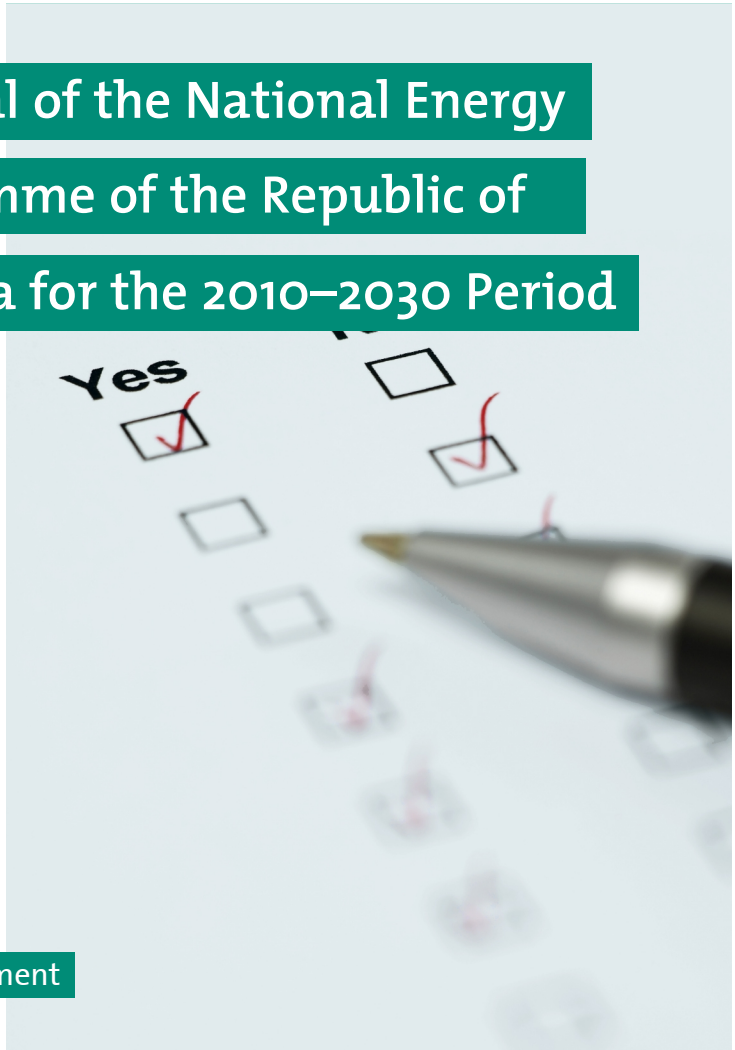
ENVIRONMENT AGENCY AUSTRIA umweltbundesamt

Proposal of the National Energy Programme of the Republic of Slovenia for the 2010–2030 Period



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AUSTRIAN ENERGY AGENCY

Expert Statement

ENVIRONMENT AGENCY AUSTRIA umweltbundesamt

EXPERT STATEMENT ON THE PROPOSAL OF THE NATIONAL ENERGY PROGRAMME OF THE REPUBLIC OF SLOVENIA FOR THE 2010–2030 PERIOD

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AUSTRIAN ENERGY AGENCY

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CONTENT

1 ZUSAMMENFASSUNG

Die Republik Slowenien hat gemäß Art. 10 des Protokolls über die Strategische Umweltprüfung zur Konvention über die Umweltverträglichkeitsprüfung im grenzüberschreitenden Rahmen (Espoo-Konvention) und der EU-Richtlinie 2001/42/EG den Entwurf eines Nationalen Energieprogramms für den Zeitraum 2010 bis 2030 bekannt gemacht.

Das Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft hat erklärt, dass die Republik Österreich auf Grund möglicher erheblicher Umweltauswirkungen des slowenischen Nationalen Energieprogramms an der grenzüberschreitenden Strategischen Umweltprüfung teilnehmen wird.

Das Umweltbundesamt hat die Österreichische Energieagentur beauftragt, eine Fachstellungnahme zum Entwurf des nationalen slowenischen Energieprogramms zu erstellen.

Ausgangslage

Slowenien hat in seiner Energiepolitik die folgenden Zielvorgaben definiert:

- Versorgungssicherheit und sichere Energiedienstleistungen,
- Umweltbezogene Nachhaltigkeit, Bekämpfung des Klimawandels,
- Wettbewerbsfähigkeit der Wirtschaft und Gesellschaft, verfügbare und erschwingliche Energie und Energiedienstleistungen beziehungsweise
- Sozialer Zusammenhalt.

In seinem künftigen Nationalen Energieprogramm Sloweniens stellt die langfristige Nutzung der Kernenergie einen zentralen Punkt dar. Die Hauptmaßnahmen in diesem Zusammenhang sind:

- die Verlängerung der Laufzeit des Kernkraftwerks Krško,
- die Errichtung eines neuen Kernkraftwerks-Blocks am Standort Krško.

Darüber hinaus ist Slowenien bestrebt, den Anteil erneuerbarer Energieträger am Energieverbrauch entsprechend der Ziele des EU Energie- und Klimapakets zu erhöhen und die Voraussetzung für die Entwicklung zu einer Gesellschaft mit geringen CO_2-Emissionen (*Low-Carbon-Society*) zu schaffen.

Zu diesem Zweck wurden verschiedene Szenarien für den Zeitraum 2010 bis 2030 entwickelt, die verschiedene Unter-Programme für nachhaltige Energie, Elektrizität, Energieträger und horizontale Maßnahmen enthalten. Eine Bewertung der Auswirkungen bezüglich ihrer energiewirtschaftlichen Relevanz und ihrem Beitrag zur Erreichung der Zielvorgaben der Energiepolitik zeigen massive Präferenzen für Szenarien mit starkem Fokus auf den Bereich der Kernenergie. In einer übergreifenden Beurteilung der Umweltverträglichkeit wurde auch ein Szenario mit starker Konzentration auf die Kernenergienutzung als das aus Sicht des Umweltschutzes akzeptabelste identifiziert.

Bewertung

Sowohl der Entwurf des Nationalen Energieprogramms als auch der Umweltbericht zur übergreifenden Beurteilung der Umweltverträglichkeit beinhalten jedoch massive Schwachstellen.

Das Nationale Energieprogramm unterschätzt die tatsächlichen Kosten der Kernenergienutzung bei weitem. Der Umweltbericht behandelt nicht die Aspekte und Risiken bezogen auf die Betriebssicherheit von Kernkraftwerken und die Endlagerung von radioaktiven Abfällen. Die möglichen Auswirkungen von schweren Unfällen in den Anlagen zur Nutzung der Kernenergie auf Slowenien und seine Nachbarländer und die damit verbundenen negativen Auswirkungen auf die Gesundheit der Bevölkerung, die Umwelt und die Wirtschaft werden völlig ausgeklammert.

Für die Entwicklung eines umfassenden und schlüssigen Nationalen Energieprogramms ist es erforderlich, viele zusätzliche Aspekte zu berücksichtigen und konkrete Lösungen für offene Probleme zu finden.

Für die weitere Entwicklung des Entwurfs des Nationalen Energieprogramms sind daher die folgenden Empfehlungen zu berücksichtigen und offene Fragen zu beantworten.

Empfehlungen und Fragen

Energiepolitik

Slowenien hat nationale und internationale Ziele bezogen auf Energieeffizienz, erneuerbare Energieträger und Treibhausgas-Emissionen zu erreichen. Viele Maßnahmen der Energiepolitik, die in der Vergangenheit entwickelt wurden, blieben ohne Erfolg, weshalb Slowenien seine Anstrengungen in diesem Bereich erhöhen muss.

Fragen:

Aus welchen Gründen hat Slowenien verschiedene Ziele, die in der Energiepolitik verankert wurden, nicht erreicht?

Wie wird sichergestellt, dass die neuen Ziele erreicht werden?

Szenarien des Nationalen Energieprogramms

Der Entwurf des Nationalen Energieprogramms beinhaltet einen unvollständigen Vergleich von Versorgungsszenarien für elektrische Energie und die wichtigsten Möglichkeiten für die Energieversorgung. Das Programm beschreibt die bedeutendsten Herausforderungen für die künftige Stromversorgung in der Errichtung neuer Wasserkraftwerke, dem Ersatz bestehender Wasserkraftwerke und der effizienten Nutzung von Kohle und Erdgas zur gekoppelten Erzeugung von Strom und Wärme.

Eine Schwachstelle der ausgewählten Szenarien besteht darin, dass der Entwurf des Nationalen Energieprogramms sich stark auf die Kernenergie konzentriert und keine Szenarien berücksichtigt, die einen mittel- und langfristigen Verzicht auf die Kernenergienutzung beinhalten.

Empfehlungen:

- Im Entwurf des Nationalen Energieprogramms sind zusätzliche Szenarien zu untersuchen, die eine Stilllegung des Kernkraftwerks Krško am Ende der ursprünglich vorgesehenen Laufzeit und seinen Ersatz durch einen alternativen Erzeugungs-Mix (z. B. auf Basis von erneuerbaren Energieträgern und thermischen Kraftwerken mit Kraft-Wärme-Kopplung) berücksichtigt. Ein weiteres Szenario für eine Stilllegung des Kernkraftwerks Krško vor 2020 sollte ebenfalls dargestellt werden.
- Die bestehenden Szenarien müssen dahingehend erweitert werden, dass konkrete Kosten für die Laufzeitverlängerung des Kernkraftwerks Krško, die Errichtung des Blocks Krško 2 sowie die Lagerung und Behandlung von nuklearen Abfällen berücksichtigt werden.

Fragen:

Bis zu welchem Jahr soll die Laufzeit des Kernkraftwerks Krško konkret verlängert werden?

Welcher Anteil der bestehenden Potenziale für Energieeffizienzmaßnahmen und die Nutzung erneuerbarer Energieträger wird mit den dargestellten Szenarien ausgenutzt? Welches technisch und wirtschaftlich nutzbare Potenzial bleibt ungenutzt?

Der slowenische Strommarkt und Stromimporte

Die Umsetzung der Maßnahmen, die im Entwurf des Nationalen Energieprogramms beschrieben sind, würde zu einer starken Erhöhung der Stromexporte aus Slowenien führen. Slowenien würde sich zu einem großen Exporteur für elektrische Energie aus nuklearer Erzeugung entwickeln. Es kann daraus geschlossen werden, dass kein nationaler Bedarf für die Errichtung eines zweiten Kernkraftwerks-Blocks in Krško besteht.

Empfehlungen:

- Zu erwartende künftige Regelungen über die Kennzeichnung von elektrischer Energie für Endkunden und deren mögliche Auswirkungen auf den Export von elektrischer Energie aus Kernkraftwerken sollten in den Szenarien des Nationalen Energieprogramms berücksichtigt werden.
- Ein Nationales Energieprogramm sollte sich auf die tatsächlichen Erfordernisse des nationalen Energiebedarfs konzentrieren und keine Strategien zur Erhöhung der Stromexporte durch einzelne Unternehmen, die sich in Staatsbesitz befinden, enthalten.
- Wenn ein neues Kernkraftwerk mit der angedachten Leistung errichtet wird, wird die Stromerzeugung in Slowenien massiv von der Kernenergie abhängig sein, wobei große Strommengen exportiert werden müssten. Solche Überkapazitäten und ein derart unvorteilhafter Erzeugungs-Mix sollten jedenfalls vermieden werden.

Fragen:

Welche Erzeugungskapazitäten wären für Slowenien ausreichend, wenn das Nationale Energieprogramm nicht auf die Ausweitung des Stromexports ausgerichtet wäre?

Welcher Anteil der Erzeugung des neuen Kernkraftwerksblocks Krško 2 ist für den Export vorgesehen?

Übertragungsnetz und Reserve-Kapazitäten

Die vorgesehenen Erweiterungen der grenzüberschreitenden Übertragungsleitungen sind eng mit dem Vorhaben verbunden, die slowenischen Stromexporte beträchtlich zu erhöhen. Die Errichtung des Kernkraftwerks Krško 2 würde auch zusätzliche Investitionen in Reserve-Kapazitäten im Kraftwerksbereich erforderlich machen, welche die Kosten der Stromversorgung für die slowenischen Kunden erhöhen würden. Der Haupt-Nutznießer der erforderlichen Investitionen wäre der Eigentümer und Betreiber des neuen Kernkraftwerks.

Empfehlung:

- Die Errichtung eines 1000-MW-Kernkraftwerks in einer Regelzone, die über eine Höchstlast von ca. 2.100 MW verfügt ist nicht zweckmäßig, ineffizient und verursacht zusätzliche Kosten. Es wird empfohlen, dass die Erhöhung der Kraftwerkskapazitäten auf kleinere Erzeugungseinheiten ausgerichtet wird. In Österreich besitzt der größte Kraftwerksblock beispielsweise ca. 450 MW bei einer Höchstlast der Regelzone von ca. 8.300 MW.

Fragen:

Wie wird sichergestellt, dass die Erweiterung der Übertragungs-Kapazitäten zu den Nachbarstaaten durch deren Nutznießer, die Stromexporteure, finanziert wird?

Welche Investitionen in das Übertragungsnetz wären nicht erforderlich, wenn das Kernkraftwerk Krško 2 nicht errichtet würde?

Ist sicher gestellt, dass die Leistung des neuen Kernkraftwerks mit dem Übertragungsnetz kompatibel ist? Welche Untersuchungen wurden dazu durchgeführt?

Welche zusätzlichen Sekundär- und Tertiär-Regelreserven sind für Slowenien erforderlich, wenn der größte Kraftwerksblock in der Regelzone von ELES, der 1000-MW-Block des Kernkraftwerks Krško 2 sein sollte?

Welche Investitionssumme ist für zusätzliche Reservekapazitäten erforderlich und wer wird die dafür anfallenden Kosten tragen?

Unabhängigkeit der Beurteilung der Umweltauswirkungen

Die Beurteilung der Umweltauswirkungen des Sub-Programms für Kernenergie wurde einer Studie entnommen, die von GEN Energija, dem Initiator des Programms, in Auftrag gegeben wurde. Darüber hinaus – oder als eine Konsequenz daraus – ergibt sich, dass Risiken im Zusammenhang mit nuklearer Sicherheit und die Umsetzung und nachhaltige Behandlung von hochradioaktiven Abfällen nicht in die Beurteilung der Umweltauswirkungen einbezogen wurden.

Empfehlung:

- Der Umweltbericht ist zu erweitern, um auch die Risiken und möglichen Umweltauswirkungen von schweren Unfällen und Störfällen in Anlagen zur Stromerzeugung aus Kernenergie sowie zur Behandlung von nuklearen Abfällen abzudecken.

Frage:

Gibt es Pläne zur Beurteilung der wirtschaftlichen Begründung für die Laufzeitverlängerung des Kernkraftwerks Krško und die Errichtung des Kernkraftwerks Krško 2 sowie zu den ökologischen Auswirkungen dieser Maßnahmen, durch eine unabhängige Stelle, um der Öffentlichkeit und den Entscheidungsträgern neutrale Informationen über den Nutzen und die Kosten der Kernenergie für die Gesellschaft und die Wirtschaft zur Verfügung zu stellen?

Kernkraftwerks-Kapazitäten in Slowenien

Derzeit ist ein Druckwasserreaktor von Westinghouse mit einer elektrischen Nettoleistung von 620 MW (Kernkraftwerk Krško) in Betrieb, der mit einem Anteil von beinahe 40 % zur Stromerzeugung in Slowenien beiträgt. Die Laufzeit des Kernkraftwerks Krško endet im Jahr 2023. Entsprechend dem Entwurf des Nationalen Energieprogramms soll die Laufzeit des Kernkraftwerks „bis mindestens 2043“ verlängert werden. Im Entwurf des Nationalen Energieprogramms ist auch das Vorhaben dargestellt, einen zusätzlichen Reaktor mit einer elektrischen Leistung von 1.100 MW bis 1.700 MW am Standort Krško zu errichten, wenn gewisse Bedingungen erfüllt werden. Als frühester möglicher Zeitpunkt für die Aufnahme seines Betriebs wurde das Jahr 2022 angegeben.

Die Errichtung eines neuen Kernkraftwerks mit einer Leistung des bis zum 2,5-fachen des bestehenden Kernkraftwerks würde sehr große Kernkraftwerkskapazitäten ohne entsprechenden nationalen Bedarf in Slowenien ergeben. Das Kernkraftwerk Krško 2 wird ein Kraftwerk sein, welches ausschließlich oder zumindest hauptsächlich für den Stromexport betrieben wird. Daraus ergibt sich, dass Slowenien sämtliche ungelösten Probleme, Risiken und Kosten der Kernenergieerzeugung von seinen Nachbarstaaten übernimmt, um sich als Stromexporteur zu positionieren.

Empfehlung:

- Es wird empfohlen, dass eine Studie erstellt wird, in der die tatsächlich makro-ökonomischen Kosten eines zusätzlichen Kernreaktors im Vergleich zum Nutzen aus den Stromexporten dargestellt werden.

Laufzeitverlängerung des Kernkraftwerks Krško

Das Genehmigungsverfahren für die Laufzeitverlängerung des Kernkraftwerks Krško „bis mindestens 2043“ ist derzeit im Gange. Es gibt neue Vorschriften in Slowenien im Zusammenhang mit dem Übereinkommen für nukleare Sicherheit (CNS), die es erforderlich machen, dass das Kernkraftwerk Krško schwere Unfälle beherrschen kann. Darüber hinaus werden derzeit „Stress-Tests“ für Kernkraftwerke in den Mitgliedstaaten der EU durchgeführt. Zusätzlich sollten die WENRA-Sicherheitsziele für neue Kernkraftwerke, die sich explizit auch auf be-

stehende Kraftwerke beziehen, angewendet werden. Die WENRA-Sicherheitsziele verlangen, dass die Häufigkeit von Kernschäden so weit wie praktisch möglich gesenkt wird. Unfälle mit Kernschmelze, die zu frühen Freisetzungen führen sind praktisch zu beseitigen. WENRA entwickelt auch Positionspapiere zu ausgewählten Schlüsselthemen, die für Kernkraftwerke relevant sind (Flugzeugabsturz, Praktischer Ausschluss[1]) und bis Ende 2012 verfügbar sein werden.

