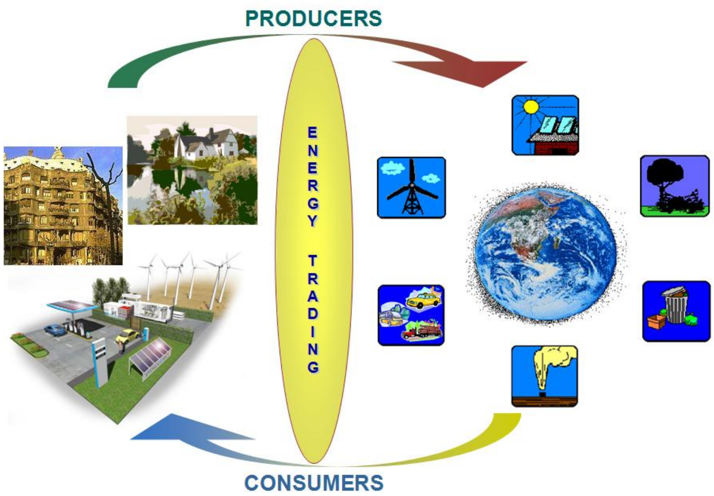
THESIS:

Our current systems for generation and supply of electrical power are out-of-date and need a QUANTUM LEAP!



A QUANTUM LEAP for current national energy supply systems will be the establishment of new local ENERGY COMMUNITIES ('EC'), operating based on local and almost autonomous energy system architectures (DECENTRALIZED ENERGY CLUSTER) and new business models.

Those models shall focus on the fact that the EC Members are acting often simultaneously as DEC investors as well as energy producers and consumers.

Introduction

This Thesis shall simultaneously initiate a mind shift at all involved sites and encourage the superseding of the historically grown Energy Provisioning Paradigm (‘EPP’).

It’s foreseeable, that the near future will be dominated by a new EPP, providing and applying new and already proven business models as well as technologies to the energy economy.

Local ENERGY COMMUNITIES (‘EC’) will supersede current energy supply systems, by applying new decentralized energy system architectures: DECENTRALIZED ENERGY CLUSTER (‘DEC’). These DEC will enable almost autonomic cycles for efficient, decentralized renewable energy generation, distribution (incl. energy trading), storage and application. An online Energy Account Management System (‘EAMS’) will manage energy trading not only between EC Members but as well between nearby ECs. The EAMS will enable online and onsite (using regional Energy Cards) energy trading.

A key role in this EC establishment process will be played by local EC Members, acting often simultaneously as DEC investors as well as energy producers and consumers.

The Energy Turnaround Initiative ‘Mi Energía Solar’ (‘MES’)/ ‘My RENERGY’, shall act as a catalyst platform, to enable and accelerate the Quantum Leap for the establishment of local EC and to provide simultaneously correspondingly required services as well as knowledge (www.mienergiasolar.es / www.myrenergy.com)!

Key parameters of selected energy systems from the U.S., Spain and Germany have been evaluated (see Appendix). These diagrams shall provide comparison and transparency about those national energy supply systems and reveal their shared weaknesses.

Common sense and the facts presented on the “Mi Energía Solar” / “My Renergy” Service Portal raise the *question*:

Is the existing energy supply system, incl. the power transmission grid (‘Macro-Grid’), with their substantial losses on power generation / transmission (54-72% / 7-10%), the appropriate and efficient way, to distribute electricity, generated from decentralized renewable energy sources (available almost everywhere due to their nature) the same way as electricity coming from a few conventional plants (high carbon-footprint or nuclear, fare away from final energy consumption..?

A short history of energy transformation

Our ancient ancestors discovered, while still living in burrows, very early the power of making and using heat, by burning wood in fire places.

Later generations discovered the secret to make fire from fossil resources (carbon, petroleum, natural gas) and they learned to better maintain the heat, even generating high pressured vapor from water, to accelerate mechanic systems. They called this Thermo Dynamics.
Shortly after they learned that laws of Thermo dynamics could be applied as well and directly to other gases, resulting from the burning processes of fossil resources. That all finally led to the so far best practices of Thermo dynamics application for ePower generation and Mobility. But there was a growing awareness of the threatening downsides and limitations of Thermo Dynamics, the knowledge, that it's causing >60% of primary energy losses and even worse it's the resource of >66% of all CO_2 emissions.
Those CO_2 emissions contribute to Global Warming, with all its currently known and yet foreseeable consequences…
At this stage, our ancestors discovered recently, that changing the burning process and material, but still applying Thermo Dynamics at the outcome site, would mostly eliminate the CO_2 emissions… at least at the power plant stage (see further info at:
http://www.hydrogenambassadors.com/background/electricity-from-nuclear-energy2.php).
So, they substituted the fossil burning by nuclear fission to produce the heat input for the still Thermo Dynamics based ePower generation. There still remains the unsolved problem of the produced and threatening nuclear output material, which can't be recycled yet in a sustained way…
Another shared downside, besides the above described losses of Thermodynamics, is the substantial amount of needed cooling water, which needs to be absorbed from the nearby environment (i.e. rivers) and will be returned to it inevitably at higher temperature levels…

