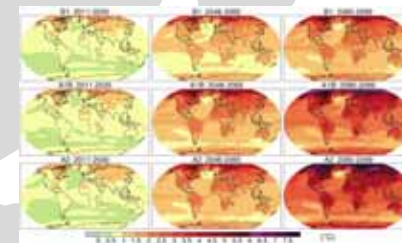
Economy



Energy



Demography



Environment



S&T



# Global Developments until 2025

## ➤ Country outlooks

### ➤ Quantitative and qualitative analysis of socio-economic and geopolitical developments of 11 countries outside Europe

- Australia, Canada, China, India, Japan, Russia, South Korea, Ukraine and the USA
- Brazil and South Africa

Australia	
<p><b>ECONOMY</b></p> <p>GDP (PPP) in current international dollars in 2006: 682.20 billion            GDP (PPP) in current international dollars in 2025 (est.): 1056.9 billion</p> <p>GDP growth 2008 (est.): 3.1%            Average GDP growth 2008-2025 (est.): 2.29%</p>	<p><b>POPULATION</b></p> <p>Population absolute number 2005: 20,310,000            Population absolute number 2025 (est.): 24,393,000</p> <p>Working age population 2005: 62.7%            Working age population 2025 (est.): 56.7%</p> <p>Urban population 2005: 88.2%            Urban population 2025 (est.): 91.3%</p>
<p><b>ELECTION and BUDGET</b></p> <p>Election Cycle:            President: no President; part of the Commonwealth with the Queen as head of state; head of the government is the Prime Minister, who is appointed from the parliamentary majority;            Parliament: 2010, 2013, 2016, 2019, 2022, 2025, 2028</p> <p>Budget Cycle: annual</p>	<p><b>RISKS and THREATS</b></p> <p>Internal</p> <ul style="list-style-type: none"> <li>• Demographic issues and particularly social disparities and ageing of the population</li> <li>• Immigration and ethnic differences</li> <li>• Water scarcity</li> </ul> <p>External</p> <ul style="list-style-type: none"> <li>• Growing economic competition on world market, especially in Asia</li> <li>• Increasing engagement in global events (i.e. humanitarian commitments)</li> <li>• Risk of terrorism</li> </ul>

## ➤ Summary

### ➤ New alliances and partnerships leading to a more complex international context by 2025



# Space Exploration Trends

# Space Exploration Trends

- **Space exploration** has become a major **element** of the **portfolio** of many **country** with **global aspirations**
  - **Numerous exploration plans/aspirations** United States, Europe (ESA+national space agencies), Japan, China, India, Russia etc.
  - **Internationalisation** and **globalisation** of **space exploration**
- Increasing **interests** in sustained **cooperative exploration** activities
  - Global Exploration Strategy etc.