Ein Alterungsmanagement-Programm (AMP) wurde vor kurzem als Teil der ersten periodischen Sicherheitsüberprüfung des Kernkraftwerks Krško in die Wege geleitet. Allerdings könnte ein späterer Beginn eines systematischen Alterungsmanagement-Programms nachteilige Konsequenzen für die nukleare Sicherheit haben.

Empfehlung:

- Die Entscheidung über eine Laufzeitverlängerung soll erst getroffen werden, wenn die Ergebnisse des Europäischen Stress-Tests für Kernkraftwerke und die WENRA-Positionspapiere zu Schlüsselthemen verfügbar sind, um sicher zu stellen, dass strengere Standards angewendet werden und die nukleare Sicherheit verbessert wird. Es sollte mehr Zeit für die Datensammlung für das Alterungs-Management-Programm vorgesehen werden

Fragen:

In welchem Ausmaß werden die WENRA-Sicherheitsziele für neue Kernreaktoren und die WENRA-Positionspapiere zu Schlüsselthemen, die derzeit ausgearbeitet werden, im Genehmigungsverfahren zur Laufzeitverlängerung des Kernkraftwerks Krško, berücksichtigt?

Ist es vorgesehen, weitere Schritte im Zusammenhang mit der Laufzeitverlängerung des Kernkraftwerks Krško zu verschieben, bis die Ergebnisse des europäischen „Stress-Tests" (einschließlich der Peer-Review auf EU-Ebene) verfügbar sind?

Welche Maßnahmen zum Alterungsmanagement wurden im Kernkraftwerk Krško umgesetzt, bevor das neue AMP nach 2005 umgesetzt wurde?

Gibt es spezifische Herausforderungen im Kernkraftwerk Krško, auf die sich das Alterungsmanagement-Programm konzentriert – Systeme, Strukturen oder Komponenten, die besondere Beachtung erfordern?

Errichtung eines neuen Kernkraftwerksblocks in Krško (Krško NPP2)

Der Entwurf des Nationalen Energieprogramms sieht die Errichtung eines zweiten Kernkraftwerks mit einer Leistung von 1.100 bis 1.700 MW vor. Die WENRA-Sicherheitsziele und die Positionspapiere zu Schlüsselthemen (siehe oben) müssen dafür zur Gänze berücksichtigt werden. Allerdings wurde im Zusammenhang mit dem Übereinkommen für nukleare Sicherheit (CNS) aufgezeigt, dass die Slowenische Atomaufsichtsbehörde (SNSA) keine ausreichenden Ressourcen für die Genehmigung und Überwachung des Designs, der Konstruktion und des Betriebs eines neuen Kernkraftwerks, besitzt.

[1] Praktischer Ausschluss von Unfällen, die zu großen frühen radioaktiven Freisetzungen führen können.

Im Entwurf des Nationalen Energieprogramms wurde festgelegt, dass die tatsächliche Umsetzung des Projekts Krško 2 von Marktbedingungen, unternehmerischen Entscheidungen und der gesellschaftlichen Akzeptanz abhängen soll.

Empfehlung:

- Vor einer Entscheidung über die Errichtung eines neuen Kernkraftwerks in Krško sollen alle umweltbezogenen und wirtschaftlichen Nutzen und Kosten für die Lagerung radioaktiver Abfälle untersucht werden. Die WENRA Sicherheitsziele und die Positionspapiere zu Schlüsselthemen sollen berücksichtigt werden und ausreichende Ressourcen zur Sicherstellung der Nuklearsicherheit in Slowenien sollen zur Verfügung gestellt werden.

Fragen:

Welche Sicherheitsstandards würden auf das neue Kernkraftwerks-Projekt angewendet, insbesondere in Bezug auf den Ausschluss von Unfällen mit großen oder frühen Freisetzungen?

Wie kann garantiert werden, dass zeitgerecht ausreichende Ressourcen für die Atomaufsichtsbehörde (SNSA) für den Genehmigungsprozess eines neuen Kernkraftwerks zur Verfügung stehen? Gibt es dazu bereits konkrete Aktivitäten?

Welche Marktbedingungen und unternehmerische Entscheidungen werden für die Entscheidung über die tatsächliche Errichtung des Kernkraftwerks Krško 2 von Bedeutung sein?

Da sich der Entwurf des Nationalen Energieprogramms auf die soziale Akzeptanz der weiteren langfristigen Nutzung der Kernenergie in Slowenien bezieht, stellt sich die Frage, in welcher Form die gesellschaftliche Akzeptanz in den Entscheidungsfindungsprozess einbezogen wird? Wird es eine Volksabstimmung zur Entscheidung über die Umsetzung des Projekts Krško 2 geben?

Welche Indikatoren werden für die Beurteilung der gesellschaftlichen Verträglichkeit des Kernkraftwerks-Projekts Krško 2 relevant sein?

Lagerung von schwach und mittelradioaktiven Abfällen

Der Entwurf des Nationalen Energieprogramms beinhaltet das Vorhaben der Errichtung eines Endlagers für schwach- und mittelradioaktive Abfälle in Vrbina in der Gemeinde Krško bis zum Jahr 2023. Das steht im Widerspruch zum jüngsten slowenischen Bericht im Rahmen des Übereinkommens für nukleare Sicherheit (CNS), in dem erklärt wurde, dass ein Gesetz aus dem Jahr 2002 vorsieht, dass ein Lager für schwach- und mittelradioaktive Abfälle bis 2013 in Betrieb sein muss.

Die Finanzierung des Lagers wird vom Fond für die Dekommissionierung des Kernkraftwerks Krško und die Lagerung von radioaktiven Abfällen aus dem Kernkraft Krško und (für institutionelle radioaktive Abfälle) aus dem Staatsbudget zur Verfügung gestellt. Für die Umsetzung dieses Investitionsprogramms sind EUR 106 Millionen vorgesehen. Allerdings warnte der Slowenische Rechnungshof im August 2011 davor, dass die derzeitigen Beiträge des Betreibers des Kernkraftwerks Krško nicht ausreichen, um die Finanzierung für die Dekommissionierung und die Errichtung eines Endlagers für radioaktive Abfälle bereit zu stellen.

Empfehlung:

- Die zu erwartenden Kosten für ein Lager (sowohl für LILW als auch für HILW) sollen in die Kosten der elektrischen Energie internalisiert werden. Eine Entscheidung über die Laufzeitverlängerung des Kernkraftwerks Krško und die Errichtung von Krško 2 soll von der Funktionsfähigkeit eines Endlagers für schach- und mittelradioaktive Abfälle abhängig gemacht werden.

Fragen:

Welchen Grund gibt es für den offensichtlichen Widerspruch bezüglich der Fertigstellung eines Lagers für schwach- und mittelradioaktive Abfälle zwischen dem CNS-Report 2010 und dem Entwurf des Nationalen Energieprogramms?

Welche Finanzmittel sind derzeit für die Errichtung eines Lagers für schwach- und mittelradioaktive Abfälle verfügbar und wie hoch ist dabei der Anteil der öffentlichen Finanzmittel?

Lagerung von hochradioaktivem Abfall

Alle hochradioaktiven Abfälle des Kernkraftwerks Krško werden derzeit im Brennelement-Lagerbecken des Kraftwerks außerhalb des Reaktorgebäudes gelagert. Allerdings geht aus den verfügbaren Informationen nicht eindeutig hervor, wie dieses Lagergebäude gegen externe Ereignisse geschützt ist. Darüber hinaus ist nicht klar, wo hochradioaktive Abfälle (HLW) zwischen 2023, wenn das Lagerbecken in Krško voll sein wird, und dem Jahr 2065 gelagert werden sollen. Es bleibt unklar, in welchem Ausmaß eine Wiederaufbereitung durchgeführt werden soll.

Der Entwurf des Nationalen Energieprogramms beinhaltet die Zielvorstellung, einen Vorschlag für das Management von hochradioaktiven Abfällen (HLW) vorzubereiten. Die Entscheidung bezüglich des Konzepts für die Endlagerung der abgebrannten Brennelemente soll bis 2020 erfolgen. Ein Endlager soll bis 2065 in Betrieb gehen. Eine Endlagerung im Ausland wird ebenfalls als eine Option angesehen. Das Management der radioaktiven Abfälle und der abgebrannten Brennelemente erfordert einen Plan mit einem konkreten Zeitrahmen für die Errichtung des Lagers. Allerdings gibt es dafür derzeit keine Strategie, es gibt keine Abschätzungen über die Kosten eines Endlagers für hochradioaktive Abfälle und keine Pläne darüber, mit welchem internationalen Partner ein Endlager gemeinsam errichtet werden könnte.

Empfehlung:

- Eine Entscheidung über die Laufzeitverlängerung des Kernkraftwerks Krško und die Errichtung von Krško 2 soll von einer Lösung der Endlagerproblematik für hochradioaktive Abfälle abhängig gemacht werden. Die Ergebnisse des Europäischen Stress-Tests sind zu berücksichtigen. Die zu erwartenden Kosten für die Endlagerung von hochradioaktiven Abfällen sind in die Stromkosten einzubeziehen.

Fragen:

Welchen Schutz bietet das Lagergebäude dem Abklingbecken mit den abgebrannten Brennelementen im Falle von externen Ereignissen (z.B. Flugzeugabsturz)? Ist sein Schutz vergleichbar mit dem des Reaktorgebäudes?

Jeder Kraftwerksbetreiber braucht eine dauerhafte Lösung für die Behandlung der entstehenden Abfälle. Welche Lösung wird für die hochradioaktiven Abfälle aus dem Kernkraftwerk Krško vorgesehen?

Welche Kosten sind für die Endlagerung von hochradioaktiven Abfällen zu erwarten?

Mit welchem anderen Staat plant Slowenien eine bilaterale Lösung für die Endlagerung radioaktiver Abfälle zu finden?

Werden die Kosten, die für die Endlagerung von hochradioaktiven Abfällen zu erwarten sind, in die Energiepreise internalisiert, wie es im Entwurf des Nationalen Energieprogramms als Schlüsselelement für den Übergang zu nachhaltigen Energielösungen formuliert ist?

Welche Vorhaben oder Konzepte gibt es derzeit für die Lagerung verbrauchter Kernbrennstoffe (die nicht wieder aufbereitet werden) bezogen auf Mengen, Standorte und Zeitdauer? Wie wird insbesondere der Zeitraum von 2023 bis 2043 überbrückt? Wird in Erwägung gezogen, die Kapazität des Abklingbeckens mit den abgebrannten Brennelementen dadurch zu erhöhen, dass die Lagerdichte erhöht wird? Ist es geplant, weitere Schritte bezüglich der Pläne zur Lagerung abgebrannter Kernbrennstoffe bis zum Vorliegen der Ergebnisse des Europäischen „Stress-Tests" (einschließlich der Schlussfolgerung aus der Peer-Review) zu verschieben?

Wie viel verbrauchter Kernbrennstoff sollte wiederaufbereitet werden? Wo soll die Wiederaufbereitung erfolgen? Wo würden wiederaufbereitete Abfälle gelagert werden?

Wie gedenkt die Regierung der Republik Slowenien die Anforderungen der EU-Richtlinie über die Entsorgung radioaktiver Abfälle und abgebrannter Brennelemente zu erfüllen? Welche Pläne gibt es für die Endlagerung von radioaktiven Abfällen, welche Kosten werden dafür erwartet und welche Finanzierungsmaßnahmen sind für die Lagerung zusätzlicher Abfälle, die durch eine Laufzeitverlängerung des Kernkraftwerks Krško und die Errichtung von Krško 2 anfallen, vorgesehen.

Uranbergbau

Der Entwurf des Nationalen Energieprogramms erwähnt, dass Forschungen betrieben werden sollen, um die natürlichen Ressourcen (Kohle, Uran, Öl und Erdgas) in Slowenien zu erfassen. Die Uranmine Žirovski (Žirovski vrh Uranium Mine) wurde 2005 geschlossen und es besteht kein Zugang mehr zu dieser Mine.

Empfehlung:

- Da der Uranbergbau massive negative Auswirkungen auf die Umwelt hat, wird davon abgeraten, die Uranmine Žirovski zu reaktivieren.

Frage:

Gibt es Pläne zur Reaktivierung der Uranmine Žirovski?

Finanzierung des Sub-Programms für Kernenergie

Die erforderlichen Finanzmittel für die Errichtung des Kernkraftwerks Krško 2 werden im Entwurf des Nationalen Energieprogramms mit 2,2 bis 4 Milliarden Euro angegeben und die Kosten für die Laufzeitverlängerung des Kernkraftwerks Krško mit 125 Millionen Euro. Es wird angegeben, dass keine öffentlichen Gelder für diese Investitionen verwendet werden sollen. Die Finanzierungskosten wurden in die erfolgte Kostenabschätzung nicht inkludiert.

Investitionen in die Nutzung der Kernenergie sind gekennzeichnet von Kostenüberschreitungen und steigenden spezifischen Errichtungskosten (Euro je installiertes kW). Berücksichtigt man die jüngsten Schätzungen für die Errichtungskosten von Kernreaktoren insbesondere auf Grund der Erfahrungen mit dem EPR in Flamanville (Frankreich), werden die Errichtungskosten für Krško 2 wohl kaum unter 6 bis 8 Milliarden Euro liegen. Darüber hinaus ist eine Darstellung der Investitionskosten ohne Berücksichtigung der Finanzierungskosten irreführend und verdeckt die tatsächlichen Kosten. Für Investitionen im Kernenergiebereich sind Zinssätze von 11 % realistisch, die zu erheblichen Finanzierungskosten führen und die auch transparent dargestellt werden müssen, um Entscheidungsträgern nachvollziehbare und vollständige Informationen zur Verfügung stellen zu können.

Es gibt derzeit weltweit keinen einzigen Reaktor, bei dem das gesamte finanzielle Risiko der Errichtung ausschließlich von privaten Akteuren getragen wurde. Übliche Formen der Förderungen beinhalten geförderte Kredite, Förderungen bei der Kapitalausstattung, Bereitstellung von Urananreicherung und Dienstleistungen der Aufsichtsbehörden unter den tatsächlichen Kosten, Deckelung der Haftung für die Auswirkungen von Unfällen oder Terroranschlägen, unzureichende Maßnahmen für die Stilllegung am Ende der Laufzeit sowie die Sozialisierung von Kosten und Risiken, die mit der Behandlung radioaktiver Abfälle verbunden sind.

Empfehlung:

- Anstatt in eine veraltete Technologie zu investieren, mit der es in 60 Jahren nicht gelungen ist, elektrische Energie ohne massive öffentliche Förderungen zu erzeugen, sollte das Ende der Laufzeit des Kernkraftwerks Krško als Chance gesehen werden, das Energieversorgungssystem tatsächlich zu modernisieren und den Energiesektor im Sinne nachhaltiger Lösungen weiter zu entwickeln.

Fragen:

Sind möglicherweise benötigte Erneuerungen der Sicherheit des Kernkraftwerks Krško in den geschätzten Kosten für die Laufzeitverlängerung enthalten?

Wie hoch sind die geschätzten reinen Investitionskosten für die Laufzeitverlängerung des Kernkraftwerks Krško und die Errichtung von Krško 2?

Welcher Zinssatz wurde in der Kostenabschätzung für den Entwurf des Nationalen Energieprogramms verwendet?

Welche direkten oder indirekten Förderungen in Form von Kreditbürgschaften, Deckelung von Haftungen für Schäden aus Unfällen oder Angriffen, Sozialisierung von Kosten und Risiken, die mit dem Management radioaktiver Abfälle verbunden sind, wurden dem Betreiber des Kernkraftwerks Krško bisher gewährt?

Externe Effekte und Low-Carbon-Society

Im Entwurf des Nationalen Energieprogramms wird die Kernenergie als wichtiges Element zum Übergang in eine Low-Carbon-Society dargestellt. Gleichzeitig wird erörtert, dass die teilweise Einbeziehung externer Kosten in den Energiepreis ein Schlüsselelement für den Übergang zu nachhaltigen Energielösungen ist. Die Gesamtemissionen der Kernenergie über den gesamten Lebenszyklus liegen von 5 bis 40 gCO_2e/kWh. Allerdings hängen die Emissionen sehr stark vom Urangehalt des Uranerzes ab. Bei sinkendem Urangehalt können CO_2-Emissionen von 82 bis 210 gCO_2e/kWh erwartet werden. Neben den CO_2-Emissionen der Kernenergie gibt es allerdings viel wichtigere Externalitäten, wie radioaktive Abfälle, die Kosten der Dekommissionierung und die Kosten für die Sicherheit des Reaktors.

Empfehlung:

- Die derzeitigen Bemühungen, die Kosten für CO_2-Emissionen zu internalisieren sollen auf andere Externalitäten ausgeweitet werden. Um zu einem transparenten Entscheidungsfindungsprozess beizutragen und ernsthafte Alternativen zur Kernenergie anzubieten, sollen Regulierungsbehörden die Kosten für die Abfälle, Stilllegung, Sicherheitsvorkehrungen für Kernreaktoren darstellen und feststellen, welcher Anteil dieser Kosten nicht im Strompreis enthalten ist.

Frage:

In welchem Ausmaß wurden die Kosten für die Abfälle, die Stilllegung, Sicherheitsvorkehrungen für Kernreaktoren im Umweltbericht berücksichtigt und in die Kosten der Stromerzeugung in Kernkraftwerken einbezogen?

Auswirkungen von möglichen ernsten Störfällen und Unfällen

Auch mit verbesserten Sicherheitsmaßnahmen kann ein massiver Reaktorunfall nicht ausgeschlossen werden. Es verbleibt ein maßgebliches Risiko eines Erdbebens am Standort Krško, das zu schwerwiegenden Schäden am Kernkraftwerk führen könnte und als Folge daraus zur Freisetzung von radioaktivem Material. Zusätzlich können Bedienungsfehler des Reaktors, Unfälle – wie beispielsweise Flugzeugabstürze – und bewusste Aktionen zur Herbeiführung eines GAU in Form von Terroranschlägen nicht ausgeschlossen werden. Im Falle eines Reaktorunfalls kann Österreich – abhängig von der vorherrschenden Wetterlage – massiv von radioaktiven Freisetzungen betroffnen werden. Die folgende Abbildung zeigt beispielhaft die möglichen Auswirkungen eines Unfalls im Kernkraftwerk Krško unter Verwendung der aktuellen Wettersituation am 16. Mai 1995.

