





**Energy Technology and Fluid Dynamics** 

**David Smeulders** 

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### To start

- If you have questions during the presentation use chat function.
- Mute your microphone to avoid interference
- Information will be shared on energy-tue.nl



## **Two major societal challenges\***

#### Transport and storage of energy



#### Transport and storage of data





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#### \* Among other challenges



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## Mission

- Decarbonize our energy system using methane and hydrogen routes
- Build high-tech systems to carry energy and information
- Explain that it works (society, students)

How?

- Generic applications (e.g. porous materials)
- Collaborate with organizations, industry and government
- Experiments
- Numerical tools



## **Research topics**



# **Applications**

- Solar collectors/heat pipes •Fuel Cells
- •CO<sub>2</sub> separation/sequestration
- Geothermal energy
- Lithography/inkjet printing
- LNG for aircraft
- •Experiment, theory, numerics











## Let's make things visible





porous media science & technology









### Mentors

- David Smeulders
- Harald van Brummelen (computational fluid dynamics)
- Rick de Lange (SET)

## For what?

- Course list approval (core, electives, free space)
- Later: internship and graduation project
- How?
- L.J.M.Essink@tue.nl



## **Course overview\***

	Q1			
4UM00	Mico-fabrication	CORE		5
4CM00	Control Engineering	CORE		5
4BM60	Interfacial Transport Phenomena	CORE		5
4BM00	Advanced Engineering mathematics	CORE		5
4DM00	Structural dynamics and vibro-acoustics	Specialization	Rob Fey/Ines Lopez	5
4MM00	Composites and light-weight materials	Specialization		5
4CM10	System theory for control	Specialization		5
4RM00	Intoduction to computational Fluid dynamics	Specialization	Deen	5
4LM60	Structural performance of polymers and pol. Comp.	Specialization		
2IMA10	Advanced algorithms	Mathematics	prof. M.T. de Berg	5
2MMN10	Scientific computing	Mathematics	Anthonissen	
3MT020	Micro- and nanofluidics	Applied Physics	Huinink/Darhuber	5
3MT150	Environmental Fluid Mechanics	Applied Physics	v. Heijst/Matute	5
8VM00	Cardiovascular Fluid Mechanics	Biomedical Engineering	v.d. Vosse	5
6CPT10	Advanced transport phenomena	Chemical Technology	Kuipers	5
6EMA01	Micro flow chemistry and process technology	Chemical Technology	Rebrov	5
6EMA02	Particle-based simulations	Chemical Technology	Peters	
0EM110	Research Methodology for the Innovation Sciences	Innovation Sciences	Alkemade	5
7XC1M0	Circularity Built Environment	Built Environment	Schilperoort	5
7LY3M0	Building performance and energy systems simulation	Built Environment	Loonen	
0FC05	Ethics of Technology	Innovation Sciences	Nickel	
3MP010	Introduction Plasma Physics	Applied Physics	Kessels	

\* Electives may have changed – pls check yourself



-	Q2			
4MM10	Advanced Comp. Continuum Mechanics	CORE		5
4DM10	Multibody and non-linear dynamics	CORE		5
4BM20	Experimentation for Mechanical Engineering	CORE		5
4SE000	Sustainable energy sources	CORE	Speetjens	5
4EM10	Gasdynamics	Specialization	Smeulders	5
4LM20	Polymer processing	Specialization		5
4EM40	Heat and Flow in microsystems	Specialization	Frijns	5
4BM30	Modeling combustion	Specialization	Jeroen van Oijen	5
4MM20	Computational and exp. Micro-mechanics	Specialization		5
4CM70	Integrated systems design	Specialization		5
4CM60	Advanced Motion Control	Specialization		5
4SC000	Optimal Control and Dynamic Programming	Specialization		5
2MMN20	Scientific programming	Mathematics	dr. Jos Maubach	
3MT140	Experimental methods in transport physics	Applied Physics	Darhuber/Pel	5
0EM140	Energy, economy and society	SET		
7LL1M0	Sports and building aerodynamics	Built Environment	Blocken	5

	Q3			
4DM20	Optimization	CORE		5
4EM30	Scientific computing	CORE		5
4CM00	Control Engineering	CORE		5
4DM30	Non-linear control	Specialization		5
4UM10	Microfluidics put to work	Specialization	Wyss	5
4LM30	Multiscale modeling of polymer mechanics	Specialization		5
4CM30	Supervisory control	Specialization		5
4CM40	Physical Modeling	Specialization		5
4EM50	Thermal energy storage	Specialization	Zondag	2.5
4BM10	Hydraulic turbomachines	Specialization	v. Esch	5
4DM60	Control distributed parameter systems	Specialization		2.5
4CM40	Physical Modeling	Specialization		5
4BM50	Introduction petroleum production	Specialization	Golombok	2.5
2MMA20	Partial differential equations	Mathematics		
2MMA30	Modeling and perturbation methods	Mathematics		
3MT010	Advanced fluid dynamics	Applied Physics	v. Heijst	5
3MT100	Chaos	Applied Physics	v.d. Water	5
3MT120	Advanced Computational Fluid and Plasma Dynamics	Applied Physics	Toschi	5
6CPT30	Advanced chemical reactor engineering	Chemical Technology		
6EMA04	Process optimization	Chemical Technology		
0EM150	Sustainability Transitions and Responsible Innovation	SET		
3MP110	Solar Cells	SET		
7LS9M0	Heat, air & moisture transfer/CFD1	Built Environment	Blocken/Schellen	5

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	Q4			
4CM50	Applications of design principles	CORE		5
4MM50	Fracture Mechanics	CORE		5
4UM00	Mico-fabrication	CORE		5
4DM40	Modeling and control of manufactering systems	Specialization		5
4BM40	Optical diagnostics for combustion and fluid flow	Specialization		5
4EM60	Advanced discretization techniques	Specialization		5
4DM50	Dynamics and control of cooperation	Specialization		2.5
4CM20	Hybrid systems and control	Specialization		5
4LM50	Rheology	Specialization		5
2MMA40	Evolution equations	Mathematics		
2MMN30	Scientific computing in partial differential equations	Mathematics		
3MT110	Geophysical fluid dynamics	Applied Physics	v. Heijst	5
3MT130	Transport in porous media	Applied Physics	Pel	5
8VM40	Cardiovascular vaste stof - vloeistof interactie	Biomedical Engineering	v.d. Vosse	5
6CPT40	Advanced separation technology	Chemical Technology		
6EMA05	Multiphase reactor modeling	Chemical Technology		
6EMA06	Advanced process design	Chemical Technology		
0EM200	International Development and Sustainability	SET		
4AT020	Future Fuels and Clean Engines	ME/SET	Somers	5
7LS6M0	Heat, air & moisture transfer/CFD2	Built Environment	Schellen/Blocken/v. Schijndel	5

# Internship and graduation

- Internship (as TU/e ambassador)
- **1. In-house internship (obliged for Higher Education students)**
- 2. List of past internships: contact students
- 3. List of past internships: contact responsible staff member
- 4. Own initiative (family, relatives, part-time jobs)
- 5. Company websites (summer internships)

Graduation project (about science; to become engineer)

- 1. Ask colleagues
- 2. Project overview (www.energy-tue.nl)



### **Personal advice**

#### Intuitive preferences are usually a good predictor for success