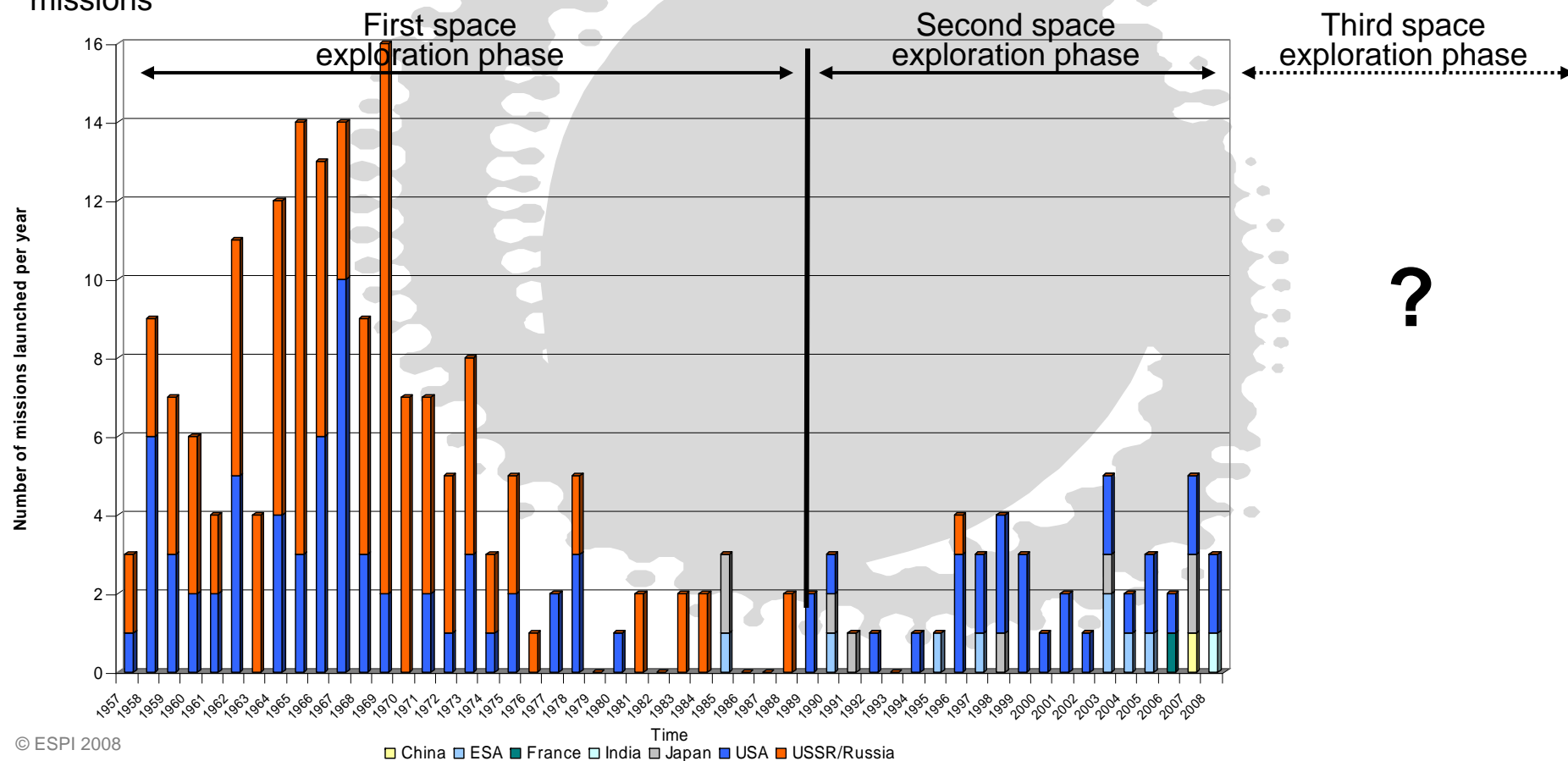


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# Space Exploration Trends

## Robotic exploration activities

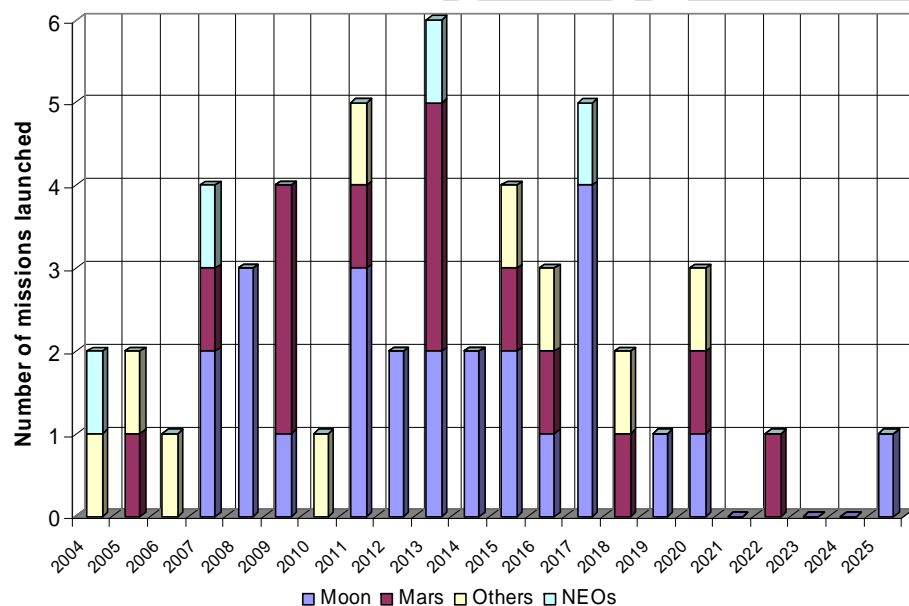
- **First space exploration phase** (Cold War) robotic exploration has been limited to the **USA** and the **U.S.S.R**
- **Second space exploration phase** (1990s-now) **multiplication** of the number of **countries** involved in robotic missions