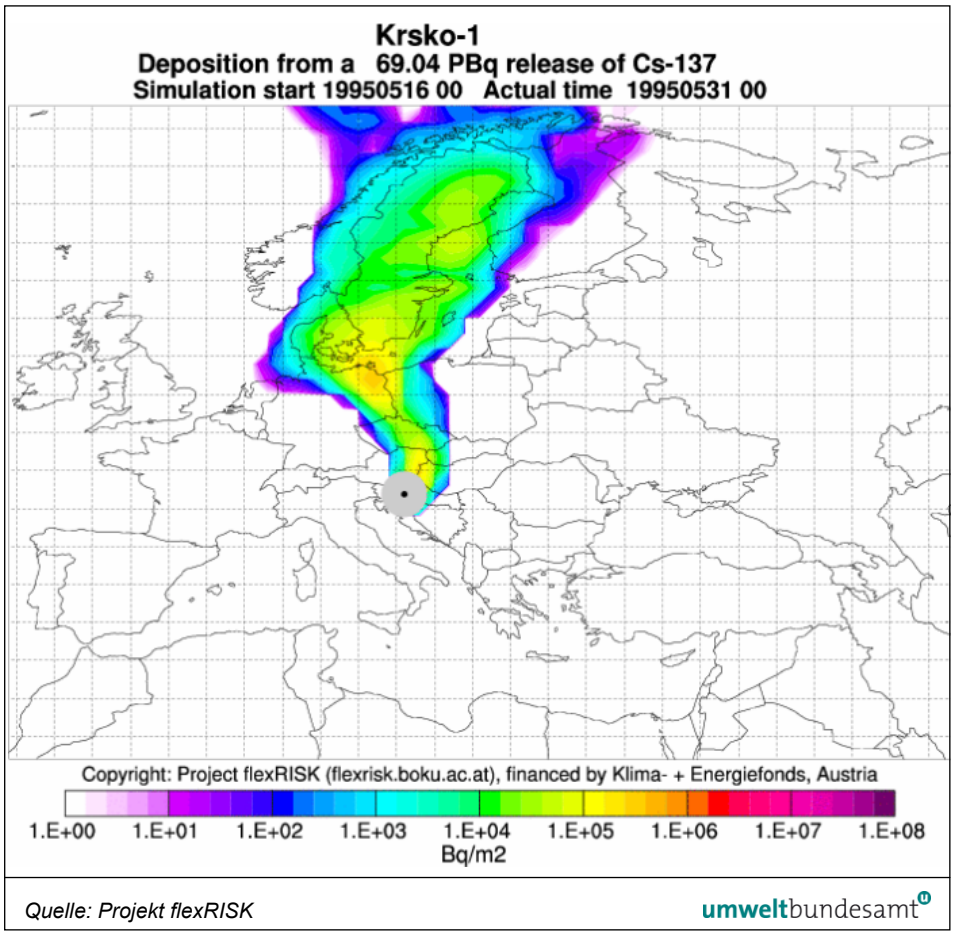

Abbildung: Hypothetischer Unfall im Kernkraftwerk Krško am 16. Mai 1995.

Empfehlung:

- Der Umweltbericht muss erweitert werden, um die Risiken und möglichen Umweltauswirkungen von schweren Störfällen und Unfällen in den nuklearen Einrichtungen Sloweniens zur Stromerzeugung, der Behandlung und Lagerung radioaktiver Abfälle und abgebrannter Brennelemente abzudecken. Insbesondere sind auch die grenzüberschreitenden Auswirkungen zu beurteilen.

Nuklearhaftung

Die Nuklearhaftung und Vorkehrungen für Entschädigungen, die derzeit gelten, sind in gravierendem Ausmaß unzureichend. Der Trend in der EU geht eindeutig in Richtung erhöhter Abgeltung von Schäden aus Kernkraftunfällen. Die Haftungsrahmen, die in manchen neuen Mitgliedstaaten noch immer bestehen, werden von der internationalen Gemeinschaft als zu niedrig angesehen.

Die gesamten Entschädigungen gemäß Pariser Konvention belaufen sich auf 1,5 Mrd Euro. Dieser Betrag reicht für Unfälle in der Größenordnung von Tschernobyl oder Fukushima bei weitem nicht aus. Dies bedeutet, dass im Falle eines derartigen Unfalls in Slowenien internationale Rettungspakete die zusammen brechende slowenische Wirtschaft stützen müssten. Damit werden Risiken von einem (staatlichen) Betreiber eines Kernkraftwerks auf die internationale Staatengemeinschaft verlagert.

Empfehlung:

- Es besteht massiver Bedarf, sicher zu stellen, dass für das gesamte Risiko eines Reaktorunfalls vollständige und effektive Entschädigungen zur Verfügung stehen. Darüber hinaus ist Marktverzerrungen im Strommarkt dadurch vorzubeugen, dass die Kosten für Versicherungen und für erwartete Entschädigungen an Opfer von Reaktorunfällen in den Erzeugungspreis der Kernkraftwerke einbezogen werden.

Fragen:

Welche Reserven im Budget der Republik Slowenien sind für den Ersatz von Schäden vorgesehen, die durch große Unfälle entstehen, deren Kosten über die Haftung eines Kernkraftwerksbetreibers hinaus gehen? Kann sich die Republik Slowenien einen nuklearen Unfall im Ausmaß von Tschernobyl oder Fukushima finanziell leisten?

Welche Auswirkungen auf die Republik Slowenien müssen im Falle eines schweren Unfalls in einem slowenischen Kernkraftwerk erwartet werden und welche Auswirkungen hätte ein solcher auf die slowenische Wirtschaft und Gesellschaft?

Mit welchen Strategien will die Republik Slowenien die wirtschaftlichen Konsequenzen eines Atomunfalls bewältigen und wie will sie sicherstellen, dass die Opfer des Unfalls angemessen entschädigt werden?

2 SUMMARY

The Republic of Slovenia has notified Austria about the development of a draft proposal for a “National Energy Programme for the 2010 – 2030 Period” according to Art. 10 of the Protocol on Strategic Environmental Assessment (SEA-protocol) to the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo-Convention) and according to Directive 2001/42/EC.

The Federal Ministry of Agriculture, Forestry, Environment and Water Management notified that the Republic of Austria will participate in the trans-boundary process because of possible significant environmental impacts of the Slovenian National Energy Programme.

The Federal Environment Agency (Umweltbundesamt) commissioned the Austrian Energy Agency to prepare an expert statement on the published documents regarding the Slovenian Draft National Energy Programme.

Initial situation

Slovenia has defined the following objectives of its energy policy:

- Security of energy and energy service supply
- Environmental sustainability, combating climate change
- Competitiveness of the economy and society, and available and accessible energy and energy services respectively
- Social cohesion

A central part of the future National Energy Programme of Slovenia will be the long-term exploitation of nuclear energy. The main measures in this context are:

- The extension of the operational lifetime of Krško NPP
- The construction of a new nuclear power plant Krško NPP2

Beyond that, Slovenia has the intention to increase the share of RES in its gross domestic energy consumption according to the targets defined in the climate and energy package of the EU and establish the conditions to develop to a low-carbon society.

For this reason, different scenarios were developed for the period 2010–2030, which contain several sub-programmes for sustainable energy, electricity, fuel and horizontal measures. An assessment of the impacts, according to their energy economic relevance and contribution to meet the objectives of the energy policy, show preference for scenarios with a strong focus on nuclear energy. The Comprehensive Assessment of Environmental Impacts identified a scenario with a strong focus on nuclear energy as the most acceptable.

Evaluation

Both the draft of the National Energy Programme and the Environmental report on the Comprehensive Assessment of Environmental Impacts contain severe weak points.

The National Energy Programme underestimates the real costs of nuclear electricity generation. The Environmental Report does not cover the aspects and risks related to the safety of nuclear power plant operation, the realisation of long-term storage or disposal of high level radioactive waste. The potential impact of severe accidents in nuclear facilities on Slovenia and its neighbouring countries, including all negative effects on people's health, the environment and the economy are completely left out.

For the development of a comprehensive and coherent National Energy Programme it is necessary to include many additional aspects and to find concrete solutions for many open issues.

For the further development of the Draft National Energy Programme the following recommendations have to be taken into account and open questions have to be answered.

Recommendations and Questions

Energy Policy

Slovenia has to reach national and international targets regarding energy efficiency, renewable energy sources and green house gas emissions. Many of the energy policy measures that were developed in the past were not successful, which further insists upon Slovenia to improve its efforts.

Questions:

Which were the reasons Slovenia did not reach several targets, which were defined in the former energy policy?

How can it be ensured, that the new targets will be reached?

Scenarios of the NEP

The draft NEP proposal contains an incomplete comparison of supply scenarios for electric energy and the key options of energy supply. The document describes that the main challenges for the future electricity supply, would be the construction of new hydroelectric power plants, the replacement of key existing hydro power plants and the efficient use of coal and natural gas in combined heat and power plants (CHP-Power Plants).

A weak spot in the selected scenarios is that the draft NEP proposal has a strong nuclear focus and scenarios abandoning nuclear generation in the medium and long-term are lacking.

Recommendations:

- The NEP programme has to survey additional scenarios that also consider a shutdown of Krško NPP at the end of its originally planned lifetime and a replacement of its capacity by an alternative generation-mix (e.g. based on RES and conventional power plants for combined production of heat and electricity). An additional scenario with an early shutdown of Krško NPP should also be shown in a separate scenario.

- The existing scenarios have to be amended, considering concrete costs for the extension of the operational lifetime of Krško NPP, the construction of Krško NPP, the treatment, storage and final disposal of nuclear waste and spent fuel.

Questions:

Until which year should the operational lifetime of Krško NPP be extended?

Which potential of energy efficiency measures and the use of RES will be exploited with the measures in the different scenarios and which technical and economically feasible potential remains unexploited?

The Slovenian electricity market and exports of electricity

The implementation of the measures described in the draft NEP proposal would lead to a huge increase of electricity exports. Slovenia would become a major exporter of electricity generated in power plants. It can be concluded, that there is no domestic demand for constructing of Krško NPP2.

Recommendations:

- Potential future regulations for labelling of electricity for consumers and its possible effects on the export of electricity from NPP have to be taken into account in the scenarios of the National Energy Programme.
- A National Energy Programme should focus on needs of the domestic energy supply and not deliver a strategy to increase the electricity exports of one single state owned company.
- If a new NPP is built with the envisaged capacity, electricity generation in Slovenia will depend heavily on nuclear power, and large amounts of electricity would have to be exported. Such an over-capacity and unfavorable generation mix should be avoided.

Questions:

How will it be ensured that the enhancement of transmission capacities to neighbouring countries will be financed by the beneficiaries of these measures, which are the electricity exporting companies?

Which investments into the transmission grid become unnecessary if Krško NPP2 would not be built?

Which generation capacities would be sufficient for Slovenia if the National Energy Programme would not intend to increase electricity exports?

Which part of the new NPP's production would be exported?

Transmission system and reserve capacities

The intended enhancement of cross-border transmission lines is strongly linked to Slovenia´s plan to significantly increase electricity exports. The construction of Krško NPP2 would need additional investments also in reserve capacities which would increase the costs of electricity supply for Slovenian customers. The main beneficiary of the investments would be the owner and operator of the NPP.

Recommendations:

- The construction of a 1,000 MW unit within a control area with a peak load of about 2,100 MW is inappropriate, inefficient, and causes additional costs. It is recommended increase the generation capacities by building smaller units. In Austria the largest unit is about 400 MW within a control area that has a peak load of about 8,300 MW.

Questions:

Is it guaranteed that the capacity of the new NPP will be compatible with the national grid? Which analyses have been performed?

Which additional secondary and tertiary reserves are necessary for Slovenia, when the biggest unit in the ELES control area will be the 1,000 MW nuclear unit of Krško NPP2?

Which investments in additional reserve capacities are necessary and who will have to cover their costs?

Independence of the Assessment of the Environmental Acceptability

The Assessment of the Environmental Acceptability of the sub-programme "nuclear energy" is taken from a study that was ordered by GEN energija d.o.o, the initiator of the programme "nuclear energy." Moreover, or as a consequence, „the risks associated with nuclear safety and the implementation of the sustainable handling of high level nuclear waste are not included in the evaluation of environmental impacts of NEP measures."

Recommendation:

- The Environmental Report has to be amended to cover the risks and potential environmental impacts of severe accidents and nuclear events in nuclear facilities for electricity generation, treatment and storage of nuclear waste and spent fuel.

Question:

Are there any plans to assess the economic rationales of an extension of the operational lifetime of Krško NPP and the construction of Krško NPP2 and the ecological impact of these measures by an independent organisation to provide both the public and the decision-makers with neutral information about the benefits and costs of nuclear energy to their community?

Nuclear power capacity in Slovenia

Currently, a Westinghouse pressurized water reactor with a net electric power of 620 MW (Krško NPP) is in operation; the share of nuclear power in the electricity generation mix in Slovenia reaches almost 40%. The operational lifetime of Krško NPP ends in 2023. According to the draft NEP proposal, the operational life of Krško NPP is to be extended "until at least 2043." The draft NEP proposes to construct an additional reactor with an electric capacity of 1,100 to 1,700 MW on a location in Krško, if certain conditions are met. The earliest possible date for the start of operation is 2022.

Constructing a new NPP with a capacity of up to 2.5 times that of NPPK would create a very large nuclear capacity in Slovenia without corresponding domestic electricity demand. Krško NPP2 will be a power plant exclusively or at least mainly used for electricity export. As a consequence, Slovenia will take over all the unresolved problems, risks and costs of nuclear energy from its neighbouring countries to position itself as an electricity exporter.

Recommendation:

- It is recommended to conduct a study to determine the actual macroeconomic cost of an additional reactor in comparison to the benefits from electricity exports.

Question:

Is it guaranteed that the capacity of the new NPP will be compatible with the national grid? Which analyses have been performed? Which part of the new NPP production would be exported?

Lifetime extension of Krško NPP

The licensing procedure to extend the lifetime of Krško NPP *"until at least 2043"* is presently under way. There are new regulations in Slovenia in the context of the Convention of Nuclear Safety (CNS) that require Krško NPP to withstand severe accidents. Moreover, "stress tests" for nuclear power plants are currently being conducted in the EU member states. Additionally, the WENRA safety objectives for new nuclear power plants, which explicitly also refer to existing plants, should be applied. The WENRA safety objectives require that the core damage frequency is to be reduced as far as reasonably achievable. Core melt accidents which could lead to early or large releases have to be practically eliminated. WENRA also develops position papers on selected key issues relevant for new NPP (e.g. airplane crash, practical elimination) that will be available by the end of 2012.

An aging management programme (AMP) has been recently initiated as part of the first periodic safety review of NPPK. However, a late establishment of a systematic AMP might have negative consequences on nuclear safety.

Recommendation:

- The decision for lifetime extension should only be taken once the results of the European Stress Tests for nuclear power plants are available to make sure that standards will be stricter and nuclear safety will be improved. It should be guaranteed, that there is a sufficient data base for the aging management programme.

Questions:

To which extent will the WENRA safety objectives for new power reactors, and the WENRA position papers on key issues, which are being elaborated at present, be taken into account in the licensing procedure for life time extension of the NPPK?

Is it planned to postpone further steps in the context of NPPK lifetime extension until the results of the European "stress sest" (including the conclusions of the peer review) are available?

Which aging management activities took place at NPPK before the new AMP was implemented after 2005?

Are there specific challenges at NPPK the AMP is focussing on – systems, structures or components requiring special attention?

Construction of a new nuclear power plant in Krško (Krško NPP2)

The draft NEP proposal foresees the construction of a second NPP with a capacity of 1,100–1,700 MW. The WENRA safety objectives and the position papers on key issues (see above) will have to be taken into full account. However, in the context of the CNS framework it was highlighted that the Slovenian Nuclear Safety Administration (SNSA) "*does not have sufficient resources for licensing and overseeing the design, construction and operation of a possible new plant."*

The draft NEP proposal states, that the actual realisation of the project Krško NPP2 should *depend on conditions in the market, business decisions and social acceptability of the project*.

Recommendation:

- Before deciding on the construction of a new NPP in Krško, all environmental and economic benefits and costs need to be considered and a solution found for the radioactive waste disposal. The WENRA safety objectives and the position papers on key issues need to be taken into account; sufficient resources to ensure nuclear safety in Slovenia need to be provided.

Questions:

Which safety standards would apply to the new NPP project, in particular concerning the exclusion of accidents with large or early releases?

How will be guaranteed that SNSA has sufficient resources available for the licensing procedure for a new NPP? Are concrete activities already under way?

Which conditions, business decisions will be relevant to take the decision for building a new unit at NPPK?

Since the draft NEP-proposal makes a reference to the social acceptability of the further long-term exploitation of nuclear energy in Slovenia (pp. 1, 33, 35, 39, etc.), in what way will the social acceptance of the population be included in the decision-making process? Will a referendum decide about the implementation of the project Krško NPP2?

Which indicators will be applied to assess the social acceptability of the project Krško NPP2?

Disposal of low and intermediate level radioactive waste (LILW)

The draft NEP proposal includes the plan for a final disposal of low and intermediate level waste (LILW) at Vrbina in the Krško municipality by 2023. The latest Slovenian CNS report however states, that an Act from 2002 requires a LILW repository to be operational by 2013.