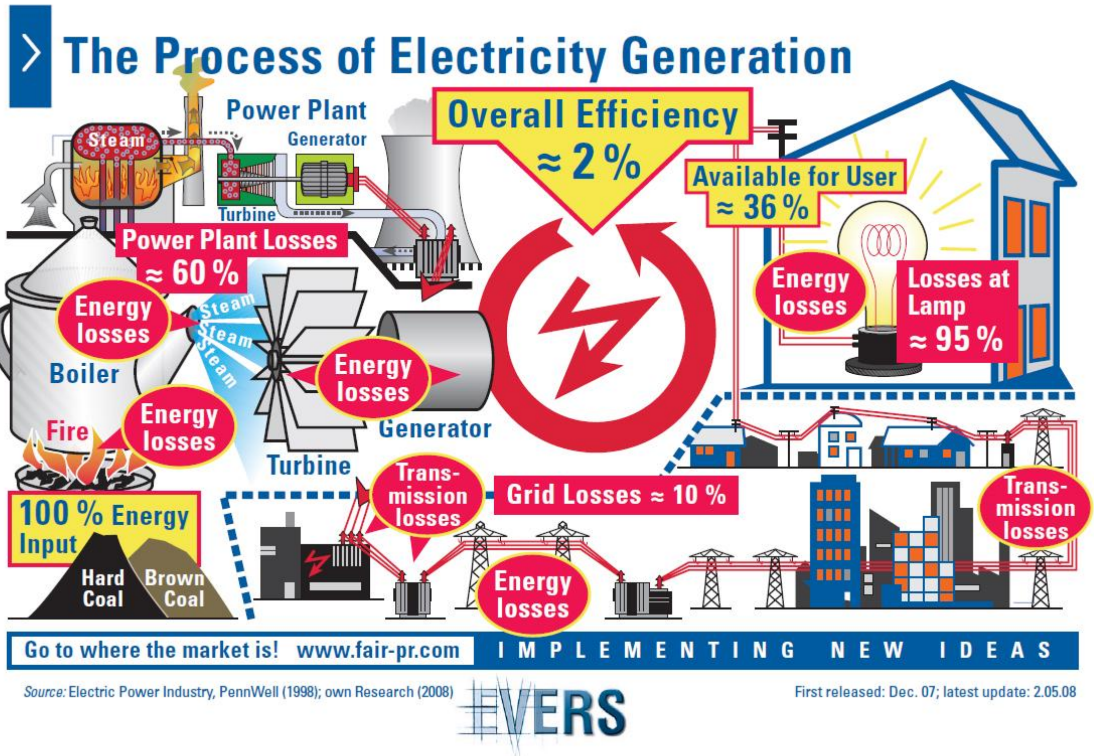
That raises the question: Is Thermo Dynamics still the most appropriate way to transform valuable Primary Energy (coal, oil, natural gas, nuclear) for ePower generation and Mobility acceleration…?

We have to admit, that we are still slaves of Thermo Dynamics, with all its consequences (energy losses, CO_2 emissions and other contaminations), even though we already know much better…!

Renewable Energy can be generated, stored (i.e. Electricity and Hydrogen) and applied without Thermo Dynamics!

It's a common challenge and responsibility to finally leverage this Paradigm Shift…! We owe it to future generations, to act now..!

Bottom line: Ancient fire places have just been transformed into Thermal Power Plants (incl. nuclear), Combined Heat and Power Plants and Internal Combustion Engines…



The great visionary, Arno A. Evers, rose in his book
"Hydrogen Society...more than just a Vision?"
(http://www.hydrogenambassadors.com/the-hydrogen-society-more-than-just-a-vision.html)
the challenging question: "Can 35 Steam Locomotives fly..?"

The answer is: "Yes…, it's just a matter of the molecular constellation..!" (http://www.hydrogenambassadors.com/background/35-locomotives-could-not-fly-or-evolution-in-the-aircraft-industry-1903-2007.php).

Now, a miracle similar to the one of the European commercial airliner Airbus A380 needs to be enforced, in order to initiate a Quantum Leap of the energy sector..!

CURRENT ENERGY SYSTEMS…

STATUS QUO:

The examples provided above and in Appendix supposedly help to reveal some true and alerting facts about actual energy system constellations in leading industry countries, like the U.S., Spain and Germany.

This provides sufficient proof to emphasize on the importance for an accelerated establishment of new decentralized energy system architectures and business models, like ENERGY COMMUNITIES ('EC') based on DECENTRALICED ENERGY CLUSTER ('DEC').

In these countries, with their leading energy generation and transmission technology companies, those critical facts about current system constellations are often less known and have been eluded from the public discussion…

Common sense and the facts presented on the "Mi Energía Solar" Service Portal raise the further questions:

1. Did this system ever make sense and should it be promoted continuously by further extensions of the existing out-of-date network..?
2. Who will benefit from that…?

Conclusions

A new energy strategy, determined to act as a guideline throughout the next decades, is urgently needed.

However, it can only be done based on a clean analysis of the actual energy supply system status, which is presented here in extracts (see Appendix).

THE QUANTUM LEAP: ENERGY COMMUNITIES ('EC')

The current challenge…

Our current energy supply infrastructure is based on a historically conditioned Energy Provisioning Paradigm ('EPP'), which is responsible for the fact that electricity from renewable sources (i.e. in Germany: hydroelectric since 1891 and wind power for mechanical mil acceleration since 1870s) has always been treated by the power providers like electricity from normal power plants and was fed into the out-of-date and inefficient long distance energy transmission grid ('Macro-Grid').

This is questionable, not only from a physical point of view!

That historic system concept is based on a few power plants, which have been operated centralized, depended on their limited logistical access to fossil or natural primary energy resources (carbon, petrol, and natural gas or Hydro power). Accordingly substantial network infrastructures had to be installed and operated, in order to distribute the electricity from its origins, a few central ('n') locations of power generation, to its destination, the almost infinite decentralized ('m') locations of power application…

There are several approaches, still within the framework of the out-of-date EPP, to better meet the challenge of this dynamic n-to-m energy transmission. Accordingly current and future network infrastructures shall be enhanced by facilities for a real time energy supply/demand information exchange. This Smart Grid concept is supposed to enable better energy supply/demand balancing, even along the Macro-Grid.

Some serious doubts remain, whether the challenges on a future energy supply system, can sufficiently be solved in this way!

EC Abstract

A QUANTUM LEAP for current national energy supply systems will be the establishment of new local ENERGY COMMUNITIES, operating based on local and almost autonomous energy system architectures (DECENTRALIZED ENERGY CLUSTER) and new business models. Those models shall focus on the fact that the EC Members are acting often simultaneously as DEC investors as well as energy producers and consumers.

The individual energy balance of each EC Member will be maintained via local energy accounts, whereof energy can be acquired, by using locally valid Energy Cards for (i.e. wireless) onsite trading. For example, while EC Members are producing solar energy or distributing their waste efficiently to the local waste conversion plant (pyrolysis), they are continuously accumulating balance on their energy accounts. These balances can be utilized for credits, i.e. when fuelling the car at the local fuelling station, provided that the consumed energy carrier (i.e. electricity or hydrogen), has been generated from local energy community resources.

DECENTRALIZED ENERGY CLUSTER (‘DEC’)

Renewable primary energy source (Solar, wind, waste, biomass etc.), available based on their nature in the direct neighborhood of the final energy application, have new requirements on an energy transmission system. A new energy system architecture has to be applied, the DECENTRALIZED ENERGY CLUSTER.

Those DEC are based on local Renewable Energy (RE) sources, local RE storage media, local RE applications and a local energy transmission grid (‘Micro-Grid’), successfully applying the Smart Grid concept for a balanced energy distribution, within a DEC and between them.

