



Aalto-yliopisto  
Perustieteiden  
korkeakoulu

# Uusiutuvan energian käytöstä Euroopassa (aihe-esittely)

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Työn saa tallentaa ja julkistaa Aalto-yliopiston avoimilla verkkosivuilla. Muilta osin kaikki oikeudet pidätetään.

# Tausta

- Kestävän kehityksen tavoite 7
- EU sitoutunut näihin
  - Vähintään 32% energiasta uusiutuvaa vuoteen 2030 mennessä

# Tavoitteet

- Eksploratiivinen tutkimus
- Tarkoitus avata uusiutuvan energian trendejä
- Lisäksi tavoitteena tulkita muodostuneita klustereita
  - Onko mailla yhteispiirteitä?
- Jatkoanalyysille tarvetta: Syitä klustereille jne.

# Rajaukset

- Analyysi keskittyy ainoastaan uusiutuvien osuuteen, sekä tämän osuuden kehitykseen
- Aineisto vuosilta 2004-2020
- Klusterianalyysin ohella syvempää analyysiä ei tehdä

# Aineisto

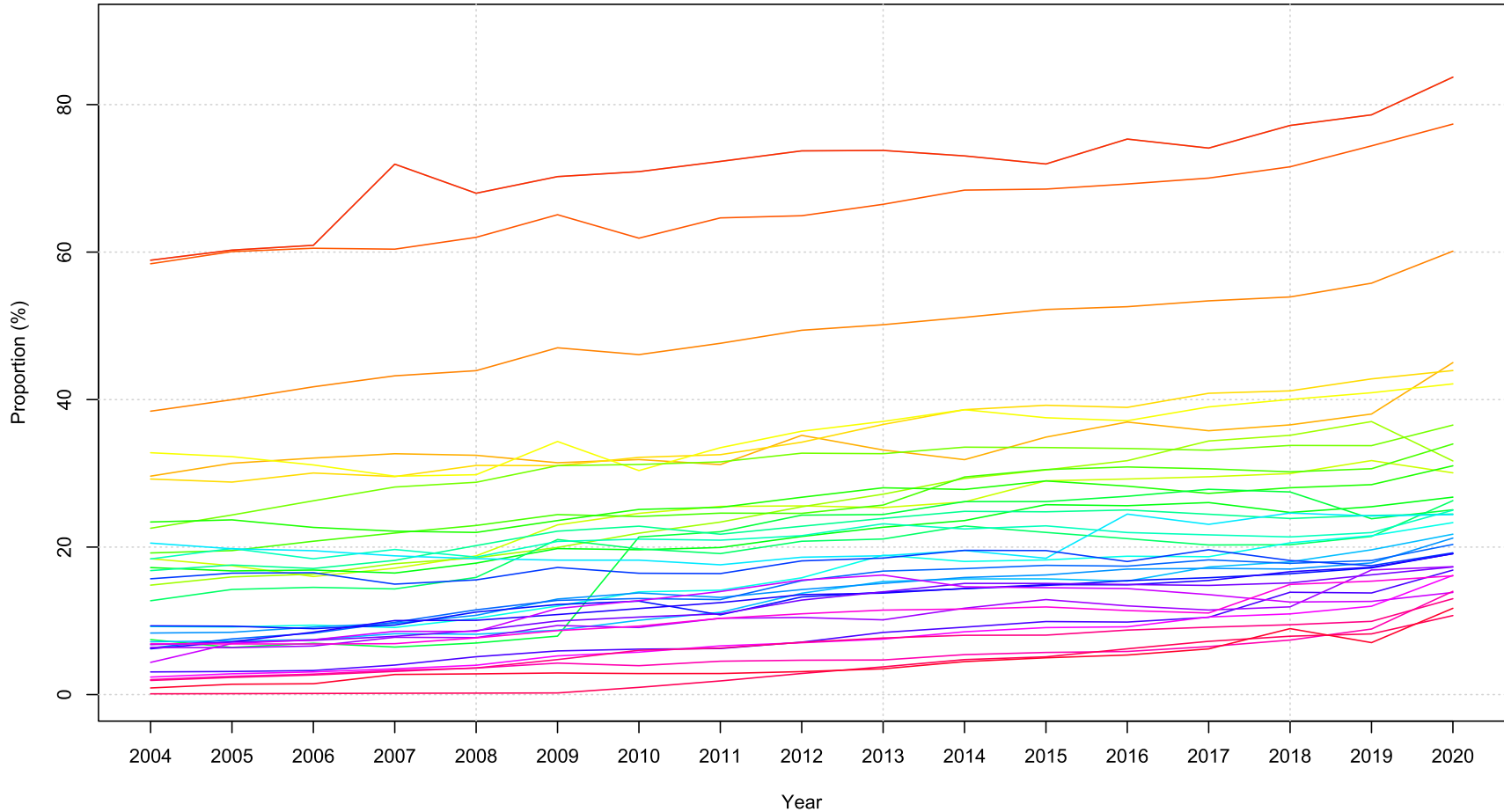
- Todellisen maailman dataa
- Kestävän kehityksen indikaattori 7.2.1
  - Uusiutuvan energian osuus kokonaiskulutuksesta
- [Eurostatin data](#)