The financing of the disposal will be provided by the Fund for Financing Decommissioning of Nuclear Power Plant Krško and Disposal of Radioactive Waste from the Krško NPP and (for institutional waste) by the state budget. EUR 106 million are foreseen for implementing this investment programme. However, the Court of Auditors of the Republic of Slovenia issued a warning in August 2011 that the current contributions of the operator of NPPK are insufficient to provide sufficient funding for decommissioning and the construction of a nuclear waste disposal.

Recommendation:

- The expected costs of a nuclear waste disposal (for both LILW and HLW) need to be internalised into the cost of electricity. A decision on the lifetime extension of NPPK and the construction of NPPK2 should be made conditional on the operability of a permanent disposal of low and intermediate level waste.

Questions:

What is the reason for the apparent discrepancy regarding the completion of the LILW-repository, between the CNS-Report 2010 and the draft NEP proposal of 2011?

What are the present funds available and what is the share of public funds for the construction of the LILW-repository?

Disposal of high level radioactive waste (HLW)

All high level radioactive waste from Krško NPP is currently stored in the NPP spent fuel pool, outside the reactor building. The available information does not show to which extent this building is protected against external events. Moreover, it is not clear where HLW will be stored between 2023, when the storage pool at Krško is full, and 2065. It remains unclear to which extent reprocessing will be implemented.

The draft NEP proposal includes the objective to prepare a "*proposal of the resolution concerning decomposition and management of high-level waste (HLW)."* The decision regarding the concept for final disposal of spent fuel is to be taken by 2020. A repository should be operational by 2065. Multinational disposal is also seen as an option. The Radioactive waste and spent fuel management directive requires a plan with a concrete timetable for the construction of disposal facilities. Currently a strategy and a cost estimation of the disposal for radioactive waste as well as the strategy on international partners for constructing a shared repository are lacking.

Recommendation:

- A decision on the extension of the lifetime of Krško NPP and the construction of Krško NPP2 should be made strictly conditional on a solution to the disposal of HLW. The expected costs of a permanent storage of HLW have to be included in the electricity price.

Questions:

Which protection does the fuel handling building provide for the spent fuel pool, in case of external events (e.g. aircraft crash)? Is this protection equivalent to that provided by the reactor building?

Any generator of electricity needs to have a permanent solution for dealing with the accumulated waste. What are the envisaged solutions for the high-level waste in Krško NPP? What are the expected costs for a permanent storage of this high-level waste?

With which state does the Republic of Slovenia intend to find a bilateral solution to the permanent disposal of radioactive waste?

Will the expected costs of a permanent storage of high-level radioactive waste be internalized in the price of energy as is formulated as a "key element in the transition to sustainable energy options" in the draft NEP-proposal?

What plans or concepts are there at present for the storage of spent fuel (to the extent it is not reprocessed) – regarding amounts, site(s) and periods of time? In particular, how will the time period 2023–2043 be bridged? Is increasing the density of the storage considered as an option? Is it planned to postpone further steps regarding the planning of spent fuel storage until the results of the European "stress test" (including the conclusions of the peer review) are available?

How much of the spent fuel is expected to be reprocessed – in which facility? Where would the reprocessed waste be stored?

How does the Government of the Republic of Slovenia intend to fulfil the requirements of the radioactive waste and spent fuel management directive? In particular, what are the plans for a permanent disposal of radioactive waste, what are the expected costs and the intended financing schemes for the additional waste generated by an extension of the operational lifetime of Krško NPP and the construction of Krško NPP2?

Uranium mining

The draft NEP proposal mentions *"research with the aim to record natural resources (coal, uranium, oil and natural gas)*." However, the Žirovski vrh Uranium Mine was closed in 2005 and access to the mine is no longer possible.

Recommendations:

- Since uranium mining has significantly negative effects on the environment it is recommended to not re-activate the Žirovski vrh uranium mine.

Question:

Are there any plans for a re-activation of the Žirovski vrh uranium mine?

Funding for the sub-programme nuclear energy

The required funds for the construction of Krško NPP2 in the draft NEP proposal are estimated between EUR 2.2 billion and 4 billion. The costs for the extension of the Krško NPP operational life amount to EUR 125 million. According to this document, no public funds will be provided for these investments. The expected financing costs are not included in the cost estimation.

However, investment in nuclear energy is characterised by a history of cost-overruns and increasing costs per KW installed capacity. Considering recent estimates of construction costs of nuclear reactors and particularly the experience with the EPR in Flamanville (France), the construction costs of Krško NPP2 will hardly be lower than EUR 6 to 8 billion. Moreover, the presentation of investment costs without the costs for financing the project is misleading and hides the actual costs. For investments in nuclear energy a discount rate of 11% is realistic, which results in significant costs that need to be transparently calculated in order to provide decision-makers with comprehensible and relevant information.

Worldwide, there is no single reactor where the financial risk for the construction was exclusively borne by private actors. Common forms of subsidies include subsidized access to credit, subsidies to capital equipment, below-cost provision of enrichment and regulatory oversight services, caps on liability resulting from an accident or attack, inadequate provisions for end-of-life activities such as plant decommissioning, and socialization of costs and delivery risks associated with managing nuclear waste.

Recommendation:

- Instead of investing into an outdated technology, which did not manage to generate electricity without large-scale public subsidies over the past 60 years, the end of the operating lifetime of Krško NPP should be understood as an opportunity to modernise the electricity system and transform the energy sector into a sustainable, low-carbon industry.

Questions:

Are possible updates in the security architecture of Krško NPP included in the estimated costs for the extension of Krško NPP operational life?

What are the estimated overnight investment costs for the extension of the operating lifetime of Krško NPP and for the construction of a new reactor in Krško?

Which discount rate was used for calculating the cost estimation in the draft NEP-proposal?

Which direct or indirect subsidies in the form of loan guarantees, caps on liability resulting from an accident or attack, socialization of costs and delivery risks associated with managing nuclear waste, etc. are currently provided to the operator of Krško NPP?

Externalities and low-carbon society

The draft NEP proposal presents nuclear energy as an important element in the transformation into a low-carbon society. The gradual inclusion of external costs in the price of energy is called to be a key element in the transition to sustainable energy options. The total emissions of nuclear energy over the full life-cycle are rated from 5 to 40 gCO_2e/kWh. However, the carbon emissions of one kWh electricity generated by an NPP depend largely on the uranium ore grade. With decreasing ore grades CO_2-emissions of 82–210 gCO_2e/kWh can be expected. Besides the carbon emissions from nuclear electricity mentioned above, major externalities need to be included into the price of electricity, which concern the risks specific to nuclear facilities: liabilities for major accidents, usually not covered by insurances and paid by the society and the state where nuclear damage occurs.

Recommendation:

- Further externalities need to be included in current efforts to internalise the costs of carbon emissions. To enable a transparent decision-making process and offer alternatives to nuclear energy, regulators should specify the waste, decommissioning, and nuclear risk specific costs and analyse which share of these costs are not internalised in the electricity price.

Question:

To what extent does the environmental report take into account the waste, decommissioning, and risk related costs of nuclear power and internalise them in the electricity prices?

Impact of severe accidents

Even with improving safety measures a major nuclear accident cannot be ruled out. There remains a prevailing probability of an earthquake at the site of the Krško NPP, which could lead to severe damage at the power plant and in the consequence to the release of radioactive material. Additionally, mistakes in the operation of the reactor, accidents such as plane crashes and conscious actions to initiate the largest possible damages (terrorist attacks) can not be excluded. In case of a nuclear accident and depending on the prevailing weather conditions, Austria will be vastly affected by radioactive emissions. The following figure illustrates possible impacts of an accident in Krško using an actual weather situation from 16th of May 1995 as example.

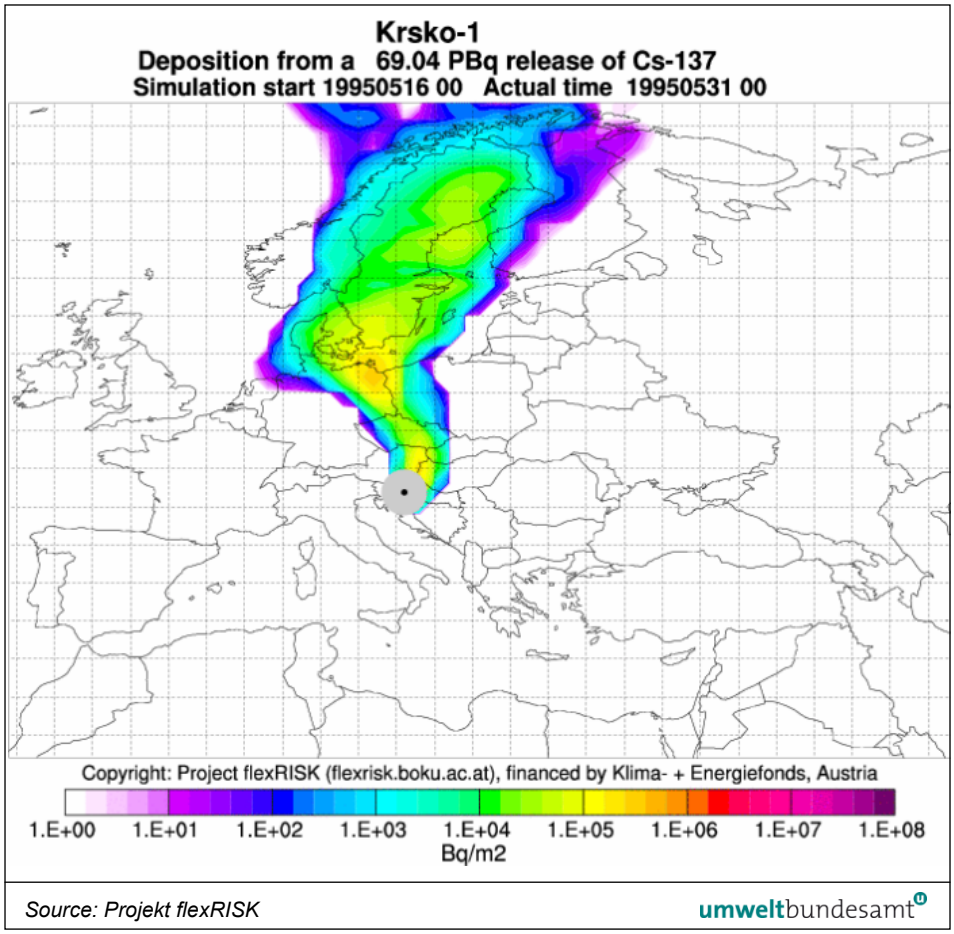

Figure: Hypothetical accident in the NPP Krško on the 16th of May 1995.

Recommendataion:

- The Environmental Report has to be amended to cover the risks and potential environmental impacts of severe accidents at nuclear power plants, facilities for the treatment and storage of nuclear waste and spent fuel. In particular cross-border impacts need to be assessed.

Nuclear liability

The nuclear liability and compensation arrangements currently in place are severely inadequate. The trend in the EU definitely points towards higher compensation for nuclear damage, the amounts still valid in some new EU member states are considered too low by the international community.

The total available compensation due to Slovenia's international obligations under the Paris regime amounts to EUR 1,500 million. This amount will not be sufficient in the case of a nuclear accident in the size of Chernobyl or Fukushima. As a consequence, international rescue packages will have to bail-out a struggling Slovenian economy. Risks are transferred from the (state-owned) operator of Krško NPP to the international community.

Recommendation:

Full and effective compensation for the risks of nuclear accidents needs to be established. To prevent electricity market distortions it is necessary to internalise the costs of private insurance and the expected compensations for victims of nuclear accidents in the price of electricity from nuclear generation.

Questions:

Are any reserves in the budget of the Republic of Slovenia dedicated to compensations in case of a major accident if the damages exceed the capped liability of nuclear operators? Can the Republic of Slovenia afford a nuclear accident in the size of Chernobyl or Fukushima?

Which impacts on the Republic of Slovenia must be expected in case of a severe accident in a Slovenian NPP and which impact on the country's economy and society would occur?

What are the strategies by the government of Slovenia to cope with the economic consequences of a nuclear accident and the compensation of victims of a nuclear accident?

3 INTRODUCTION

On behalf of the Republic of Slovenia the Slovenian Ministry of Economy has developed a draft proposal for a National Energy Programme for the 2010–2030 Period ("Active Energy Management").

The Republic of Slovenia has notified the draft proposal for the National Energy Programme according to Art. 10 of the protocol on strategic environmental assessment (SEA-protocol) to the Convention on Environmental Impact Assessment in a Trans-boundary Context (Espoo-Convention) and according to Art. 7 of Directive 2001/42/EC of the European Parliament and of the Council on the Assessment of the effects of certain plans and programmes in the environment.

Two main documents describe the National Energy Programme:

- Proposal of the National Energy Programme of the Republic of Slovenia for the 2010–2030 Period: "Active Energy Management", draft, June 2 2011 (DRAFT NEP PROPSAL 2011)
- Environmental Report for the Comprehensive Assessment of Environmental Impacts for the National Energy Programme (for the 2010–2030 period), June 2011 (ER 2011)

The Republic of Austria, represented by the Federal Ministry of Agriculture, Forestry, Environment and Water Management of Austria, will participate in the trans-boundary process according to the SEA-protocol and to Art. 7 of Directive 2001/42/EC due to possible significant impacts on its environment, caused by the implementation of the planned NEP. In particular the nuclear part of the draft NEP can lead to nuclear events or severe accidents with significant impacts the citizens and the environment of the Republic of Austria.

The Austrian Energy Agency was commissioned by the Ministry of Agriculture, Forestry, Environment and Water Management to prepare this expert statement on the draft National Energy Programme of the Republic of Slovenia. This expert statement focuses in particular on the nuclear relevant aspects of the draft National Energy Programme.

4 NATIONAL ENERGY PROGRAMME 2010–2030

4.1 Energy Policy

The draft NEP needs to follow European and International obligations for the Republic of Slovenia. Slovenia has to fulfil national and international targets regarding energy efficiency, renewable energy sources and green house gas emissions. Many of the energy policy measures, which were developed and implemented in the past, turned out to be insufficient; this leaves Slovenia under pressure to increase its efforts now.

According to EU Directive 2006/32/EC (EUROPEAN COMMISSION 2006) each member state of the European Union has to achieve 1% of energy savings annually; the total indicative target for energy savings in the period from 2008 to 2016 adds up to 9%. The draft NEP admits that the energy efficiency improvements are far too slow in Slovenia to reach the objectives set in the National energy efficiency action plan 2008–2016, which was developed according to Directive 2006/32/EC. *In 2008, on average, less than half the final energy savings foreseen in the plan were achieved.* This is very disappointing, when taking into account, that Slovenia still has a significantly higher energy-intensity than most of the EU member States. *In 2008, the energy-intensive use of primary energy was 54% higher in comparison to the EU-27-levels.* Until now Slovenia did not manage to increase its energy efficiency to reach the disconnection between economic growth and increase of energy consumption.

EU Directive 2009/28/EC sets binding national targets for the share of renewable energy sources in gross domestic energy consumption. According to this directive Slovenia needs to increase its RES share in its gross final energy consumption from 16% in 2005 to 25% in 2020. *In 2008, the share of RES in the gross final energy consumption amounted to 14.9%.* This shows that the share of RES has decreased from 2005 to 2008 by 1.1%, thus putting pressure on Slovenia. In the remaining 12 years until 2020 it is necessary to increase the share of RES by 10.1 percentage points, which is more ambitious than the original plan to increase the share of RES by 9% within 15 years.

The targets which have to be fulfilled are mainly determined by the EU climate and energy package, which is focuses on measures to increase the use of RES and energy efficiency. The goal of the climate and energy package is the development of sustainable energy supply systems with less GHG emissions.

On the national level, Slovenia is strongly focussing on the long-term exploitation of nuclear energy. The key measures in the draft NEP proposal are the extension of the operational lifetime of Krško NPP and the construction of a new nuclear power plant, Krško NPP2.

Questions:

Which are the reasons for Slovenia not reaching several targets, which were defined in the former energy policy?

How can it be ensured, that the new targets will be reached?

4.2 Content of the draft NEP proposal

The draft NEP proposal is structured in four sub-programme segments each with several sub-programmes:

I. PROGRAMME IMPLEMENTATION FRAMEWORK
- 1 Situation and Challenges in Slovenia
- 2 International Markets
- 3 Technological Development
- 4 SWOT Analysis

II. NEP STRATEGY
- 1 Strategic Framework of NEP
- 2 Energy Policy Objectives
- 3 Strategy for the Attainment of Objectives
- 4 Priority Areas

III. NEP SUB-PROGRAMMES

SUSTAINABLE ENERGY
- 1 Efficient Use of Energy
- 2 Use of Energy in Transport
- 3 Renewable Energy Sources
- 4 Co-generation of Heat and Electricity
- 5 Local Energy Supply

ELECTRICITY
- 6 Development of the Electricity Market
- 7 Electricity Generation
- 8 Transmission of Electricity
- 9 Electricity Distribution Network

FUEL
- 10 Natural Gas Market
- 11 Natural Gas Supply
- 12 Liquid Fuel
- 13 Coal
- 14 Nuclear Energy

HORIZONTAL MEASURES/RELATED POLICIES
- 15 Taxes and Prices
- 16 Research, Technological and Entrepreneurial Development
- 17 Education and Training
- 18 Use of Space

IV. ASSESSMENT OF NEP IMPACTS
- 1 Long-term Energy Balances 2008–2030
- 2 Financial and Investment Flows
- 3 Fulfilment of International Obligations
- 4 NEP Indicators
- 5 Environmental Impacts
- 6 Summary of NEP Impacts

V. IMPLEMENTATION AND MONITORING OF THE PROGRAMME
- 1 Institutional Measures for the Implementation of the Programme
- 2 Funding
- 3 Monitoring of Programme Implementation

4.3 Objectives of the National Energy Programme

As stated in the draft NEP proposal the official objectives of the Slovenian energy policy are

- **Security** of energy and energy service supply;
- **Environmental sustainability**, combating climate change
- **Competitiveness** of the economy and society, and available and accessible energy and energy services respectively;
- social cohaesion.

The long-term vision is the transition to a low-carbon society. The draft NEP proposal describes the efficient use of energy (EUE), the exploitation of renewable energy sources and the development of active electricity distribution networks as priority fields, which shall have a leading role in the future transition process.