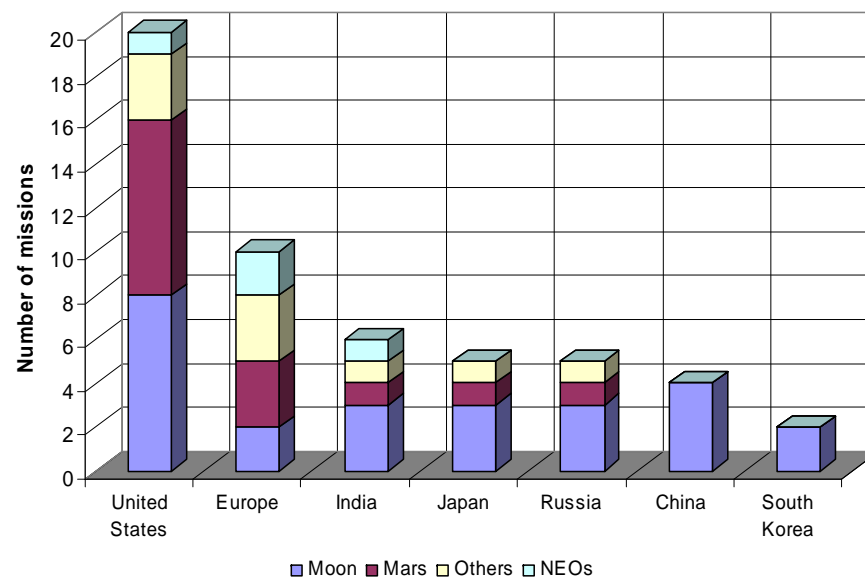
# Space Exploration Trends

## Robotic exploration activities

- The **moon** is the **centre of attention**
  - 1957-1990 **2 countries** sent probes to the moon
  - 1990-2025 **8 countries + ESA** are going to the moon (+ Google lunar X Prize participants...)
- **Mars** is another **target of choice**



Robotic missions beyond LEO planned and scheduled for launch from 2004 until 2025 to the Moon, Mars, NEOs and others planetary bodies



Robotic missions planned and scheduled for launch from 2004 until 2025 per country and destinations

# Space Exploration Trends

## Human spaceflight activities

- **38 countries** sent nationals in space
- **8 countries** sent more than **2 nationals in space** (USA, Russia, Germany, France, Canada, Japan, Italy and China)
- **2 countries** (USA, Russia) sent more than **10 nationals in space** (+Europe)
  - In the **1961-1990 timeframe** astronauts from **21 countries** went to space
    - Afghanistan, Cuba, Mongolia, Saudi Arabia, Syria, Vietnam etc.
  - **Since the 1990s**, **17 countries** sent their first human in space
    - Brazil, China, Israel, Malaysia, South Africa, South Korea etc.
    - China is the only country in that period to have done it independently!
- **3 countries** have autonomous human access to **LEO** (**Russia, USA** and **China**) and soon possibly **India, Europe** and **Japan**

# Space Exploration Trends

## Country outlooks

- Overview of national space background and exploration plans
- Relations with Europe both at space and political levels