# Aineisto

Dataset:	Share of energy from renewable sources [NRG_IND_REN_custom_6865784]																		
Last updated:	04/04/2023 23:00																		
Time frequency	Annual																		
Energy balance	Renewable energy sources																		
Unit of measure	Percentage																		
TIME	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
<b>GEO (Labels)</b>																			
Albania	29,620	31,367	32,070	32,657	32,448	31,437	31,867	31,187	35,152	33,167	31,856	34,913	36,953	35,776	36,572	38,042	45,015	41,389	
Austria	22,553	24,353	26,276	28,144	28,788	31,039	31,205	31,552	32,734	32,665	33,550	33,497	33,370	33,136	33,784	33,755	36,545	36,445	
Belgium	1,916	2,325	2,658	3,140	3,611	4,746	6,004	6,302	7,086	7,671	8,038	8,060	8,744	9,136	9,472	9,929	13,000	13,014	
Bulgaria	9,231	9,173	9,415	9,098	10,345	12,005	13,927	14,152	15,837	18,898	18,050	18,261	18,760	18,695	20,581	21,545	23,319	17,015	
Croatia	23,404	23,691	22,668	22,161	21,986	23,596	25,103	25,389	26,757	28,040	27,817	28,969	28,266	27,280	28,047	28,466	31,023	31,329	
Cyprus	3,071	3,131	3,263	4,001	5,131	5,920	6,161	6,245	7,111	8,428	9,144	9,903	8,833	10,478	13,873	13,777	16,879	18,419	
Czechia	6,773	7,113	7,362	7,895	8,674	9,977	10,513	10,945	12,814	13,927	15,074	15,070	14,926	14,799	15,139	16,239	17,303	17,667	
Denmark	14,839	15,955	16,332	17,747	18,543	19,948	21,888	23,389	25,465	27,173	29,310	30,469	31,715	34,387	35,159	37,020	31,681	34,718	
Estonia	18,420	17,478	16,011	17,139	18,811	23,009	24,575	25,515	25,586	25,356	26,130	28,987	29,232	29,538	29,970	31,730	30,069	38,010	
European Union - 27 countries (from 2020)	9,605	10,182	10,778	11,749	12,552	13,850	14,405	14,547	16,002	16,659	17,416	17,820	17,978	18,411	19,096	19,887	22,038	21,775	
Finland	29,232	28,814	30,043	29,561	31,071	31,045	32,166	32,532	34,222	36,630	38,633	39,230	38,943	40,857	41,185	42,807	43,939	43,096	
France	9,319	9,272	8,936	9,426	11,168	12,215	12,671	10,813	13,239	13,880	14,362	14,803	15,451	15,847	16,384	17,174	19,109	19,342	
Georgia	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	19,000	
Germany (until 1990 former territory of the FRG)	6,207	7,167	8,466	10,039	10,072	10,851	11,667	12,470	13,549	13,757	14,381	14,901	14,885	15,472	16,660	17,266	19,090	19,168	
Greece	7,161	7,277	7,458	8,249	8,183	8,731	10,077	11,153	13,741	15,326	15,683	15,690	15,390	17,300	18,001	19,633	21,749	21,928	
Hungary	4,364	6,931	7,433	8,575	8,564	11,673	12,742	13,972	15,530	16,205	14,618	14,495	14,377	13,556	12,548	12,634	13,850	14,115	
Iceland	58,899	60,270	60,921	71,925	67,981	70,238	70,909	72,298	73,727	73,787	73,043	71,949	75,329	74,104	77,173	78,612	83,725	85,785	
Ireland	2,378	2,822	3,073	3,497	3,979	5,243	5,755	6,605	7,029	7,521	8,516	9,083	9,189	10,520	10,942	11,979	16,160	12,546	
Italy	6,316	7,549	8,328	9,807	11,492	12,775	13,023	12,881	15,441	16,741	17,082	17,525	17,415	18,267	17,796	18,181	20,359	19,034	