According to the draft NEP proposal the key challenge for future developments in the energy industry is reaching a balance between as little environmental impacts as possible, adequate security of supply and the improvement of competitiveness of society and economy.

The Republic of Slovenia holds the opinion, that the NEP shall represent *an intensive strategy of promoting the sustainable use and local supply of energy.*

Despite this approach one of the main measures proposed in the draft NEP proposal is the continued long-term exploitation of nuclear energy by extending the operational life of the existing nuclear power plant Krško NPP and the construction of a new unit Krško NPP2 on a location next to it. The actual realisation of the project *depends on conditions in the market, business decisions and social acceptability of the project*.

Questions:

Which conditions, business decisions will be relevant for the decision of the actual realisation of a new unit at Krško?

Which indicators will be relevant for the assessment of the social acceptability of the project?

Since the draft NEP-proposal makes a reference to the social acceptability of the further long-term exploitation of nuclear energy in Slovenia (pp. 1, 33, 35, 39, etc.), in which form will the social acceptance of the population be included in the decision-making process? Will there be a referendum to decide on the implementation of the project Krško NPP2?

4.4 Scenarios of the NEP

The draft NEP proposal contains a superficial comparison of supply scenarios for electric energy and the key options of energy supply. The document describes how the main challenges for the future electricity supply would be the

construction of new hydroelectric power plants, the replacement of key existing hydro power plants and the efficient use of coal and natural gas in CHP-Power Plants.

Considering these explanations in the draft NEP proposal, it is astonishing that all the estimated scenarios concentrate on major measures for the use of nuclear energy.

The scenarios covered by the draft NEP proposal are:

- **Basic Scenario (BS):**

  The basic scenario is determined by the prolongation of the operational lifetime of Krško NPP although there is no concrete description of necessary investments in further safety measures as a result of the findings after the disastrous accident in Fukushima NPP in Japan this year and the expected results of the stress test for Krško NPP. Additional measures in this scenario are the acceleration of the construction of new hydro power plants, the modernisation of existing ones and the construction of high efficient CHP power plants.

- **Nuclear Scenario (NS):**

  The nuclear scenario (NS) is an upgrade of the basic scenario (BS) which is focussing on the extensive use of nuclear technologies. In addition to the prolongation of the operational lifetime of Krško NPP 2 it is focussed on the construction of a new Krško NPP2 next to the existing one. According to this scenario NPPK shall have a capacity of 1,000 MW and will start operation before 2030.

- **Gas Scenario (GAS):**

  The gas scenario (GAS) is the second upgrade of the basic scenario by assuming the construction of two additional gas fired thermal power plants with a total capacity of 800 MW until 2030. This scenario contains also the lifetime prolongation of Krško NPP in the same way as the basic scenario.

The draft NEP proposal contains a brief description of two further alternatives, an additional nuclear scenario (AS NS) and an additional gas scenario (AS GAS) which cover different combinations of nuclear power plants and conventional TPP.

The two nuclear scenarios contain a sub-variant in which Krško NPP2 would have a capacity of 1,600 MW (NS INT and AS NS).

For all scenarios two main strategies were considered. The *reference strategy* includes emergency measures for fulfilling the adopted obligations. In contrast to this the *intensive strategy* establishes a support environment for the implementation of all profitable projects in the field of the efficient use of energy and also shows more ambitions in the stimulation of RES-projects of local supply and combined production of heat and electricity.

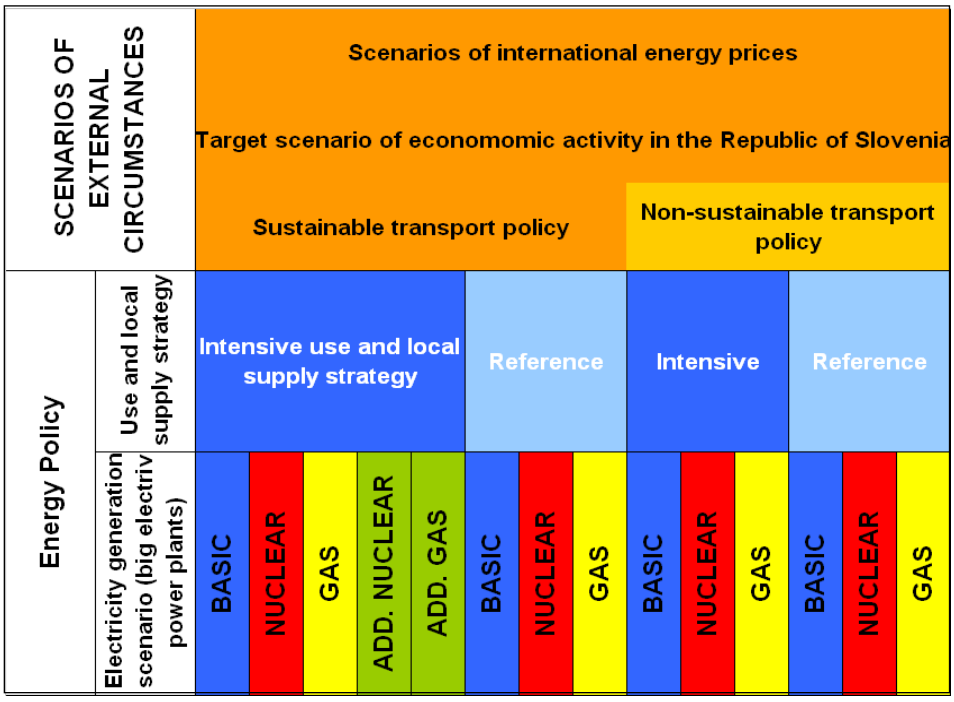

Figure 1: The scenarios of the draft NEP proposal

According to the draft NEP proposal the construction of Krško NPP2 will depend on social acceptability, on the market conditions and business decisions. As there are extensive uncertainties whether all these aspects can be fulfilled on a satisfactory level, there is a strong need to develop scenarios without a long-term use of nuclear power. The accident in Fukushima led to sharpened public awareness for the risks of nuclear power and a decrease in acceptance of new nuclear projects. A survey on the attitudes of EU citizens to the EU Energy Policy showed already in 2007 – a long time before Fukushima – that a majority of the citizens believe, that the nuclear energy share should decrease, because of the risk of accidents and the problems with nuclear waste (See Figure 2).

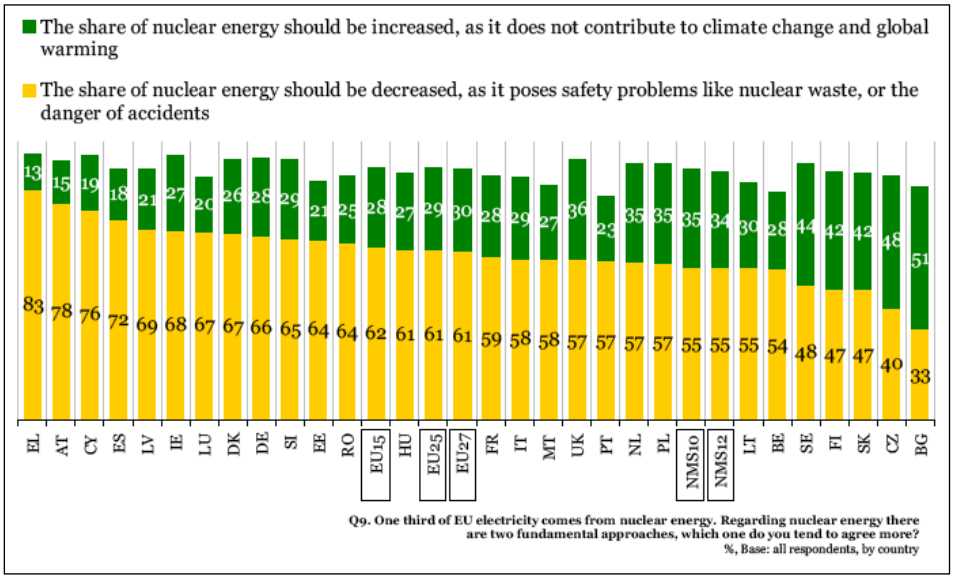

Figure 2: Gallup, Attitude on issues related to EU Energy Policy, European Commission, DG TREN, April 2007

These aspects show the weak spot of the selected scenarios: no scenarios were prepared for abandoning nuclear power in the medium and long-term.

There are at least two important scenarios missing in the draft NEP proposal:

- A non-nuclear based scenario, with the shutdown of Krško NPP until 2023 and the replacement of its capacity by RES and conventional high efficient fossil fuelled power plants for CHE.
- A scenario with an early shutdown of Krško NPP before 2020.

The assessment of the different scenarios in the draft NEP proposal leads to the result that the basic and the nuclear scenarios are recommended for the final NEP. The general direction of the NEP is the extension of the operational lifetime of Krško NPP and the construction of Krško NPP2. This is a surprising result taking into consideration that concrete information on how many additional years the lifetime extension of Krško NPP will amount to, the amount and cost of additional safety and security measures, the concrete timeframe for the construction of Krško NPP2, the intended reactor type and details to the costs of the project are not covered by the draft NEP proposal in detail.

The draft NEP proposal covers energy efficiency measures and RES only in an amount that fulfils national and international targets in these fields. The actual potentials for energy efficiency measures and the development for RES is not covered in the document. Therefore it is impossible to evaluate the ambition of the NEP concerning energy efficiency and RES.

Recommendations:

- The NEP programme needs to survey additional scenarios that also consider a shutdown of Krško NPP at the end of its originally planned lifetime and a replacement of its capacity by an alternative generation-mix (e.g. based on RES and conventional power plants for combined production of heat and electricity). An additional scenario with an early shutdown of Krško NPP should also be shown in a separate scenario.
- The existing scenarios need to be supplemented with additional data, mention concrete solutions and costs for the extension of the operational lifetime of Krško NPP, the construction of Krško NPP, the storage and treatment of nuclear waste and spent fuel.

Questions:

Until which year should the operational lifetime of Krško NPP be extended?

Which potential of energy efficiency measures and the use of RES will be exploited with the measures in the different scenarios and which technical and economically feasible potential remain unexploited?

4.5 The Slovenian electricity market and electricity exports

The Slovenian domestic electricity market one of the small markets in the EU. The annual electricity consumption reached its historical peak in 2007 with 13.2 TWh to decrease in consequence of the economic crisis to 11.7 TWh in 2010.

The projections the NEP proposals is based on assume that the domestic electricity consumption in Slovenia will increase in the long-term to 14.2 TWh in 2030 with an average growth rate of 1.6% between 2010 to 2020 and 0.3% from 2020 to 2030.

According to these figures the domestic electricity demand will grow by 2.5 TWh in the period 2010–2030.

Compared to these figures, however, the electricity generation will increase in a significantly higher amount. In the intensive basic scenario it will increase by 5.6 TWh (from 16.2 TWh in 2010 to 21.8 TWh in 2030) and in the intensive nuclear scenario it will increase dramatically by 13.5 TWh (from 16.2 TWh in 2010 to 29.7 TWh in 2030).

These developments will be coupled to a significant increase of electricity exports. The estimated annual electricity export in 2030 is according to the figures draft NEP proposal (page 152) about 7.6 TWh in the intensive basic scenario (BS INT) respective 10.2 TWh in the nuclear scenario (NS INT). This is more than the overall production of the planned Krško NPP2 with an annual production of about 7.8 TWh.

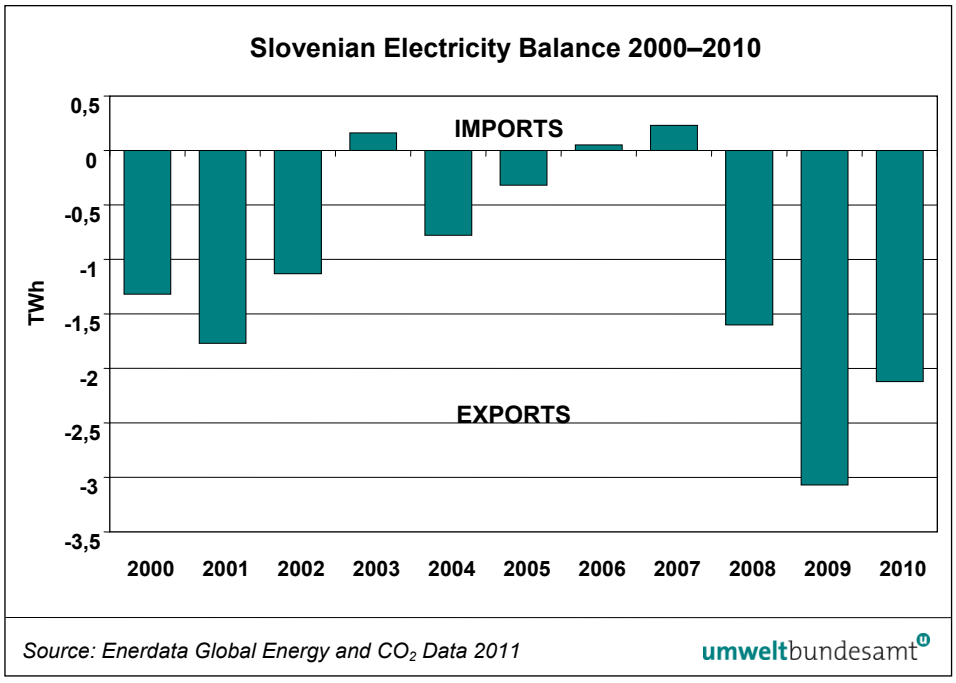

Figure 3: Slovenian Electricity Balance 2000 – 2010.

Figure 3 shows that Slovenia is already a net exporter of electricity. In the last three years Slovenia´s net export reached between 1.6 TWh and 3 TWh per year. In 2009, Slovenia was the 6th largest electricity exporting country within the European Union. Figure 4 shows that only France, Germany, the Czech Republic, Bulgaria and Spain have exported more electricity in 2009 than Slovenia.

These figures show clearly that there is need for the construction of Krško NPP2 to satisfy domestic demand. **Therefore it can be concluded that Krško NPP2 will be a power plant exclusively or at least mainly used for electricity export**.

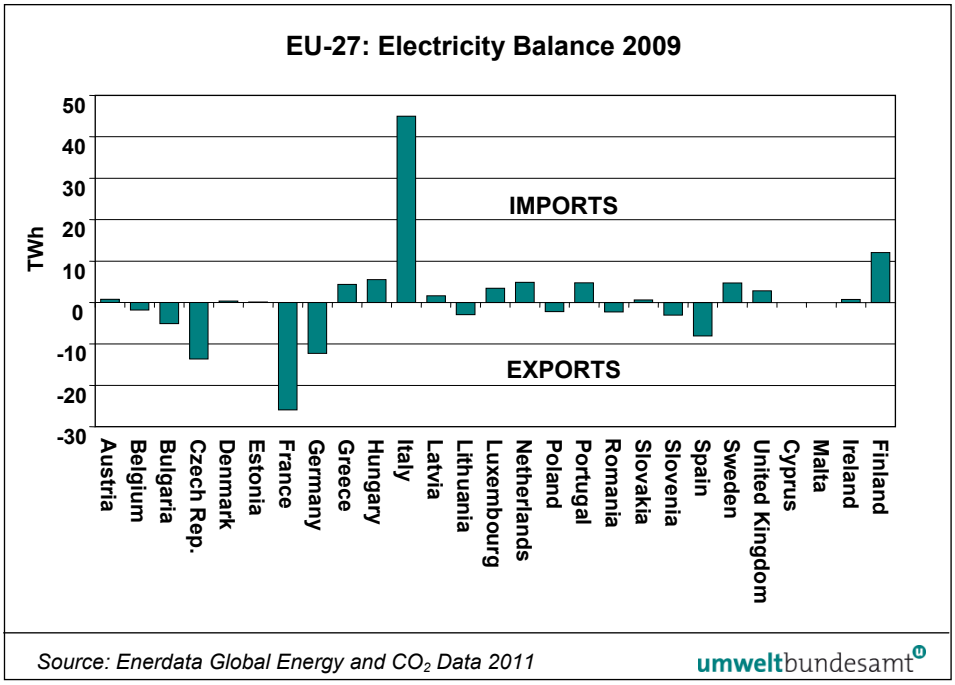

Figure 4: Electricity Balance of the EU-27 in 2009.

With the plan to increase the nuclear capacities by constructing Krško NPP2, Slovenia obviously intends to support the business of one specific state owned utility, GEN-Energija, who would construct and operate the new nuclear power plant, under measures determined in the NEP.

This approach is an obstacle to the development of a competitive and transparent national electricity market and poses the threat of market distortions in the affected regional markets.

The enhancement of the transmission capacities to the neighbouring countries especially Hungary and Italy is also a measure to develop the grid infrastructure for large electricity exports from Krško NPP2.

International development shows that citizens in many European countries such as Germany, Switzerland and Italy and also Austria reject nuclear power; in particular in those regional markets, which are important for Slovenia, the relevance of nuclear power will continue to decrease. Countries which abandoned nuclear power or plan to phase out their nuclear power plants have a tendency towards developing more stringent guarantees of origin for electricity. It can be expected that in the future there will be mandatory guarantees of origin for all primary energy sources, not only for electricity from renewable energy sources as laid down in Directive 2009/28/EC. Many stakeholders in the EU are already asking for a labelling of electricity for final customers which covers the whole chain of electricity sale and provides information such as carbon dioxide emissions and nuclear waste.

These developments will reduce the possibility to sell electricity from nuclear generation in member states where a majority of customers rejects nuclear power. This leads to completely changed economic conditions for the construction and operation of nuclear power plants.

Recommendations:

- Potential future regulations for labelling of electricity for consumers and their possible effects on the export of electricity from NPP have to be considered in the scenarios of the National Energy Programme.
- A National Energy Programme should focus on the needs for the domestic energy supply and should not contain a strategy to increase the electricity exports of one particular state owned company.
- If a new NPP is built, with the capacity envisaged, electricity generation in Slovenia will depend heavily on nuclear power, and large amounts of electricity would have to be exported. Such an over-capacity and unfavorable generation mix should be avoided.