The rapidly arising divers DECs with their local Micro-Grids will be furthermore connected via the national Macro-Grid, to enable cross regional energy balancing, during time windows of high or low energy demand/capacity. But, the focus shall remain on the establishment of many new Micro-Grids and not on a new Macro-Grid!

In order to avoid further landscape impacts, the necessarily remaining part of the national Macro-Grid shall be implemented ideally as mostly new buried HVDC cable lines!

This shall enable an efficient integration of still centralized established renewable energy sources (i.e. Off-shore wind, Hydro power, waste conversion etc.). Accordingly those sources can be integrated efficiently into the overall and cross-regional energy supply system.

The DECs shall provide a mixture of separated AC and DC transmission to corresponding local AC and DC applications. There shall be a special focus on loss optimized transmissions between AC/DC sources and AC/DC applications!

The more technical description of the DEC will be provided soon at: www.mienergiasolar.es / www.myrenergy.com…

MY ENERGY COMMUNITIES

It's time for change…!

What we need, is a clear an official commitment for a dominantly decentralized energy supply system, which converts the energy only, where it's actually needed. Not even a single (old or new) nuclear, coal or gas power plants would be needed to supply the energy actually required to meet the local and national energy demand. But all this is achievable only if the sources are used "by their nature", depending on local existing renewable sources of energy. They have to be used locally within a maximum radius of 15 kilometers, to be prepared for future wireless energy transmission technology application, with their 15km intersection distance limits, due to curvature of the earth. Requiring only small storage capacity, these autonomous units can therefore also be utilized to cover all transportation services in and cross their region, too. The necessary facilities should in each case be used and operated locally and above all, they have to be owned by the consumers.

This will change the consumer behavior in households, SME`s, industry and transport automatically into the right direction. The corresponding savings will be based on the shared roles of almost autonomous simultaneous power conversion from renewable sources and its application.

The corresponding system will be the most efficient and also the most secure energy supply system. It can propel constructive acting countries and regions to the forefront of the Renewable Energy race in the coming years, alleviating today`s fears of dependency on uncertain foreign and expensive supplies of imported fossil fuels.

With "Out of the Box" thinking and new infrastructures like the one mentioned here, we can save more energy than our collective imagination may allow us to believe.

As a next step, we will need strong and responsible individuals (politicians and entrepreneurs) who understand how to transfer these ideas to our population, bringing them to discussions on open and unbiased forums.

The concepts can then be implemented rapidly in the local area and be adapted efficiently to other areas. All the necessary components and processes for this transition phase are in part known for years and already exist. What is needed is to provide “only” the meaningful connections to create a new and much better picture.

Energy Trading and advantages of the EC business model

The future is now..!

The new energy infrastructure will enable energy trading within the DECs via the local Micro-Grid as well as cross regional via the national Macro-Grid.

Local ECs and decentralized energy supply, primarily based on local renewable energy sources, shall benefit from new business models.

The encouragingly growing number of ECs, especially in some northern European countries (i.e. Germany), provide already a substantial and growing knowledge about applied corresponding business models (incl. EC Memberships and investment sharing) and technology solutions.

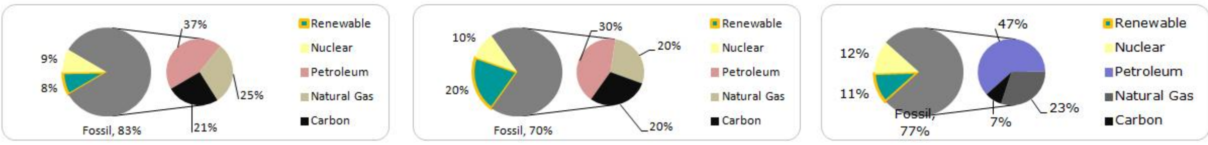
It’s not a secret anymore, that the majority of the established ECs are achieving ROIs for renewable energy technology and local Micro-Grid investments of less the 5 years!

That gives reason to believe, that not only commercial EC Members (SMEs), will gain an substantially growing competitive advantage, while their whole business model is running on stable local EC energy pricing! That is something, their competitors can only dream of, while they are still receiving energy from out-of-date, centralized energy supply systems, with their ever raising energy prices, due to the well predictable Peak-Oil dependencies…

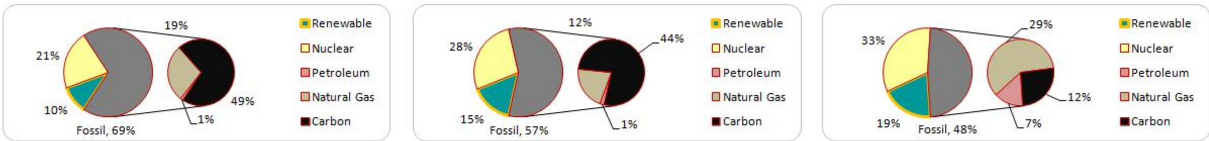
APPENDIX:

KEY PARAMETER COMPARISON: NATIONAL ENERGY PROVISIONING SYSTEMS

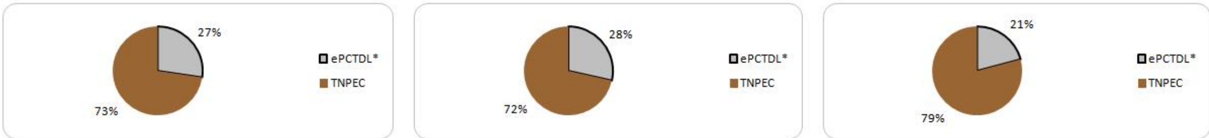
USA 2010 | **Germany 2010** | **Spain 2010**



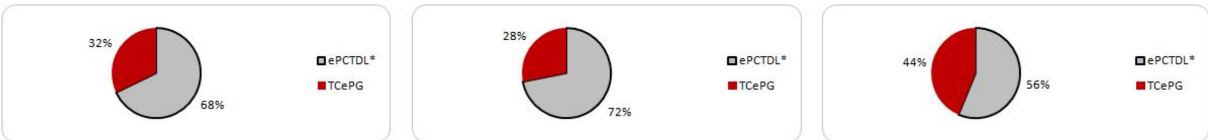
Total Primary Energy consumption national



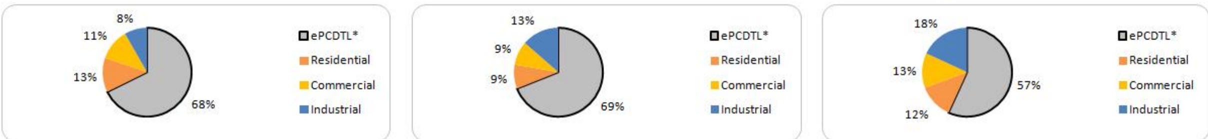
Primary Energy rate mix on e-Power Generation