Kosovo (under United Nations Security Council Resolution 1244/99)	20,541	19,773	19,511	18,812	18,429	18,230	18,230	17,598	18,625	18,823	19,544	18,484	24,472	23,082	24,616	24,215	24,401	22,364	
Latvia	32,794	32,264	31,141	29,615	29,811	34,317	30,375	33,478	35,709	37,037	38,629	37,538	37,138	39,008	40,019	40,929	42,132	42,107	
Lithuania	17,221	16,768	16,887	16,482	17,824	19,798	19,639	19,943	21,437	22,689	23,592	25,748	25,612	26,038	24,695	25,474	26,773	28,230	
Luxembourg	0,899	1,402	1,469	2,725	2,809	2,929	2,851	2,855	3,112	3,494	4,471	4,987	5,364	6,194	8,942	7,046	11,699	11,735	
Malta	0,102	0,123	0,149	0,177	0,195	0,221	0,979	1,850	2,862	3,760	4,744	5,119	6,208	7,219	7,914	8,230	10,714	12,154	
Moldova	7,450	6,402	6,960	6,443	6,994	7,924	21,369	22,081	24,328	24,419	26,169	26,173	26,888	27,836	27,476	23,843	25,057	22,280	
Montenegro	:	35,694	34,842	32,925	32,290	39,371	40,640	40,648	41,513	43,696	44,098	43,073	41,529	39,693	38,801	37,722	43,770	39,891	
Netherlands	2,030	2,478	2,778	3,298	3,596	4,266	3,917	4,524	4,659	4,691	5,415	5,714	5,846	6,507	7,394	8,886	13,999	13,003	
North Macedonia	15,702	16,466	16,527	14,976	15,555	17,238	16,451	16,407	18,128	18,509	19,559	19,526	18,044	19,636	18,179	17,485	19,222	17,287	
Norway	58,417	60,069	60,521	60,398	62,003	65,071	61,889	64,638	64,932	66,480	68,406	68,545	69,235	70,036	71,566	74,406	77,358	74,086	
Poland	6,882	6,867	6,859	6,903	7,686	8,676	9,281	10,337	10,955	11,452	11,605	11,881	11,396	11,059	14,936	15,377	16,102	15,624	
Portugal	19,205	19,523	20,792	21,907	22,929	24,405	24,150	24,603	24,574	25,699	29,508	30,514	30,864	30,611	30,203	30,623	33,982	33,982	
Romania	16,811	17,571	17,096	18,195	20,204	22,157	22,834	21,743	22,825	23,886	24,845	24,785	25,032	24,454	23,875	24,290	24,478	23,596	
Serbia	12,724	14,257	14,542	14,327	15,888	21,024	19,763	19,118	20,790	21,095	22,864	21,989	21,147	20,287	20,320	21,443	26,297	25,280	
Slovakia	6,391	6,360	6,584	7,766	7,723	9,368	9,099	10,348	10,453	10,133	11,713	12,882	12,029	11,465	11,896	16,894	17,345	17,412	
Slovenia	18,397	19,809	18,416	19,675	18,646	20,765	21,081	20,937	21,551	23,160	22,459	22,879	21,975	21,658	21,378	21,968	25,000	25,000	
Spain	8,345	8,444	9,156	9,667	10,744	12,958	13,782	13,176	14,239	15,181	15,879	16,221	17,015	17,118	17,023	17,852	21,220	20,729	
Sweden	38,427	39,982	41,734	43,224	43,922	47,024	46,099	47,632	49,403	50,153	51,151	52,220	52,597	53,390	53,916	55,785	60,124	62,573	

# Aineisto

Timeseries: Proportion of renewable energy used



# Menetelmät

- K-means++ algoritmi
  - Tehdään datan eri osajoukoille
  - Vertaillaan klusteroinnin tuloksia
- Elbow-method
  - Klusterien lukumäärän määrittämiseen
- Python



# Aikataulu

- Tulosten analysointi ja johtopäätökset 10/2023
- Työn kirjoittaminen 10-11/2023
- Valmis työ 11/2023