Questions:

How will it be ensured that the enhancement of transmission capacities to neighbouring countries will be financed by the beneficiaries of these measures, which are the electricity exporting companies?

Which investments into the transmission grid become unnecessary if Krško NPP2 would not be constructed?

Which generation capacities would be sufficient for Slovenia if the National Energy Programme would not intend to increase electricity exports?

4.6 Transmission System and reserve capacities

The national Transmission System Operator ELES is responsible for the Slovenian control area within the ENTSO-E grid Continental Europe. Corresponding to the size of the country the control area is also very small compared with other member states of the EU.

ELES is obliged to provide secondary active power reserves to maintain the balance between generation and consumption within its control area and to maintain the desired frequency values as well as the scheduled energy exchange with neighbouring countries. The amount of the secondary reserves according to the methodology as defined by the UCTE Operation Handbook (UCTE OH) are ±80 MW. These reserves are purchased within Slovenia.

In addition to the secondary active power reserves, that are used to cover unforeseen deviations from the operation schedule and to replace missing power in case of outages the amount of tertiary reserves must be sufficient to cover the outage of the largest generation unit in the control area. In Slovenia the total amount of tertiary active power reserves is 348 MW which equals 50% of the power produced at Krško NPP. The reserves for the other 50% of the power are in the responsibility of the Croatian TSO.

For a TSO it is possible to purchase 50% of the required secondary and tertiary reserves outside of the own control area. As ELES purchases all secondary reserves within Slovenia it has only to purchase 134 MW of tertiary reserves in Slovenia. 214 MW of tertiary reserves can be purchased abroad as cross-border tertiary reserves (ELES 2009). This means that only about 25% of the power of the largest generation unit, which is Krško NPP, has to be covered by Slovenian domestic reserves.

The draft NEP proposal determines that at least between 66% and 100% of the secondary reserves and at least a 50% share of tertiary and secondary reserves together will have to be provided within Slovenia. Considering the possible construction of Krško NPP2 this means, that the need for a significant increase in national reserve capacities will arise. These reserve capacities depend on the size of the largest generation unit in the control area. A nuclear unit with more than 1,000 MW (which corresponds to nearly 50% of the peak load of the control area) is much too large for the small ELES control area which leads to inappropriate high costs for secondary and tertiary reserves. These costs will have to be covered by the electricity consumers. This results in Slovenian consumers having to cover these additional indirect costs of nuclear generation to subsidize the electricity exports of GEN-Energija; which can have negative impacts on Slovenia as a business location and lead to severe market distortions.

In the draft NEP proposal it was correctly recognised, *that smaller generation units are more appropriate in the Slovenian system, since less reserve capacities need to be provided upon failure of the largest unit. With smaller units it is easier to achieve a diversification of sources, locations of generation capacities and also of suppliers*. No explanation is provided, why the respective subprogrammes of the NEP do not follow up these correct findings.

Recommendation:

- The construction of a 1,000 MW unit within a control area that represents a peak load of about 2,100 MW is inappropriate, inefficient, and causes additional costs. To increase generation capacity it is recommended to prefer the construction of smaller units. In Austria the largest unit has around 400 MW within its control area with a peak load of about 8,300 MW.

Questions:

Which additional secondary and tertiary reserves are necessary for Slovenia, when the biggest unit in the ELES control area will be the 1,000 MW nuclear unit of Krško NPP2?

Which investments in additional reserve capacities are necessary and who will have to cover their costs?

5 ENVIRONMENTAL REPORT

5.1 Content of the Environmental Report

The draft NEP proposal and its sub-programmes will have important and major impacts on the environment. A Comprehensive Assessment of Environmental impacts (CEIA) is essential to assess the consequences of the environmental effects of the draft NEP proposal in accordance with Directive 2001/42/EC and to decide which of these are unacceptable.

The purpose of the "Environmental Report for the Comprehensive Assessment of Environmental Impacts for the National Energy Programme (for the 2010–2030 period)" (ER 2011) is to determine the environmental aspects which have to be included in the preparation of the NEP measures. Potential stumbling blocks for reaching environmental objectives need to be identified.

The legal background for the Environmental Report (ER) is the Slovenian Environmental Protection Act, which is the national implementation of Directive 2001/42/EC.

The ER contains the following main topics:

1. Summary
2. Introduction
3. Comprehensive Environmental Impact Assessment Methodology
4. Legislative Framework and Association with Other Programmes
5. Description and Evaluation of Environmental Impacts
6. Environmental Objectives
7. State of the Environment
8. Description of the impacts of the NEP sub-programmes on the environment
9. Cross-border Impact
10. Evaluation of NEP Sub-Programme Environmental Impacts and Mitigation Measures
11. Evaluation of impacts and comparison of NEP scenarios
12. Monitoring of impacts and recommendations for further implementation of measures
13. Sources

5.2 Assessment of the Environmental acceptability

The sub-programmes of the draft NEP proposal affect different areas.

The comprehensive environmental impact assessment was carried out for the different sub-programmes according to the draft NEP proposal with focus on their impacts on:

- Natural resources (including impacts arising from the creation of waste)
- Air

- Water
- Nature
- Cultural heritage
- Climatic factors
- Landscape
- Health
- Material assets

The Environmental impacts were classified according to the life-cycle of the measures for the pre-construction phase, the construction phase, the operation phase and the decommissioning phase.

The CEIA only covers the normal operation of NPP and other nuclear facilities. An assessment of the Design Based Accidents (DBA) and Beyond Design Based Accidents (BDBA) and severe accidents in the nuclear installations is completely missing.

The authors of the ER admit *that despite the evaluation of environmental impacts, there are doubts associated with the proposal for the ADD_NPP scenario that stem from the fact that there is unease associated with the nuclear safety of the NPP and the implementation of long-term storage or removal of high level radio-active waste. The risks associated with nuclear safety and the implementation of the sustainable handling of high level nuclear waste are not included in the evaluation of environmental impacts of NEP measures.*

Furthermore the authors point out, that *in accordance with the recommendations of the European Council, we should expect an audit of the nuclear safety evaluation procedures both for the existing NPP in Krško and the planned NPP*.

The main finding within the limited scope of CEIA is, that the most acceptable scenario of the draft NER proposal is the additional nuclear scenario (ADD_NPP[2] respective AS NS[3]). This scenario is based on:

- the extension of the operational lifetime of Krško NPP
- the construction of another nuclear generation unit Krško NPP2 with a capacity of 1,000 MW to start operation before 2030
- the construction of a gas and steam power plant with a capacity of 400 MW
- no construction of unit 6 in Sostanj TPP[4]

The impact of the sub-programme for nuclear energy was assessed in the ER (ER 2011) as follows:

Impact on natural resources:

In the medium term and prior to the construction of a new nuclear power plant (NPP), permanent and safe disposal of low and intermediate level radioactive wastes (LIRAW) needs to be provided for, as well as a proposal drawn up for the handling of high level radioactive waste (HLRAW). Provided the above condition is met, the generation of electricity from nuclear energy is assessed as insignificant (grade C) from the point of view of impact on natural resources.

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[2] Abbreviation according to the ER document

[3] Abbreviation according to the draft NEP proposal

[4] A planned 549 MW block, which is foreseen to start its operation until 2015

Impact on air

With regard to the impact on air, the measures implemented as part of the nuclear energy sub-programme are assessed as grade A, because emissions from NPP do not have a significant impact on ambient air quality status.

Impact on water

Nuclear energy; from the point of view of the impacts on waters, the nuclear energy subprogramme is insignificant (grade C), provided that mitigation measures of periodic cleaning of the cooling system of an existing NPP are ensured, as well as more frequent operation with cooling cells, which would ensure that – when the discharge of the Sava River falls below 100 m3/s - there will be no possibility for river temperature to rise by more than 3 K, or alternatively less if the water in the basin of the Brežice HPP is more vulnerable to the occurrence of eutrophication due to the biomass content in the Sava River.

The new NPP may not use cooling water from the Sava River for once-through cooling (OTC).

Impact on nature and biotic diversity

Nuclear energy; an existing NPP and the new NPP are not situated in an important nature conservation area. The greatest impact of electricity generation from nuclear energy affects the aquatic environment (use of water from the Sava River for cooling). Because of the modified water regime in the area of the Brežice HPP retarding basin, it is necessary to ensure the implementation of measures for the prevention of the occurrence of eutrophication in the Brežice HPP basin, so that the heat effects from the existing NPP do not have a significant impact on biotic communities. The new Krško NPP should not use water from the Sava River as cooling water. If planning guidelines are observed, the implementation of the sub-programme is acceptable (grade C).

Impact on cultural heritage by individual

Nuclear energy; assuming that the construction of a new power plant alongside the area of the existing NPP takes place, we do not expect direct impacts on areas and structures of cultural heritage, as there are no registered heritage units in the probable area where the plant is to be sited. The impact of the sub-programme is insignificant (grade B). The impacts on archaeological heritage are impossible to assess in detail in the strategic phase of environmental impact assessment. Preliminary archaeological investigations will be performed to this end, probably in the following planning phases.

Impact on climatic factors

Nuclear energy; the impact is assessed positively, grade A.

Impact on landscape

Nuclear energy; assuming that the construction of a new nuclear power plant alongside the area of the existing NPP occurs, the impact of the sub-programme on landscape is assessed as insignificant (grade B) as the physical space around the existing NPP has no special landscape value.

Impact on health:

Nuclear energy; from the point of view of the impact on health, the measures of the nuclear energy sub-programme are assessed as insignificant (grade A) pro-

vided the measure for the extent of the impact of the NPP on the health of inhabitants is the share in the dose of natural background radiation received by an inhabitant in the vicinity of the NPP due to the operation of the NPP.

Impact on material assets:

Nuclear energy; measures of the nuclear energy sub-programme will be implemented in the existing location for electricity generation from nuclear energy, whereby existing infrastructure will be predominantly used, while the area of the new NPP is not so large as to have an important negative impact on the existing settlement of the municipality of Krško. The impact is insignificant (grade C).

Recommendations:

- The Environmental Report has to be amended to cover the risks and potential environmental impacts of severe accidents and nuclear events in nuclear facilities for electricity generation, treatment and storage of nuclear waste and spent fuel.

Question:

Are there any plans to assess the economic rationales of an extension of the operational lifetime of Krško NPP and the construction of Krško NPP2 and the ecological impact of these measures by an independent organisation in order to provide both the public and the decision-makers with neutral information about the benefits and costs of nuclear energy to their community?

5.3 Cross-Border Impact of the NEP

The ER concludes that *cross-border impacts of the implementation of NEP measures have been found to exist for all neighbouring countries: Italy, Austria, Hungary and Croatia.*

The construction of a new NPP will have impacts on all these neighbouring countries. In addition, *the envisaged NEP measures have a significant cross-border impact on the environment of neighbouring Austria as a result of the definition of the area of potential utilisation – the border section with Austria to the motorway bridge at Vučja vas on the inner Mura River, as a result of the direct and long-distance impact on the waters of the Mura River water body, and as a result of the direct and long-distance impact on nature*.

Once more we need to point out that the CEIOA lacks an assessment of the cross border impact of severe accidents and events in nuclear facilities. This amounts to seriously downplaying the dangerous risks for the Austria citizens posed by the nuclear investments the draft NEP suggests.

Recommendation:

- The Environmental report also needs to cover possible cross border impacts of potential severe accidents and nuclear events in nuclear facilities for electricity generation, treatment and storage of nuclear waste and spent fuel.

6 THE USE OF NUCLEAR POWER IN SLOVENIA

6.1 Nuclear power capacity in Slovenia

At present, one commercial nuclear power plant is in operation in Slovenia: Krško NPP, a Westinghouse pressurized water reactor. The plant started commercial operation in 1983.

The plant started to operate with a net electric power of 632 MW; this was reduced to 620 MW in 1986. After replacement of the steam generators, power output was increased again step by step, starting in 2001, and reached 688 MW in 2011. This constitutes a significant power uprate (by about 9% of the original power output) (CNS 2010; WNIH 2011; PRIS 2011).

The original design lifetime of the Krško NPP is 40 years; this would be reached in 2023. The licensing procedure to extend the lifetime to 60 years is presently under way (CNS 2010). According to the Proposal of the National Energy Programme, the operational life of Krško NPP is to be extended *"until at least 2043"* (NEP p. 35).

It is envisaged to increase nuclear generating capacity in Slovenia by constructing a new NPP on a location in Krško, with an electric capacity of 1,100 to 1,700 MW. Life expectancy for this plant is to be 60 years. However, the final decision is not taken yet (NEP p. 35). In the "nuclear scenario", one of three supply scenarios considered in the draft NEP proposal, it is assumed that the new NPP will start operating before 2030 (NEP p. 38), the earliest possible start-up being 2022 (NEP p. 39).

The share of nuclear power in electricity production in Slovenia is almost 40%; this is quite high in international comparison (BMWI 2011). (It has to be noted, however, that 50% of Krško NPP belong to a Croatian utility.) Constructing a new NPP with a capacity of up to 2.5 times that of Krško would create a very large nuclear capacity in Slovenia; a considerable part of electricity would have to be exported (see chapter 4.5). Furthermore, the nuclear plants would be located at the same site, increasing the risk that both could fail at the same time due to, for example, a natural event.

Questions:

Is it guaranteed that the capacity of the new NPP will be compatible with the national grid?

Which analyses have been performed?

Which share of the new NPP's electricity production would be exported?

6.2 Lifetime extension of Krško NPP

For the lifetime extension of Krško NPP until 2043 or longer, *"stricter standards in the area of nuclear safety"* are to be observed. The decision for an extension will have to be confirmed by the results of the European stress-tests for nuclear power plants (see below). On the basis of these results, further measures are planned (*"design or audit of international nuclear safety standards"*) (ER p. 27).

By mid-2010, the application to extend the design lifetime had been submitted to the Slovenian Nuclear Safety Administration. The applicant asserted that the requirements for license renewal as defined in US NRC 10 CFR 54 would be fulfilled (CNS 2010). These U.S. requirements, do not concern the application of stricter standards; they focus on aging management and procedural matters of lifetime extension.

However, there are new regulations in Slovenia requiring the Krško NPP to review the ability to withstand severe accidents and implement all reasonable improvements (CNS 2010).

There is no detailed discussion of the stricter standards applicable for the lifetime extension in the draft NEP proposal and ER. In this context, the question arises: to which extent should standards for new NPP be applied?

Regarding such standards, the WENRA safety objectives for new nuclear power plants are most relevant (Slovenia being a member of WENRA). These objectives are explicitly meant to be applied, as reference, to existing plants (WENRA 2010). Usually, it will not be possible for existing plants to achieve the standards for new reactors in every respect. Improvements will be limited to what is reasonably practicable. It is important to note that in evaluating what should be regarded as "reasonable", the remaining lifetime of the plant has to be taken into account – the longer the plant will be allowed to operate, the higher the safety standard to be achieved for this remaining time (RHWG 2011).

If the extension is realised, the Krško NPP will remain operating for several more decades. Therefore more of the safety rules for new nuclear power plants need to be applied. It is necessary to take into account that Krško NPP would be in operation parallel to new NPP in other EU countries, and possibly to a new NPP in Slovenia.

Among other points, the WENRA safety objectives for new nuclear power plants require core damage frequency to be reduced as much as reasonably achievable. Core melt accidents with early or large releases have to be practically eliminated.[5] Regarding core melt accidents which have not been practically eliminated, design provisions have to be taken, so that only limited protective measures are needed for the public (WENRA 2010).

Based on the safety objectives, WENRA is currently developing position papers on selected key issues relevant for new NPPs (e.g. airplane crash, practical elimination). A booklet is to be published by the end of 2012 (GUPTA 2011).

[5] In this context, the possibility of certain conditions occurring is considered to have been practically eliminated if it is physically impossible for the conditions to occur or if the conditions can be considered with a high degree of confidence to be extremely unlikely to arise.

It is important that the WENRA safety objectives and also, as far as the schedule permits, the position papers on key issues will be taken into account in the licensing procedure for the Krško NPP lifetime extension, to make sure that standards will be stricter and nuclear safety will be improved – in particular, that the likelihood and potential consequences of severe accidents will be significantly reduced.

On aging management the latest Slovenian CNS report states that an aging management programme (AMP) has been initiated as part of the first periodic safety review of Krško NPP. The project phase of the AMP was completed by the end of 2008; implementation of the AMP reached its final stage by mid-2010 (CNS 2010). According to the NEP, active monitoring of AMP implementation is required as part of the support environment for the nuclear activities (NEP p. 118).

Aging management requires the monitoring of the status of safety-relevant components over longer periods of time, starting as early as possible to collect a comprehensive data-base. It would be a severe challenge to the lifetime extension programme if a systematic AMP had only been implemented in recent years. For example, if a small defect is detected in a component now, and there are no reliable data on this component's state in the years before, it is difficult to understand the genesis of this defect and to assess its significance. Hence, a late beginning of a systematic AMP might have adverse consequences for nuclear safety.

Currently **"stress tests"** for nuclear power plants are being conducted in the countries of the European Union, as well as in some neighbouring countries. This initiative is based on a declaration of the European Council of March 24/25, 2011 (after the Fukushima accident) and follows specifications elaborated by the European Nuclear Safety Regulators' Group (ENSREG). The "stress tests" are defined as targeted reassessments of safety margins in the light of the Fukushima events and include the identification of potential for modifications which can improve the safety level of a plant. The process is to be concluded by mid-2012 and includes a peer review of the results obtained on the national level (ENSREG 2011).

The risk and safety assessments of the nuclear power plants in the framework of the "Stress Tests" is on-going for the Krško NPP. By 15 August 2011 the operators had submitted an interim report, which was sent to Slovenian Nuclear Safety Administration (SNSA) within the Ministry of the Environment and Spatial Planning. SNSA declared in its press statement of 26 August 2011 that "no major changes or additional work would be needed" at the Krško NPP.[6] However, the final report has not been completed yet (deadline: 31 October 2011). After its submission, the final report will be reviewed first by SNSA and subsequently in a European peer review process.