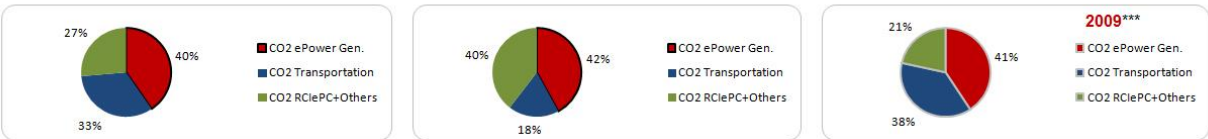
ePCTDL* rate on Total National Primary Energy Consumption [TNPEC]



ePCTDL* rate on Total Consumption for e-Power Generation [TCePG]



Total RCIePC** vs. ePCTDL*

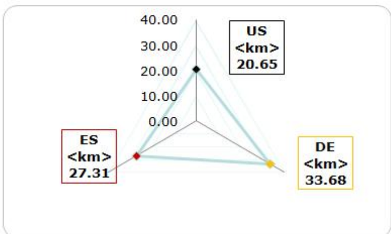


National CO_2 emissions balance

***ePCTDL**: E-Power Conversion, Transmission and Distrribution LOSSES

****RCIePC**: Residential, Commercial and Industrial e-Power Consumption

*****2009:** Spain values for 2010 not yet officially available



Total length of national e-Power Transmission Grid [1 km] vs. GDP [1.000 Mio$]

Key parameter table

Key Parameters (2008-10)	US						DE				ES			
	2008		2009		2010		2009		2010		2009		2010	
Total Primary Energy consumption national			Renewable	7,74	Renewable	8,04	Renewable	1201	Renewable	3226	Renewabl	12152	Renewabl	14678
			Nuclear	8,35	Nuclear	8,44	Nuclear	1472	Nuclear	1533	Nuclear	13750	Nuclear	16155
			Petroleum	35,27	Petroleum	35,97	Petroleum	4635	Petroleum	4678	Petroleun	63684	Petroleun	62540
			Natural Gas	23,37	Natural Gas	24,65	Natural Gas	2937	Natural Gas	3075	Natural Ga	31096	Natural Ga	31003
			Carbon	19,76	Carbon	20,82	Carbon	3003	Carbon	3226	Carbon	10550	Carbon	8463
Primary Energy rate on e-Power Generation (US: Quads / DE: Petajoule / ES: tep)	Renewable	3,68	Renewable	4,12	Renewable	4,01	Renewable	662	Renewable	854	Renewabl	7320	Renewabl	9319
	Nuclear	8,45	Nuclear	8,35	Nuclear	8,44	Nuclear	1472	Nuclear	1533	Nuclear	13750	Nuclear	16155
			Petroleum	0,39	Petroleum	0,38	Petroleum	77	Petroleum	66	Petroleun	3894	Petroleun	3358
			Natural Gas	7,04	Natural Gas	7,52	Natural Gas	614	Natural Gas	667	Natural Ga	15876	Natural Ga	14013
	Fossil	27,82	Carbon	18,3	Carbon	19,13	Carbon	2380	Carbon	2445	Carbon	8581	Carbon	6131
ePCTDL* rate on Total National Primary Energy Consumption [TNPEC] (Quads)	ePCTDL*	27,39	ePCTDL*	26,78	ePCTDL*	26,78	ePCTDL*	4002	ePCTDL*	4002	ePCTDL*	28452	ePCTDL*	27558
	TNPEC	71,81	TNPEC	71,22	TNPEC	71,22	TNPEC	10042	TNPEC	10042	TNPEC	102083	TNPEC	104565
ePCTDL* rate on Total Consumption for e-Power Generation [TCePG] (Quads)	ePCTDL*	27,39	ePCTDL*	26,78	ePCTDL*	26,78	ePCTDL*	4002	ePCTDL*	4002	ePCTDL*	28452	ePCTDL*	27558
	TCePG	12,56	TCePG	11,42	TCePG	12,7	TCePG	1203	TCePG	1563	TCePG	20969	TCePG	21418
Total RCIePC** vs. ePCTDL (Quads)	ePCDTL*	27,39	ePCDTL*	26,78	ePCDTL*	26,78	ePCDTL*	4002	ePCDTL*	4002	ePCDTL*	28452	ePCDTL*	27558
	Residential	4,7	Residential	4,95	Residential	4,95	Residential	508	Residential	508	Residenti	5958	Residenti	6069
	Commercial	4,61	Commercial	4,54	Commercial	4,54	Commercial	504	Commercial	504	Commerci	5958	Commerci	6069
	Industrial	3,35	Industrial	3,28	Industrial	3,28	Industrial	787	Industrial	787	Industrial	8578	Industrial	8779
CO2-Emissions on E-Power Generation vs. Total national CO2 emissions (Million Metric Tons)	CO2 ePower Gen.	2160	CO2 ePower Ge	2271	CO2 ePower (	2271	CO2 ePowe	349,2	CO2 ePower G	349,2	CO2 ePow	101653	CO2 ePow	
	CO2 Transportation	1850	CO2 Transporta	1876	CO2 Transpor	1876	CO2 Transpo	153,5	CO2 Transport	153,5	CO2 Trans	94208	CO2 Trans	
	CO2 RCIePC+Others	1981	CO2 RCIePC+Ot	1485	CO2 RCIePC+(	1485	CO2 RCIePC	328,8	CO2 RCIePC+C	328,8	CO2 RCIeP	54018	CO2 RCIeP	
			2010											
Total length of national e-Power Transmission Grid [1 km] vs. GDP [1.000 Mio$]	National TG length <km>		300.000	110.700	38.501									
	GDP <Mio$>		$14.526.550	$3.286.451	$1.409.946									
			US <km>	DE <km>	ES <km>									
	TG<km>/GDP<1.000Mio$>		20,65	33,68	27,31									