Australia	
<b>Space Agency:</b> Office of Space Science and Applications part of the Commonwealth Scientific and Industrial Research Organisation (CSIRO)	<b>National Space Budget:</b> 10 million USD (est) Foreseen Budget Trend: Stable
<b>Priorities in Space:</b> <ul style="list-style-type: none"> <li>• Earth observation and environment monitoring</li> <li>• Space science (radio-astronomy)</li> <li>• Space-related engineering (small scientific satellites)</li> </ul>	<b>Selected Space Exploration Prospects:</b> <ul style="list-style-type: none"> <li>• Host of ground infrastructure for radio communication and tracking to support future robotic and lunar exploration activities</li> <li>• Potential instruments for on-board robotic missions</li> </ul>

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
<b>Canada</b>	Phoenix						ExoMars												
<b>China</b>	Chang'e-1	Shenzhou-7	Chang'e-2 Yinghuo-1	Shenzhou-8-9				Long March G25	Small Lunar Rover		Lunar Bambi Return								
<b>India</b>	SRE-1	Chandrayaan-1, SRE-2		GSLV-Mk III	Chandrayaan-2				Manned Mission, Mars Orbiter		Asteroid Orbiter		Chandrayaan-3	Mission to Venus/Mercury					
<b>Japan</b>	SELENE 1		KIBO (JEM and ELM-E8), HTV 1	Venus Climate Orbiter mission (Planet-C), HTV 2	HTV 3	HTV 4	SELENE 2, HTV 5, Mars Orbiter, Lander or Penetrator		HTV 6		SELENE 3	Marco Polo							
<b>South Korea</b>														Korean Lunar Orbiter					Korean Lunar Lander
<b>Russia</b>	ISS 24P, ISS 14G, ISS 25P, ISS 26P, ISS 15G, ISS 27P	ISS 16G, ISS 29P, ISS 31P, ISS 30P, ISS 28P, ISS 17G, ISS 32P	Phobos Grunt, ISS 33P, ISS 18G, ISS 34P, ISS 19G, ISS 35P, ISS 20G, ISS 36P, ISS 21G		Angara, Chandrayaan-2	LUNA GLOB, OKA T	ExoMars	OKA T		Venera-O, Vozvrat MKA				OSTS, Angara manned version					
<b>USA</b>	Phoenix, DAWN, STS-117, STS-118, STS-120	LRO/LCR OGS, STS-124, STS-125, STS-126	Mars Science Laboratory, STS-119, STS-127, STS-128, STS-129, STS-130	COTS-1 (Dragon 3 – Cignus-1), Mars	GRAIL/LAD EE, Juno, Bigelow Station, Mars Scout/Mars : the great escape		Mars Science and Telecommunications Orbiter (MSTO), ExoMars	Ares 1, international Lunar Lander 1&2 (South and Northpole)	Robotic Lunar Mission, Aitair, Orion 5, Orion 6	Astrobiological Field Laboratory, Mars Mid Rovers, Orion 7, Orion 8	Lunar Lander 3&4, Orion 5, Orion 1G	Ares V		MGR (1), Manned Moon Mission / Lunar Outpost		MGR (2)			
<b>Europe</b>		Columbus, ATV	Node 3, Cupola, ATV 2		European Robotic Arm, ATV 3, Juno (1)	ATV 4, MoonLITE (UK)	ATV 5, Don Quixote, ExoMars, Lunar Exploration Orbiter (Ger)		Beal Colombo	Moon-NEXT		Marco Polo or other, Mars-NEXT		MGR (1), OSTS		MGR (2)			

Mapping of exploration mission in the 2007-2025 period

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# The Way Forward



# The Way Forward

- Europe needs to **anticipate** those **geopolitical changes** and **adapt** to the **evolution** of the **space exploration context**
- What is at stake?
  - Europe’s future **agenda-setting power** in the **international system**
    - **Space exploration** is a symbolic representation of **Earthly powers**
  - Europe’s **position** in the “**space hierarchy**”
  - Europe’s abilities to **attract the best partners** and remain a **partner of choice** in **future endeavours**