The "stress test" could lead to new insights regarding the robustness of the plant, for example in the case of seismic events, and also concerning back fitting requirements. In the context of Krško NPP lifetime extension, it appears advisable to postpone any further steps until the "stress test" results for this plant are available, including the peer review conclusions. For the time being the "stress test" for Krško NPP is an uncertainty factor.

[6] http://www.ursjv.gov.si/en/info/news/article/4597/5614/?cHash=33d1acd387 (26.08.2011)

Recommendation:

- WENRA safety objectives and position papers for new reactors should be applied as far as possible for the licensing procedure for Krško NPP lifetime extension.

Questions:

To which extent will the WENRA safety objectives for new power reactors, and the WENRA position papers on key issues which are being elaborated at present, be taken into account in the licensing procedure for life extension of the Krško NPP?

What type of aging management was implemented at Krško NPP before the new AMP started after 2005?

Are there specific challenges at NPP Krško the AMP is focussing on – e.g. systems, structures or components requiring special attention?

Is it planned to postpone further steps concerning Krško lifetime extension until the results of the European "stress test" (including the peer review conclusions) are available?

6.3 Construction of a new nuclear power plant in Krško (Krško NPP2)

According to the draft NEP proposal, the new NPP (with electric power output of 1,100–1,700 MW) is to be *"a third-generation nuclear power plant meeting the latest internationally acknowledged standards of technology"* (p. 117). The document states, that the new unit will be based on the newest technology (Generation III and Generation III+) (CNS 2010).

The criteria for the lifetime extension of the existing NPP, *"high environmental acceptability"* also applies to the new NPP, it needs to pass the European stress tests with a positive result. (ER p. 27).

There is no detailed explanation and no discussion of the *"latest internationally acknowledged standards"* which are to be applied to the new plant. It is clear that the WENRA safety objectives and the position papers on key issues (see above) will have to be taken into full account.

It should be noted that "Generation III" or "third generation" of NPPs is not a clearly defined category. New reactor types like the EPR, AP 1000, AES 2006 or APWR, which are usually regarded to be of Generation III, are still at the prototype stage. Their development is not completely finished; open questions remain even for the EPR, which appears to be the furthest developed type among the new ones (UMWELTBUNDESAMT 2010a).

At the present state of knowledge, it has not been demonstrated that severe accidents with far-reaching and possibly trans-boundary consequences can be regarded as practically eliminated (UMWELTBUNDESAMT 2008; UMWELTBUNDESAMT 2010a; UMWELTBUNDESAMT 2010b). Hence, this issue will require following-up, in case the new NPP will actually be built.

Reinforcement of the personnel capacities for the projects related to nuclear energy is required as part of the support environment for the nuclear activities. Among the institutions and organizations explicitly mentioned for reinforcement is the Slovenian Nuclear Safety Administration SNSA (NEP p. 119).

Reference to this was made in the latest Slovenian CNS report, stating that at the moment (mid-2010), *"the SNSA does not have sufficient resources for licensing and overseeing the design, construction and operation of a possible new plant."* SNSA therefore established a new project team to prepare for the new NPP by developing a qualified and effective infrastructure at the SNSA.

Recommendations:

- If a new NPP project is implemented, WENRA safety objectives and positions papers for new reactors should be applied fully. In particular, the concept of "practical elimination" of accidents with early or large releases should be applied in the most rigorous manner possible.
- Before a decision on a new NPP project is taken, issues concerning the back-end strategy (including final disposal) need to be solved. The time schedule for establishing a repository should be accelerated.

Questions:

Which safety standards would be applied to the new NPP project, in particular concerning the exclusion of accidents with large or early releases?

Which guarantees can be given to insure sufficient resources at SNSA for the licensing procedure for a new NPP? Are there presently concrete activities already under way?

6.4 Disposal of low and intermediate level radioactive wastes (LILW)

Permanent and safe disposal of low and intermediate level wastes (LILW) is one of the objectives of the nuclear sub-programme of the NEP. A disposal facility is to be constructed at Vrbina in the Krško Municipality by 2023 (NEP p. 117).[7] The financing for the disposal will be provided by the Fund for Financing Decommissioning of Nuclear Power Plant Krško and Disposal of Radioactive Waste from the Krško NPP and (for institutional waste) and the state budget (p. 120). 106 million EUR are foreseen for implementing this investment programme (p. 121).

The latest Slovenian report to Convention on Nuclear Safety informed about the LILW repository. Construction at the Vrbina site is to begin by the end of 2012; an Act from 2002 requires a LILW repository to be operational by 2013. The one-year delay in the siting procedure leads to the conclusion that this target will most likely not be achieved (CNS 2010). However, a one-year delay would correspond to a completion in 2014, not in 2023.

[7] Governmental Decree on the Detailed Plan of National Importance for low and intermediate level radioactive waste repository at the location of Vrbina, municipality Krško, Official Gazette of RS, No. 114/2009.

Regarding funding of the disposal, the Court of Auditors of the Republic of Slovenia warned in August 2011 that the current contributions of GEN energija, the state-owned operator of the NPP Krško, are insufficient to provide funding for both the decommissioning of the NPP and the construction of a nuclear waste disposal. Large amounts of money from the funds are being transferred to the affected communities or for salaries of civil servants.[8]

Prof. Dušan Plut, from the Department of Geography at the University of Ljubljana, points out that the price of electricity from nuclear power plants is unrealistically low because they do not include decommissioning costs and construction of the repository. This is contradicting the intention of the draft NEP proposal of including external costs in the energy prices.[9]

Questions:

What is the reason for the apparent discrepancy regarding the completion of the LILW repository, between the CNS report 2010 and the draft NEP proposal of 2011?

What are the present funds available and what is the share of public funds used for the LILW repository construction?

6.5 Disposal of high level radioactive waste (HLW)

Another objective of the draft NEP proposal is the *"preparation of a proposal of the resolution concerning decomposition and management of high-level waste (HLW)"* (p. 117). This includes spent nuclear fuel, and, in case of reprocessing, high-level reprocessing wastes.

Currently all the spent nuclear fuel produced at Krško NPP is stored in the NPP spent fuel pool. The capacity is sufficient for operation until 2023. However, the pool is located outside the reactor building, in the plant's fuel handling building (JC 2008). The available information does not state clearly, to which extent this building is protected against external events.

In the future, reprocessing of spent fuel appears to be an option (NEP p. 117). Final disposal for spent fuel is pursued as a long-term project – according to the basic reference scenario, a repository should be operational by 2065.

Multinational disposal is also seen as an option (JC 2008). The director of the Office for Nuclear Safety, Andrej Stritar, pointed out in September 2011 that for highly radioactive waste it would be much too expensive for Slovenia to build its own deposit. According to Stritar, the construction of a permanent disposal for

[8] http://www.dnevnik.si (2. September 2011)

[9] "Dejansko se dogaja to, da je cena električne energije iz jedrske elektrarne nerealna, ker ne vključuje stroškov za njeno razgradnjo in gradnjo odlagališča, poceni električno energijo pa bodo plačale prihodnje generacije, ki bodo morale še na stotine let skrbeti tudi za naše radioaktivne odpadke," (Dnevnik.si, 2. September 2011).

radioactive waste can only be financed at a bilateral or international level.[10] However, there is no cost estimate for the radioactive waste disposal available, nor a strategy on potential international partners for constructing the shared repository.

The decision on the concept for final disposal of spent fuel is to be taken by 2020 (NEUMANN 2010). Overall the information provided on this issue is rather vague; the final disposal of spent fuel does not seem to have a high priority in Slovenia at the present time.

There is no further explanation or discussion of the high-level waste proposal in the draft NEP proposal. It is not clear to which extent reprocessing will be implemented, and which intermediate storage strategy for spent fuel and/or wastes returned from reprocessing will be adopted, in particular between 2023, when the storage pool at Krško is full, and 2065.

According to another source, the spent fuel is to be transferred from the pool to a dry storage facility, after the reactor has been shut down (NEUMANN 2010). It has to be assumed that this refers to a shutdown in 2023, without lifetime extension, since the capacity of the pool would not be sufficient – unless measures were taken to increase this capacity.

However, the director of the Office for Nuclear Safety, Andrej Stritar, argued that in case of an extension of the projected operational lifetime of NPPK of 20 years, the high-level radioactive waste will remain in the cooling pond until 2025 and will go into dry waste containers after this time.[11]

Spent fuel pools are included in the European "stress tests" mentioned above. Hence, new insights regarding the safety of the pool could arise from these tests, and new back fitting requirements – adding another imponderability for the time being.

On 19 July 2011 the Council adopted the Radioactive waste and spent fuel management directive that requires member states to draw up national programmes that include plans with a concrete timetable for the construction of disposal facilities, as well as a description of the activities needed for the implementation of disposal solutions, costs assessments and a description of the financing schemes.[12] An Assessment of Environmental Impacts of a permanent storage facility is necessary.

Recommendation:

- Direct disposal of spent fuel (without reprocessing) should be practiced. Reprocessing can lead to considerable radioactive emissions to the environment, and to hazardous accidents.
- Before a decision on a new NPP project is taken, issues concerning the back-end strategy (including final disposal) need to be solved. The time schedule for establishing a repository should be accelerated.

[10] Dnevnik.si, 2. September 2011

[11] http://www.rtvslo.si/znanost-in-tehnologija/v-sloveniji-kmalu-gradnja-druge-jedrske-elektrarne/224053

[12] http://ec.europa.eu/energy/nuclear/waste_management/waste_management_en.htm

Questions:

Which protection does the fuel handling building provide for the spent fuel pool, in case of external events (e.g. aircraft crash)? Is this protection equivalent to that provided by the reactor building?

Any generator of electricity needs to have a permanent solution for dealing with the accumulated waste. What are envisaged solutions for the high-level waste in NPPK? What are the expected costs for a permanent storage of this high-level waste?

With which state does the Republic of Slovenia intend to find a bilateral solution to the permanent disposal of radioactive waste?

Will the expected costs of a permanent storage of high-level radioactive waste be internalized in the price of energy as is formulated as a "key element in the transition to sustainable energy options" in the draft NEP-proposal (p. 35, 128)?

What plans or concepts are there at present for the storage of spent fuel (to the extent it is not reprocessed) – regarding amounts, site(s) and periods of time? In particular, how will the time period 2023 – 2043 be bridged? Is it considered as an option that the capacity of the spent fuel pool would be increased by increasing the density of the storage? Is it planned to postpone further steps regarding the planning of spent fuel storage until the results of the European "stress test" (including the conclusions of the peer review) are available?

How much of the spent fuel is expected to be reprocessed – in which facility? Where would the reprocessing wastes be stored?

How does the Government of the Republic of Slovenia intend to fulfil the requirements of the Radioactive waste and spent fuel management directive? In particular, what are the plans for a permanent disposal of radioactive waste, what are the expected costs and the intended financing schemes for the additional waste aggregated by an extension of the operational lifetime of NPKK and the construction of NPKK2?

6.6 Uranium mining

The draft NEP proposal mentions *"research with the aim to record natural resources (coal, uranium, oil and natural gas)"* (p. 137). Regarding uranium, there is no further explanation or discussion of this point in the draft NEP proposal and the ER.

In the latest Slovenian CNS report, the Žirovski vrh uranium mine is mentioned. This mine was in operation from 1985–1990. The site is reported to be decommissioned and clean-up completed. In 2005 it was finally closed and access to the mine is no longer possible (CNS 2010).

Question:

Are there any plans for a re-activation of the Žirovski vrh uranium mine? If yes, what do these plans look like in detail?

6.7 Real costs of nuclear power

The draft NEP-proposal argues that a higher proportion of nuclear power in the electricity generation mix would not only increase security of supply and contribute to low-carbon electricity generation, but is "very competitive source of electricity generation" (p. 35) and would, therefore, result in lower electricity prices (Image 14). The draft NEP-proposal does not provide necessary assumptions to evaluate this argument.

This argument is not plausible when all direct and indirect public subsidies for a NPP are taken into account, the actual investment costs of a new nuclear reactor (including financing costs) are set in relation to other forms of electricity generation and the economics of a nuclear project is judged by the availability of adequate private funding sources for the investment.

The draft NEP-proposal only repeats the nuclear myth of cheap electricity. If the economics of nuclear power were indeed attractive, that is, if over the life of a plant, the impact of the nuclear plant would be to make electricity prices lower than if it had not been built, the fact that it could not be financed in a competitive market either means that nuclear power is not competitive or that there is no functioning energy market (THOMAS 2010).

6.7.1 Required funds for the sub-programme nuclear energy

The total value of investments for the sub-programme electricity generation from 2010 to 2030 is announced to amount to EUR 3.4 billion for the basic scenario and EUR 7.4 billion for the nuclear scenario. As a consequence, the construction of a new nuclear reactor is estimated to require investment costs of EUR 2.2 (this is the difference in the investment costs between the nuclear and the basic scenario in Image 13) and EUR 4 billion (p. 87). The expected financing costs are not included in this estimation. No public funds are said to be provided for these investments.

Recommendation:

- The estimated investment costs of the lifetime extension of Krško NPP and the construction of Krško NPP2 is not realistic. It is recommended to calculate the true macroeconomic costs of this plan, including the financing and external costs.

Question:

What are the estimated overnight investment costs for the extension of the operating lifetime of Krško NPP and for the construction of a new reactor in Krško?

6.7.2 Current investment costs for electricity generation

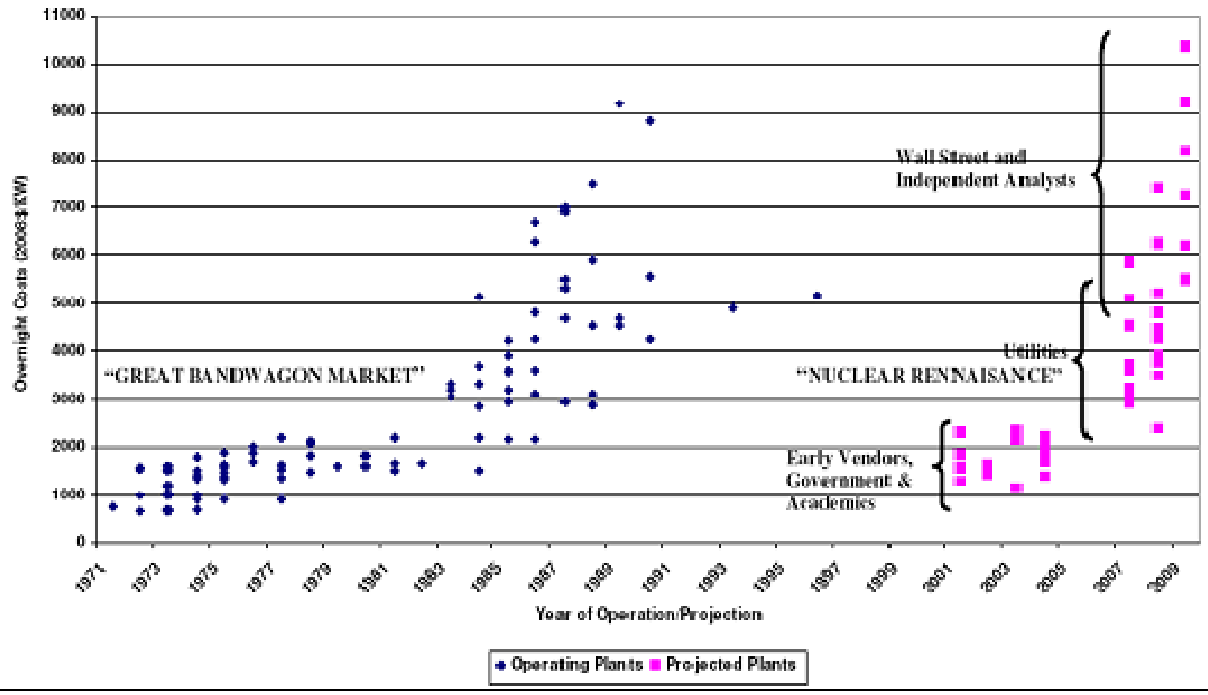
The current estimates of investment costs for nuclear reactors are considerably above the expected 2.2 to 4.0 billion. The investment cost of one kilowatt (kW) installed capacity has risen sharply in recent years. According to Nucleonics Week, the cost of one kW reached USD 4000 in 2008 (EUR 2,900). The investment cost of a new reactor with 1,600 MW would amount to around EUR

4.6 billion (MACLACHLAN 2008). Steve Kidd of the World Nuclear Association (WNA), a pro-nuclear advocacy group, argues that the investment costs of a new NPP are up to EUR 5,000 per installed kilowatt of generating capacity. That would increase total investment costs of a new reactor in Krško to EUR 8 billion (KIDD 2008).

Therefore, the construction costs of a Generation III reactor as is planned for NPPK2 will hardly be lower than EUR 6 to 8 billion.

COOPER (2009, 3) provides an overview of estimated costs of planned and the construction costs of completed reactors (Figure 5).

Construction costs of reactors completed and estimated costs of planned reactors in USD/kW



Source: COOPER (2009, 3)

umweltbundesamt

Figure 5: Construction costs of reactors completed and estimated costs of planned reactors in USD/kW according to COOPER (2009, 3)

Enormous cost-overruns are a common pattern in all recent nuclear investments. Even nuclear programmes that are commonly evaluated as successful, such as the one in France, could not avoid substantial escalation of real-term reactor construction costs in the past (GRUBLER 2009, III). Studies using historical cost data from the U.S. and France suggest that there is at least a factor 2 between the estimated and actual investment costs of a reactor (COOPER 2009b; GRUBLER 2009).

The French energy utility EDF recently admitted that the construction of a European pressurised reactor (EPR) at Flamanville (France) is going to take almost twice as long and cost nearly twice the anticipated price. Total costs are now estimated to amount to around EUR 6 billion.[13]

[13] http://www.guardian.co.uk/business/2011/jul/20/edf-french-nuclear-reactor-delays (20 July 2011)

Whereas investment in nuclear energy is characterised by a history of cost-overruns and increasing costs per KW installed capacity, the investments costs of renewables are decreasing. Investing a large share of available resources in subsidizing nuclear energy means that those funds are not available for other options such as the enlarging of electricity generation from renewable sources.