***ePCTDL**: E-Power Conversion, Transmission and Distrribution LOSSES

****RCIePC**: Residential, Commercial and Industrial e-Power Consumption

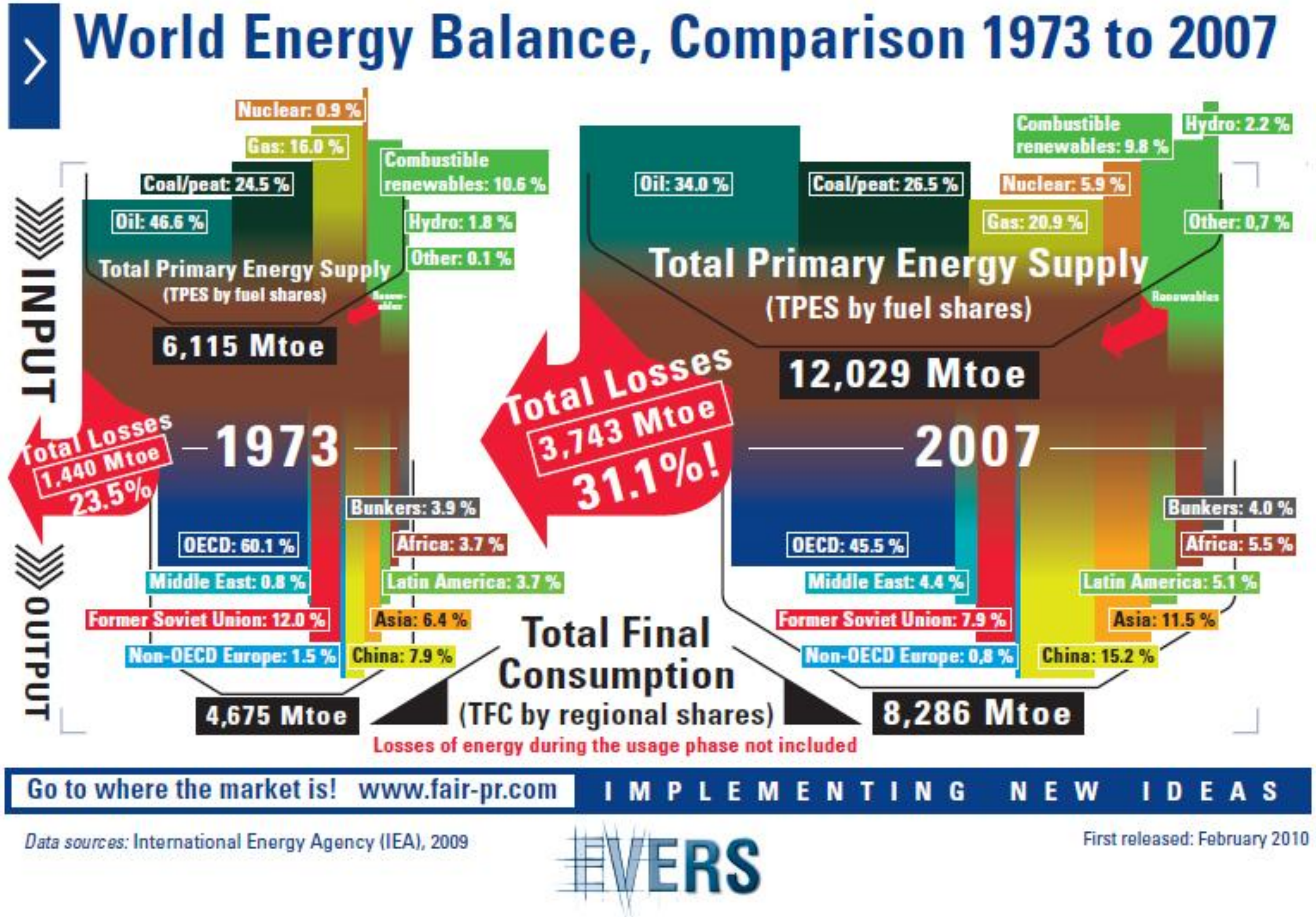
Information Sources:

- World Energy Balance, Comparison 1973 to 2007 (http://www.hydrogenambassadors.com/background/world-energy-balance-1973-2007.php)
- Libro de Energía en España 2010 (http://www.minetur.gob.es/energia/balances/Balances/Paginas/Balances.aspx)
- Observatorio de Energía y Sostenibilidad en España Informe basado en indicadores Edición 2010 (http://www.catedrabp.upcomillas.es/Documentos/Actividades/Observatorio/Febrero2011/InformeObservatorio_2010_Act.pdf)
- Lawrence Livermore National Laboratory (https://flowcharts.llnl.gov/index.html)
- AG Energiebilanzen e.V. (http://www.ag-energiebilanzen.de/viewpage.php?idpage=64)
- Statistisches Bundesamt Deutschland (http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Navigation/Publikationen/STATmagazin/Umwelt2007__12,templateId=renderPrint.psml__nnn=true)

Energy System Facts:

A. GLOBAL

World Energy Balance:
1973 vs. 2007

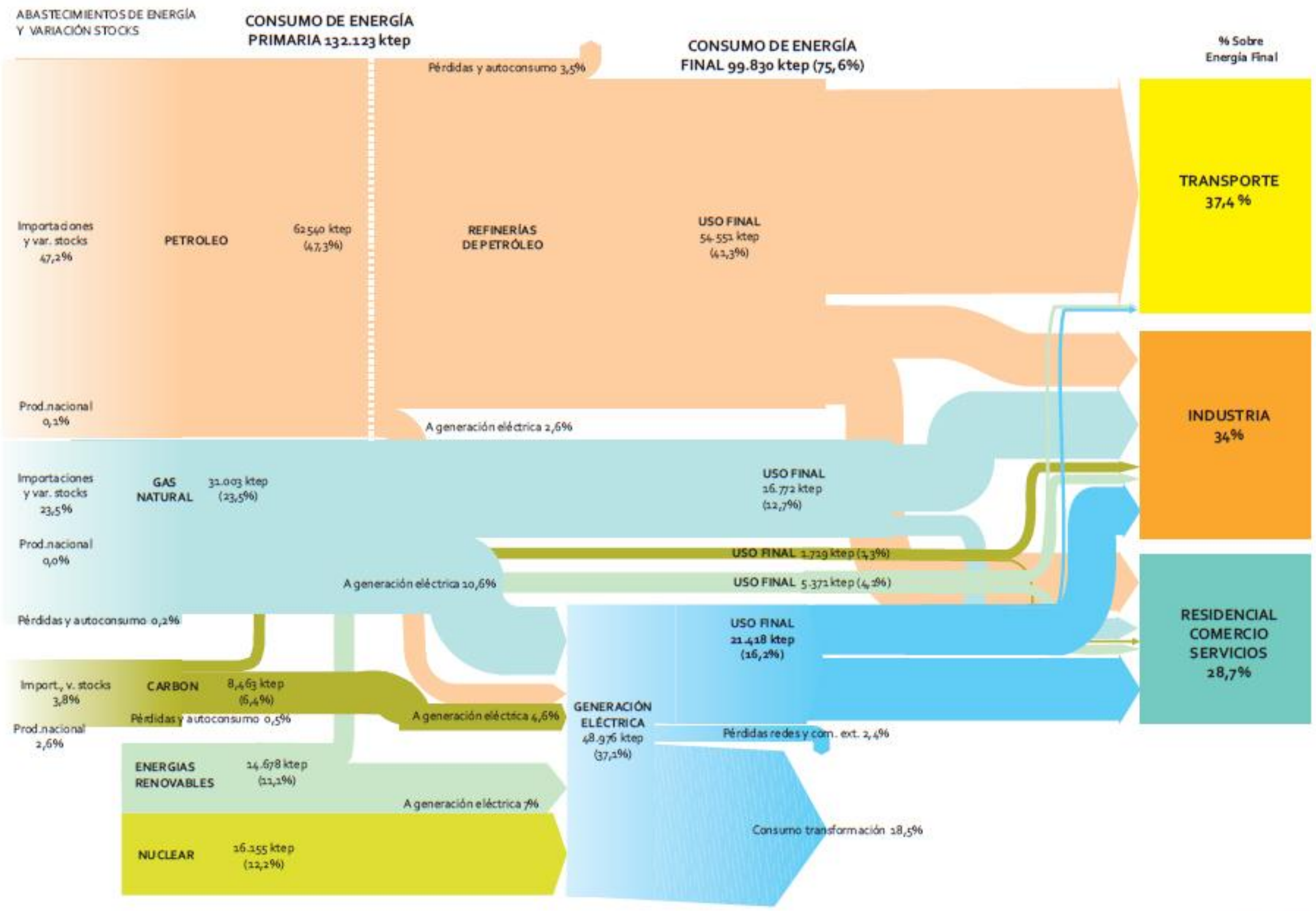


B. SPAIN

Energy flow, Spain
2010

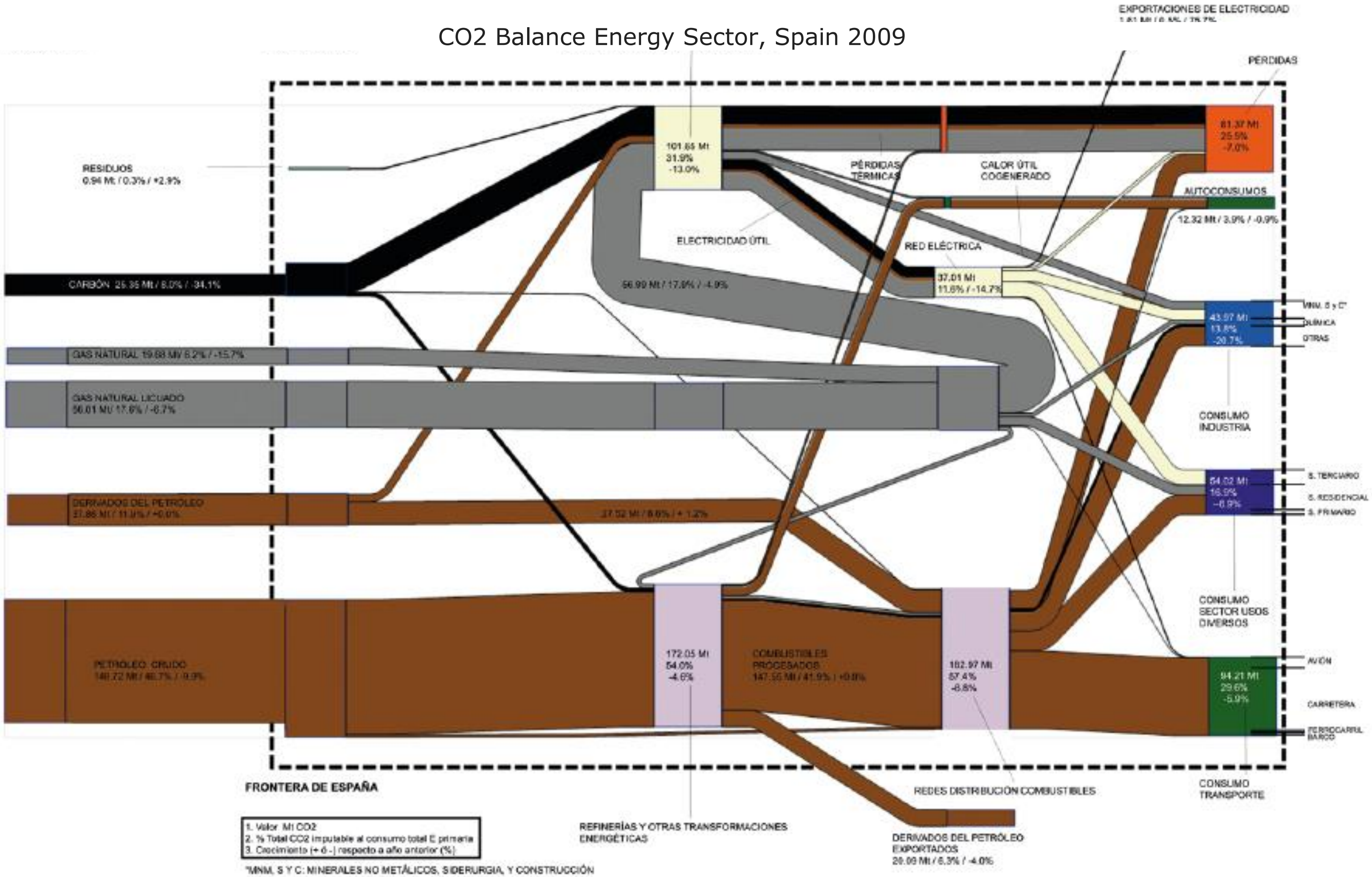
GRÁFICO 2.6. DIAGRAMA DE SANKEY DE LA ENERGÍA EN ESPAÑA EN 2010 (METODOLOGÍA AIE)

(Los % del diagrama están referidos al total de Energía Primaria)

