



IEE Template

for L^AT_EX Presentations

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Institute of Electricity Economics and Energy Innovation

Presentation Date

Agenda

- 1 Understand the **Template** for a Consistent Layout
- 2 Leverage Boxes to Organize Content
- 3 Use the **Typeface** to Enhance Readability
- 4 Reveal your content step-by-step with **Overlays**
- 5 Visualize your Numbers with **Plots**
- 6 Structure your Data with **Clear Tables**
- 7 Additional **Tips** to Improve your Design
- 8 Acknowledge Work with Proper **Citations**
- 9 Explore Design **Inspirations** to Spark your Creativity

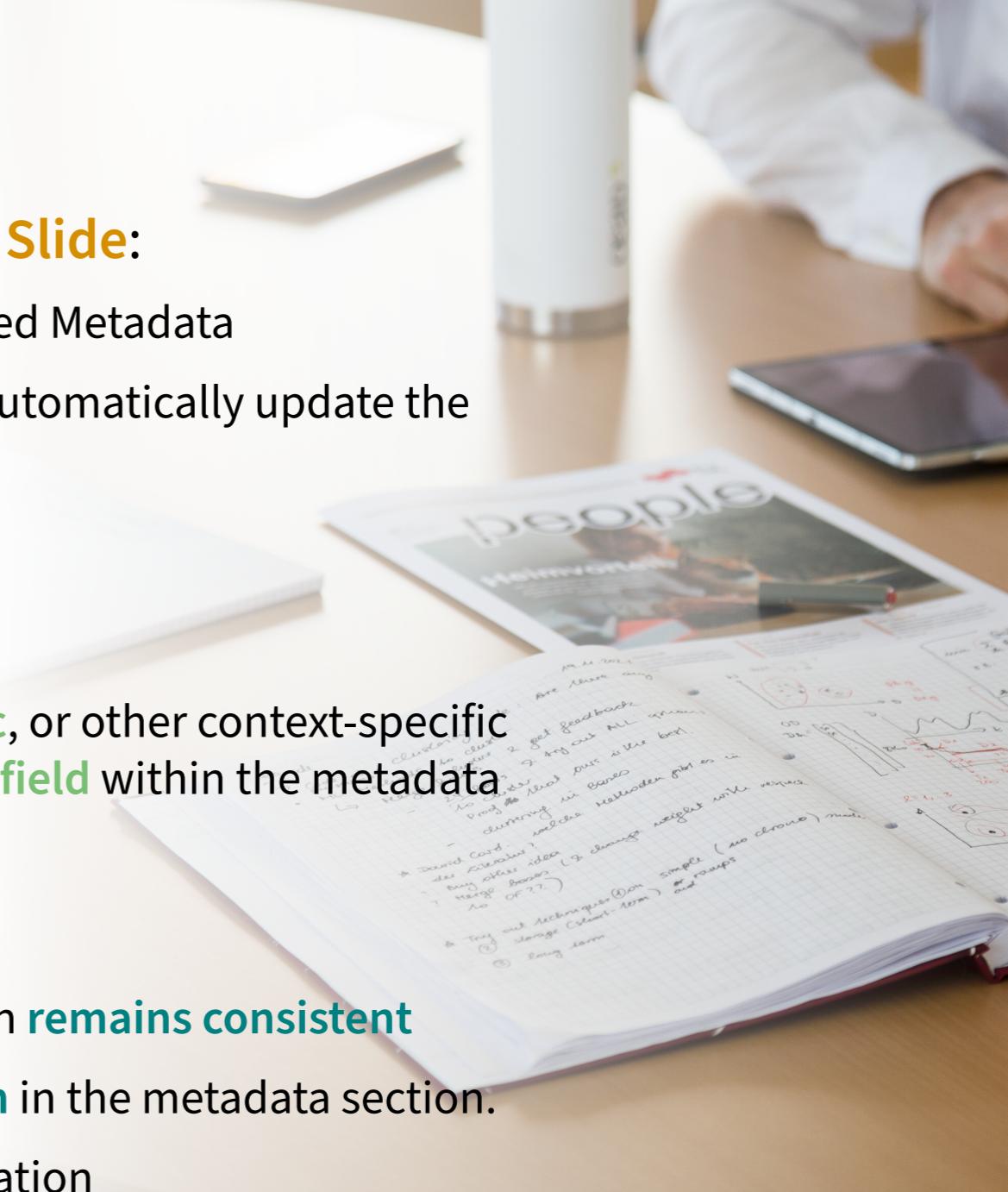


Source: Photo by [Estée Janssens](#) on [Unsplash](#)

Template

Footnote and Language

- To **change** text/name in **Footnote** and **Date on Title Slide**:
 - The presentation.tex file contains a section at the top labeled Metadata
 - Modifying the author, date, or institute in this section will automatically update the footnote and date displayed in the presentation
- Footnote Text
 - The **default footnote** text displays the **institute's name**
 - If you want to include your **lecture title**, **presentation topic**, or other context-specific information in the **footnote**, simply enter it in the **institute field** within the metadata section
- Language
 - Ensure that the **language** used throughout the presentation **remains consistent**
 - For presentations in **German**, set **language pack to german** in the metadata section.
 - The **footnote text** must **match** the **language** of the presentation