As in the case of nuclear power, there are big variations in the costs of renewable electricity between countries and between sites within a country. The following table by DIESENDORF (2010) provides an overview of estimates for ranges of values for the prices of electrical energy for various technologies from 2010 and projections for 2020. Whereas the costs of nuclear electricity are expected to further increase until 2020, the costs of electricity generation per kWh of renewable sources will continue to decrease and make new-built nuclear power plants non-competitive.

Table 1: Cost of electricity generation in Euro-Cent/kWh

Cost of electricity generation	Cost of energy 2010 €cent/kWh		Cost of energy 2020 €cent/kWh	
	min	max	min	max
Landfill gas	1.4	2.8	1.4	2.8
Wind (on-shore)	5.0	7.8	3.6	5.7
Biomass residue	5.7	11.4	5.7	8.5
Geothermal (existing)	2.8	4.3	2.8	4.3
Wind (off-shore)	10.7	17.8	5.7	8.5
Solar thermal + storage	14.2	21.4	7.1	10.7
Solar PV (power station)	14.2	21.4	8.5	14.2
Solar PV (residential)	21.4	35.6	10.7	17.8
Nuclear (mid-range of Wall St estimates)*	10.7		14.2	

*Source: DIESENDORF (2010), Fixed 2010 EUR currency, exchange rate USD-EUR=0.711 (7 September 2011); discount rate 8% real. External costs and subsidies are additional to these estimates. * Source: COOPER (2009, 3).*

Recommendation:

- Instead of investing into an out-dated technology that has not managed to generate electricity without large-scale public subsidies in the past 60 years, the end of the operating lifetime of NPPK should be understood as an opportunity to modernise the electricity system and transform the energy sector into a sustainable, low-carbon industry.

6.7.3 Financing costs

In the draft NEP-proposal the expected financing costs are not included in the cost estimate. However, the presentation of investment costs without the costs for financing the project is misleading and hides the actual costs. A study published jointly by the International Energy Agency and the OECD Nuclear Energy Agency illustrates the sensitivity of electricity generating cost to underlying discount rates. Nuclear energy only appears cheaper than electricity generated from other sources when low discount rates are assumed (NEA/IEA 1998).

Many economists argue that a real discount rate of 5% is only appropriate for risk-free investments and 10–15% is appropriate for 'average-risk' investments (DIMSON 1989). For investing into a nuclear power station within a privatised industry, DIMSON (1989) chose 11%, which represents the after-tax return expected by an investor who purchases securities with the same investment risk as the power station (DIESENDORF 2010, 4). Therefore, the financing costs of a nuclear project represent a significant share of the total costs and needs to be transparent in order to be able to compare the expected costs with alternatives.

Recommendation:

- We recommend to include the financing costs into the cost estimate of the draft NEP-proposal; this provides information for reliable business decisions for the nuclear utility but also offers transparency concerning the macro-economic effects of nuclear energy for Slovenia,

Question:

Which discount rate was used to calculate the cost estimate in the draft NEP-proposal?

6.7.4 Externalities

The draft NEP-proposal argues that a key element in the transition to sustainable energy options is the gradual inclusion of external costs in the price of energy (p. 35). Therefore the draft NEP-proposal should make the external costs available as a necessary input into the decision making process. Nuclear energy has considerable environmental impacts, e.g. waste management and disposal.

The draft NEP-proposal claims several times that nuclear energy contributes to the transformation into a low-carbon economy. The Environmental Report, prepared by the initiator of the programme, states carbon emissions generated by nuclear power plants rank among the lowest per unit and total emissions are rated between 5 to 40 g CO_2e/kWh.

However, in addition to the plant construction and operation the complete front-end (uranium mining and fuel production) and the back-end (decommissioning, waste disposal etc.) are very energy intensive and have a substantial carbon footprint. The carbon emissions of one kWh electricity generated by NPP depend largely on the uranium ore grade. The carbon intensity increases with decreasing grade: The ore grade of 0.01–0.02% results in CO_2-emissions of 82–210 gCO_2e/kWh (WALLNER et al. 2011).

According to the International Atomic Energy Agency (IAEA) currently one third of the uranium resource has an ore grade of 0.03% and less. The world average ore grade in the last five years ranged between 0.05 and 0.15% (MUDD/DIESENDORF 2007; ISA 2006, 96). Currently the majority of global uranium resources are unconventional resources which are difficult to develop into operating uranium mines. CO_2 emissions, water and energy needs, as well as costs of uranium mining are expected to rise considerably in the future.

Besides the carbon emissions from nuclear electricity mentioned above, major externalities need to be included into the price of electricity, which concern the risks specific to nuclear facilities: liabilities for major accidents, usually not covered by insurances and paid by the society and the state where nuclear damage occurs.

Recommendation:

- The current efforts to internalise the costs of carbon emissions need to include all externalities. To enable a transparent decision-making process and present alternatives to nuclear energy, regulators should be asked to specify the waste, decommissioning, and risk related costs of nuclear power generation and analyse which share of these costs is not internalised in the electricity price.

Question:

To what extent are the waste, decommissioning, and risk related costs of nuclear power considered presented in the environmental report and internalised in the costs of nuclear electricity generation?

6.7.5 Private financing and public subsidies for nuclear energy

The draft NEP-proposal states that no public funds are required for implementing the sub-programme electricity generation. Investments necessary during the operational life of the NPP in Krško and for the construction of a new reactor can be covered by revenues from the sale of energy and energy services in the market.

The confidence in private investors the draft NEP-proposal shows is surprising since empirical evidence suggests that without public subsidies and other forms of support, it is not possible to finance a nuclear power plant. Worldwide, there is no single reactor where the financial risk for the construction was exclusively borne by private actors (THOMAS 2010; SCHNEIDER, M. et al. 2009).

Due to the high investment costs and the associated financial risk, a purely private financing of new nuclear power plants has not yet succeeded. Even the OECD Nuclear Energy Agency (NEA) admits that financing nuclear power remains a challenge. An expansion of nuclear power will therefore require “strong and sustained government support” (NUCLEAR ENERGY AGENCY 2009).

The draft NEP-proposal states that a decision on the extension of the operating lifetime of NPPK and the construction of NPPK2 will be based on “quality entrepreneurial decisions.” To enable a comparison of the economics of nuclear energy with other options it is necessary to not only include costs of environmental externalities such as carbon emissions but also include the direct and indirect subsidies for nuclear power. Public subsidies “socialise” nuclear power generation costs and therefore the public needs to know.

Common forms of subsidies used around the world include subsidized access to loans; subsidies to capital equipment; below-cost provision of enrichment and regulatory oversight services; caps on liability resulting from an accident or attack; inadequate provisions for end-of-life activities such as plant decommissioning; and socialization of costs and delivery risks associated with managing nuclear waste (SCHNEIDER et al. 2010, 71).

Government programs to subsidize the cost of capital are the most common form of public subsidy and include loan guarantees, tax credits and other measures that help to reduce the effective cost of capital goods (ibid.). Loan guarantees cut nuclear construction financing costs by allowing the utilities to sell bonds at a lower interest rate. However, just because the costs are shifted to the public and therefore hidden from balance sheets does not make them disappear. People bear the risks and costs, instead of the utilities, who benefit from the subsidies.

Public loan guarantees can have serious budget implications. According to the U.S. Government Accountability Office, the average risk of default for loan guarantees is about 50 percent, which is the historic rate for the nuclear industry. A November 2009 research report by Citigroup Global Markets termed the construction risks, power price risks, and operational risks "so large and variable that individually they could each bring even the largest utility to its knees" (POWERS 2010).

As a consequence, public subsidies and other non-internalised costs result in lower financing costs for nuclear investments. But shifting the risk does not eliminate it. On the contrary, in an attempt to circumvent the sound judgment of the capital markets, subsidies induce utilities and regulators to take greater risks that will potentially result in significant costs for public budget (ibid.). Subsidies for nuclear energy distort the energy market and increase the risks from nuclear energy.

Recommendation:

- The government should specify any form of direct and indirect subsidies to the (state-owned) operator of NPPK.

Question:

Which direct or indirect subsidies in the form of loan guarantees, caps on liability resulting from an accident or attack, socialization of costs and delivery risks associated with managing nuclear waste, etc. are currently provided to the operator of Krško NPP.

6.7.6 Conclusions

The new-built Krško NPP2 would be exclusively or to a very large extent, used for electricity export. The high external costs of nuclear power and the necessary public subsidies, however, will have to be borne by the Slovenian taxpayer. These funds will not be available for pioneering and sustainable energy solutions, but will restrict Slovenian energy options for several decades. Additionally, the construction of transmission lines to provide for the export of electricity and reserve capacity for Krško NPP2, will have to be funded as well. Moreover, there is no solution for radioactive waste yet.

In essence, with the construction of Krško NPP2, for which there is no actual need, Slovenia will carry the burden of all the unresolved problems, risks and costs of nuclear energy generation. Italy, probably the main importer, will receive the electricity, while Slovenia will continue producing nuclear waste and carry the responsibility for the accumulated nuclear waste for centuries.

6.8 Impact of severe accidents

Estimating accidents in nuclear power plants means to combine low probabilities of a possible event with very high costs for the caused damage. Probabilistic approaches combined with an attitude that "*nothing will happen because it must not happen*" cannot be taken as evidence for the security of a NPP. Even largely improbable events happen, even if the probability-calculations have different results, as has been demonstrated, for example, by the accidents of Fukushima and Chernobyl.

There is historical evidence of earthquakes in Slovenia including the region of Krško. In 1976 an earthquake with a magnitude of 6.4 on the Richter Scale took place in the Friuli region. In 1895 an earthquake struck Ljubljana with a magnitude of 6.1 on the Richter Scale.

Although a nuclear power plant is able to withstand earthquakes up to a certain magnitude, this is of course not unlimited. There remains a prevailing probability of an earthquake at the site of the Krško NPP which could lead to severe damage at the power plant and result in the release of radioactive material.

Additionally, the "human factor" cannot be ruled out. This implies mistakes in the operation of the reactor, accidents such as plane crashes and conscious actions to initiate the largest possible damages (terrorist attacks). No nuclear plant worldwide would resist an attack like those targeting the World Trade Centre in New York on Sept. 11th, 2001. The risk, therefore, that a large share of Slovenia and neighbouring countries would be affected by a nuclear accident, cannot be ruled out.

In case of a nuclear accident and depending on the prevailing weather conditions, Austria will be vastly affected by radioactive emissions. The flexRISK-project calculates the dispersion of clouds of radioactivity as a consequence of serious accidents in nuclear installations in Europe and its neighbourhood for selected accidents with varying weather conditions. The meteorological data are taken from the European Centre for Medium Range Weather Forecasting. 88 actual weather situations of the year 1995 were calculated. Figure 6 illustrates possible impacts of an accident in Krško using an actual weather situation from 16th of May 1995 as an example.

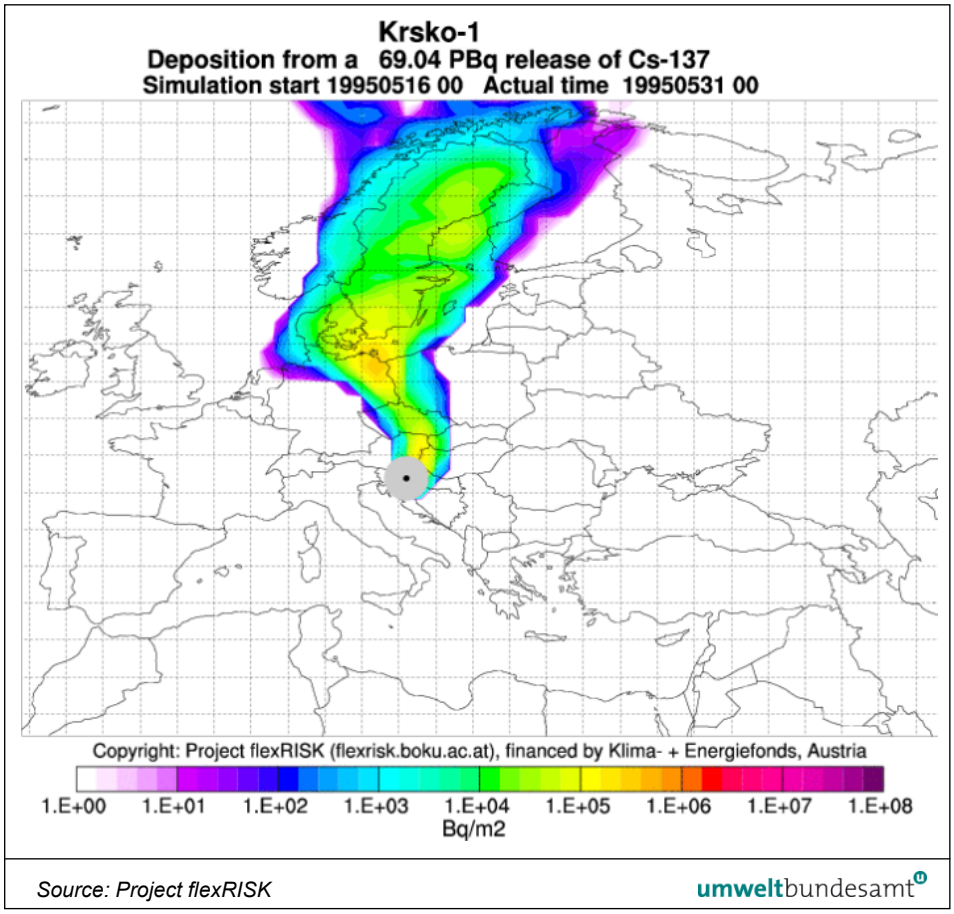


Figure 6: Hypothetical accident in the NPP Krško on the 16th of May 1995.

Recommendation:

- The Environmental report has to cover possible cross border impacts of potential severe accidents and failures in nuclear facilities for electricity generation, treatment and storage of nuclear waste and spent fuel.

6.9 Nuclear liability

The nuclear liability and compensation arrangements currently in place are seriously inadequate. This has major negative implications for reactor safety, fails to ensure compensation of damage in the event of an accident, and creates distortion of competition in the electricity market (SCHNEIDER et al. 2009, 68–70).

The trend in the EU definitely points towards higher compensation for nuclear damage, the amounts still valid in some new EU member states are considered too low by the international community. The EU Commission is preparing guidance or legislation on nuclear liability on EU-level.

Differences in terms of liability rules arise from two international regimes. While the Paris regime foresee higher minimum liability amounts than the Vienna regime, both Vienna and Paris Conventions allow caps to be placed on the amount, duration and types of damage for which nuclear operators are liable.

Slovenia is a member state of the Paris Regime (Paris 1960 and Brussels 1963) and ratified the Joint Protocol of 1988. Slovenia has ratified the 2004 Paris Convention – which amends the 1960 Paris Convention and the 1963 Brussels Supplementary Convention – in 2010 and increases the total compensation available from EUR 356 million to EUR 1,500 million.

The total available compensation due to Slovenia's international obligations amounts to EUR 1,500 million.

Specific national legislation can be set above the minimum liability amounts of the international regimes. However, Slovenian national legislation does not exceed the total available compensation of its international obligations.

Even for this restricted liability it remains unclear whether nuclear operators will be able to obtain private insurance coverage to cover their full liabilities under the Supplementary Convention. Nuclear operators are not liable for damages exceeding the amounts defined in the Convention.

In case of a nuclear accident like Chernobyl or Fukushima any economy will struggle to limit the environmental damages and compensate the victims of the accident. Estimates of the damages resulting from the Fukushima accident range from USD 25 billion to USD 130 billion. The EU-funded ExternE project estimates costs of a severe nuclear accident to range from EUR 431 million to EUR 83 billion. However, one of the largest economies such as Japan will have more resources available for clean-up and reconstruction than a smaller European country.

The Slovenian GDP reaches 0.85% of the Japanese GDP. If this relation is to mirror the ability of a country to cover the costs of a potential nuclear disaster, serious doubt remains whether Slovenia would be able to compensate for the damages of the impacts caused by radioactive releases on the neighbouring countries.

The consequences of a nearly risk-free environment, where there is always a lender of last resort, can be observed in the recent financial crisis. A limitation of responsibility and, as was argued above, financial risks invites irresponsible behaviour.

Recommendation:

- Full and effective compensation for the risks of nuclear accidents needs to be established. To prevent electricity market distortions it is necessary to internalise the costs of private insurance and the expected compensations for victims of nuclear accidents in the price of electricity from nuclear generation.

Questions:

Are any reserves in the budget of the Republic of Slovenia dedicated to compensations in case of a major accident if the damages exceed the capped liability of nuclear operators? Can the Republic of Slovenia afford a nuclear accident in the size of Chernobyl or Fukushima?

Which impacts on the Republic of Slovenia must be expected in case of a severe accident in a Slovenian NPP and which impact on the country's economy and society would occur?

What are the strategies by the government of Slovenia to cope with the economic consequences of a nuclear accident and the compensation of victims of a nuclear accident?

7 ABBREVIATIONS

AS ..... additional scenario

BS ..... basic scenario

CEIA..... Comprehensive Assessment of Environmental Impacts

CHE ..... Cogeneration of Heat and Electricity

ELES..... Elektro – Slovenija, d.o.o.

ENSREG..... European Nuclear Safety Regulators' Group

ENTSO-E ..... European Network of Transmission System Operators for Electricity (successor of UCTE)

ER ..... Environmental Report

EU ..... European Union

EUE..... efficient use of energy

GAS ..... gas scenario

GHG..... greenhouse gas

HLW ..... high level radioactive waste

LILW..... low and intermediate level radioactive waste

NEP..... National Energy Programme

NPP..... nuclear power plant

NS ..... nuclear scenario

RES..... renewable energy sources

UCTE ..... Union for the Coordination of Transport of Electricity

WENRA..... Western European Nuclear Regulators' Association

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