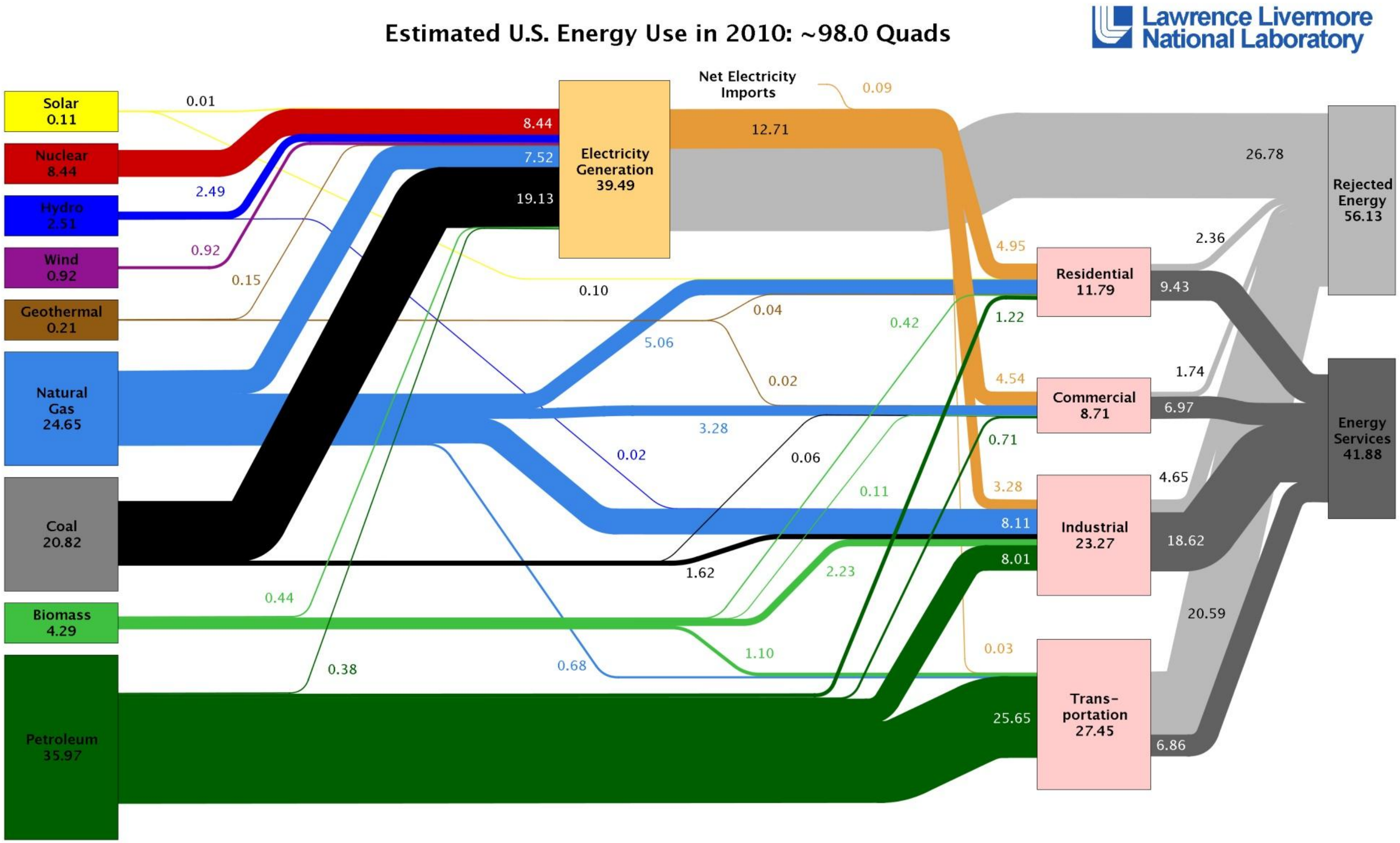


FUENTE: SEE.