# The Way Forward

- Recent (and future) **geopolitical developments**, combined with the **funding constraints** of various **space faring-countries** indicate clearly that **international cooperation** will be **important** for **future** (ambitious) **long-term exploration activities**
- Europe should **leverage** other **national efforts** through cooperation
  - International **cooperation** in **space** is an **outgrowth** of **Earthly political relations**
    - International cooperation is **highly dynamic** with an intrinsic reverberating character
  - **Europe** should lay the **foundations** and establish precedents that **invite countries** to join
    - Open-system architecture; mix of robotic and human missions; visible, robust and affordable programmes
  - **European exploration plan** must be **flexible** to adapt to **changes of priorities** and **budget cycles** of **partners**

# The Way Forward

- Europe need to **set priorities** as **resources** are **limited**:
  - Balance between **cooperation**, **independence** and **autonomy** (European missions, joint international missions in a global architecture)
  - **Autonomy** for enhanced **cooperation**
  
- Europe should give priorities to **strengthening alliances** and **partnerships**
  - Renew its commitment to the **current international order** and its **ISS partners**
  - Evolve within the **GES** but not only!
  - Involve **emerging space actors**

# The Way Forward

## Timing issues

- Takes years to prepare the **next steps** (**political** and **programmatic**)
  - **Europe’s calendar** has to be taken into account
    - **ESA 2011 Council at Ministerial Level**
    - **Next EU Financial Perspectives 2014-2020**
  - **External calendar** needs also to be taken into account to shape the perception and definition of space exploration activities worldwide

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Brazil			Pr./Pa.				Pr./Pa.				Pr./Pa.				Pr./Pa.			
Canada				Pa.					Pa.					Pa.				
China	Pr./Pa.					Pr./Pa.					Pr./Pa.					Pr./Pa.		
India		Pa.			Pr.		Pa.			Pr.		Pa.			Pr.		Pa.	
Japan		Pa.1	Pa.2			Pa.1/Pa.2			Pa.2	Pa.1		Pa.2		Pa.1	Pa.2			Pa.1/Pa.2
Korea	Pa.				Pr./Pa.				Pa.	Pr.			Pa.		Pr.		Pa.	
Russia	Pr.			Pa.	Pr.			Pa.	Pr.			Pa.	Pr.			Pa.	Pr.	
South Africa		Pr./Pa.					Pr./Pa.					Pr./Pa.					Pr./Pa.	
Ukraine		Pr.			Pa.		Pr.			Pa.		Pr.			Pa.		Pr.	
USA	Pr./Pa.		Pa.		Pr./Pa.		Pa.		Pr./Pa.		Pa.		Pr./Pa.		Pa.		Pr./Pa.	
Australia			Pa.1/Pa.2			Pa.1/Pa.2			Pa.1/Pa.2			Pa.1/Pa.2			Pa.1/Pa.2			Pa.1/Pa.2

Pr.	Presidential elections
Pa.	Elections to the Parliament; Pa.1 and Pa.2 stands for two separately elected chambers
Pr./Pa.	Presidential elections and elections to the Parliament take place in the same year

# The Way Forward

- A clear **political impetus** to Europe’s **exploration plan/strategy** should be provided
  - Linking **space exploration** with “**high politics**”
  
- **Role and ambitions of the Europe Union?**
  - European Space Policy (fourth Space Council) - May 2007
  - Informal Space Council Meeting in Kourou (French Guiana) - July 2008
  - Resolution on the European Space Policy (fifth Space Council) - September 2008
  - Mini-hearing European Parliament on Human Space Exploration - November 2008
  - Forthcoming High-Level Conferences on Space Exploration organised by the European Commission to be held in spring 2009 and in 2010
  - ...

# Thank You For Your Attention

Study downloadable at

[http://www.espi.or.at/images/stories/dokumente/studies/espi\\_report\\_14.pdf](http://www.espi.or.at/images/stories/dokumente/studies/espi_report_14.pdf)