CO2 Balance Energy Sector, Spain 2009



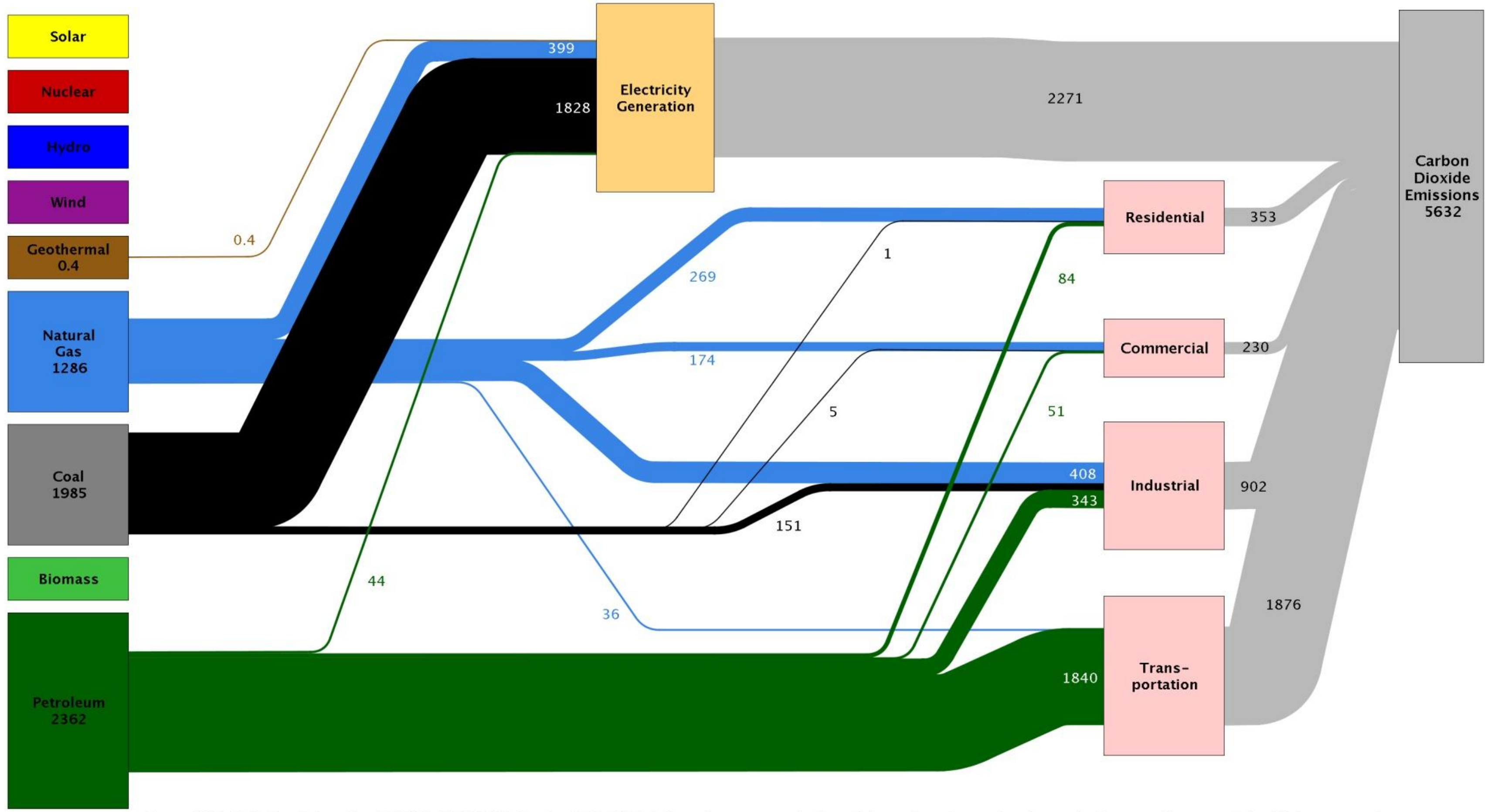
C. USA



Source: LLNL 2011. Data is based on DOE/EIA-0384(2010), October 2011. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for hydro, wind, solar and geothermal in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." (see EIA report for explanation of change to geothermal in 2010). The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 80% for the residential, commercial and industrial sectors, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

Energy-Related U.S. Carbon Dioxide Emissions in 2010:
~5632 Million Metric Tons

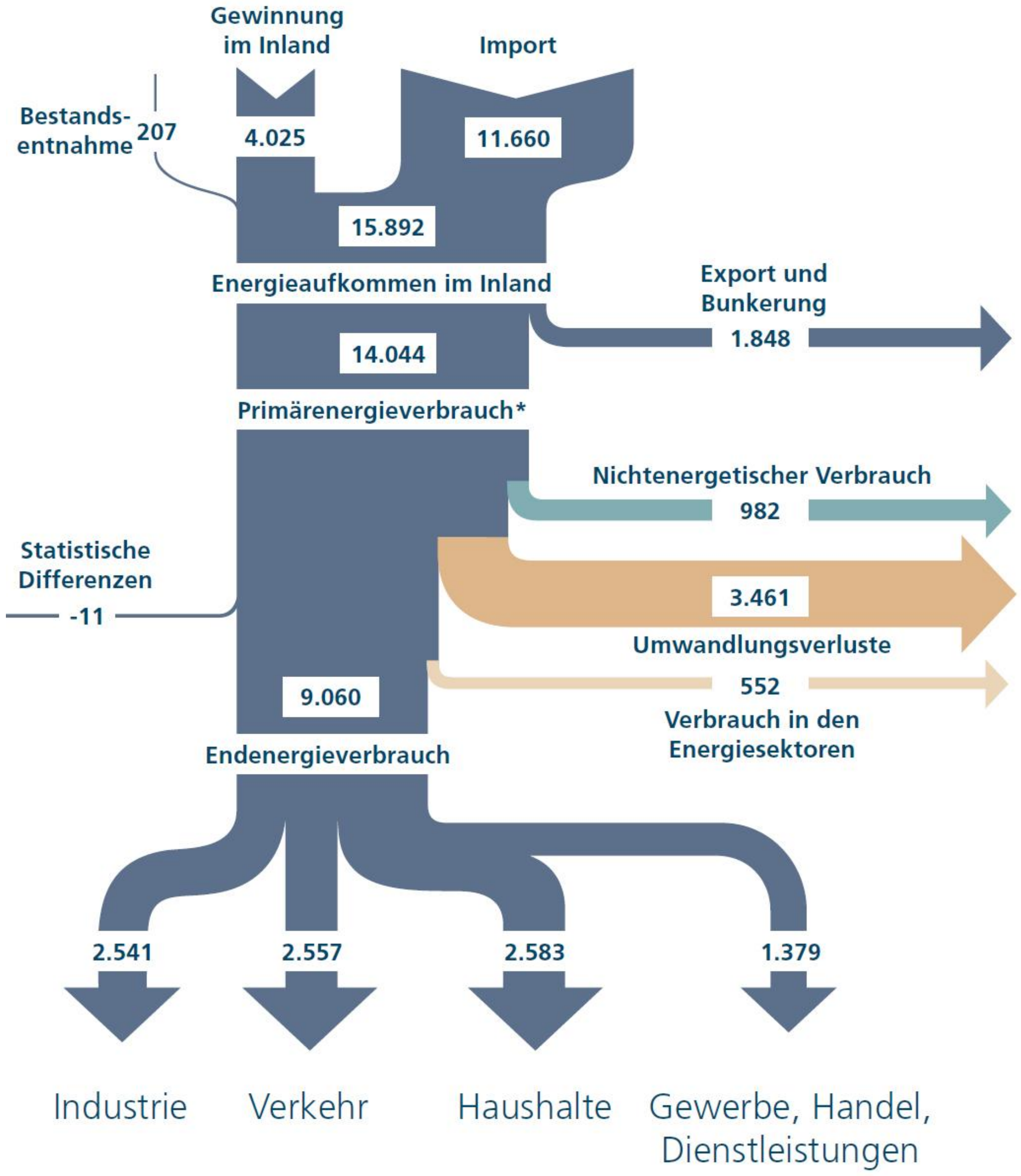
Lawrence Livermore National Laboratory



Source: LLNL 2011. Data is based on DOE/EIA-0384(2010), October 2011. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Non-fuel carbon and non-energy CO2 is not shown. The flow of petroleum to electricity production includes both petroleum fuels and the plastics component of municipal solid waste. The combustion of biologically derived fuels is assumed to have zero net carbon emissions - lifecycle emissions associated with biofuels are accounted for in the Industrial and Commercial sectors. Emissions from U.S. Territories and international aviation and marine bunkers are not included. Totals may not equal sum of components due to independent rounding. LLNL-MI-411167

D. GERMANY

Energy Flow, Germany 2010



Der Anteil der erneuerbaren Energieträger am Primärenergieverbrauch liegt bei 9,4 %.

* Alle Zahlen vorläufig/geschätzt.

29,308 Petajoule (PJ) ≙ 1 Mio. t SKE

Quelle: Arbeitsgemeinschaft Energiebilanzen 07/2011