Source: Institute of Electricity Economics and Energy Innovation/TU Graz

Color palette

Make use of the the Defined Colors

Light Shades

greenLight
blueLight
ieeLight
redLight
turquoiseLight
greenLight
yellowLight

Standard

grey
blue
iee
red
turquoise
green
yellow

Dark Shades

greyDark
blueDark
ieeDark
redDark
turquoiseDark
greenDark
yellowDark

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Boxes

Organize your Content

- Instead of using lists or enumerations, consider organizing your content into distinct groups for better structure
- Boxes are an excellent tool to enhance visual clarity and emphasize group distinctions



Designing Boxes

- Title Bar: You can choose between boxes with or without a title bar.
- Itemization: Placing itemized lists inside a box can enhance structure and improve clarity.



Additional Tips

- Use short, concise text inside the box to maximize clarity.
- Consider icons in the title bar to enhance visual appeal. You can use the icons from the fontawesome package.

Boxes

Standard Boxes with Title

```
\begin{coloredblock}[Color] [Optional: Title] [Optional: Title Formatting]  
[Optional: Alignment (t,c,b)] [Optional: Height cm] [Optional: Width cm]
```

Blue Block with Title

```
\begin{coloredblock}[blue] [Blue Block with  
Title]
```

IEE Block with Title

```
\begin{coloredblock}[iee] [IEE Block with  
Title]
```

Yellow Block with Title

```
\begin{coloredblock}[yellow] [Yellow Block  
with Title]
```

Green Block with Title

```
\begin{coloredblock}[green] [Green Block  
with Title]
```

Red Block with Title

```
\begin{coloredblock}[red] [Red Block with  
Title]
```

Grey Block with Title

```
\begin{coloredblock}[grey] [Grey Block with  
Title]
```

Boxes

Standard Boxes without Title

```
\begin{coloredblock}[Color] [Optional: Title] [Optional: Title Formatting]  
[Optional: Alignment (t,c,b)] [Optional: Height cm] [Optional: Width cm]
```

```
\begin{coloredblock}[blue]
```

```
\begin{coloredblock}[iee]
```

```
\begin{coloredblock}[yellow]
```

```
\begin{coloredblock}[green]
```

```
\begin{coloredblock}[red]
```

```
\begin{coloredblock}[grey]
```

```
\begin{coloredblock}[turquoise]
```

Boxes

Dark Boxes with Title

```
\begin{coloredblockdark}[Color] [Optional: Title] [Optional: Title Formatting]  
[Optional: Alignment (t,c,b)] [Optional: Height cm] [Optional: Width cm]
```

Dark Blue Block with Title

```
\begin{coloredblockdark}[blue] [Dark Blue  
Block with Title]
```

Dark IEE Block with Title

```
\begin{coloredblockdark}[iee] [Dark IEE  
Block with Title]
```

Dark Yellow Block with Title

```
\begin{coloredblockdark}[yellow] [Dark  
Yellow Block with Title]
```

Dark Green Block with Title

```
\begin{coloredblockdark}[green] [Dark Green  
Block with Title]
```

Dark Red Block with Title

```
\begin{coloredblockdark}[red] [Dark Red  
Block with Title]
```

Dark Grey Block with Title

```
\begin{coloredblockdark}[grey] [Dark Grey  
Block with Title]
```

Boxes

Dark Boxes without Title

```
\begin{coloredblockdark}[Color] [Optional: Title] [Optional: Title Formatting]  
[Optional: Alignment (t,c,b)] [Optional: Height cm] [Optional: Width cm]
```

```
\begin{coloredblockdark}[blue]
```

```
\begin{coloredblockdark}[yellow]
```

```
\begin{coloredblockdark}[red]
```

```
\begin{coloredblockdark}[iee]
```

```
\begin{coloredblockdark}[green]
```

```
\begin{coloredblockdark}[grey]
```

```
\begin{coloredblockdark}[turquoise]
```

Boxes

Boxes with Icon and with Title

```
\begin{coloredblockicon}[Color] [Optional: Title] [Optional: Title Size]  
[Optional: Icon] [Optional: Side of icon (l,r)] [Optional: Alignment  
(t,c,b)] [Optional: Height cm] [Optional: Width Iconblock cm]
```

Blue Box with Title and Icon



```
\begin{coloredblockicon}[blue] [Blue  
Box with Title and  
Icon] [] [\faIcon{bolt}]
```

IEE Box with Title and Icon



```
\begin{coloredblockicon}[iee] [IEE  
Box with Title and  
Icon] [] [\faIcon{bolt}] [r]
```

Yellow Box with Title and Icon



```
\begin{coloredblockicon}[yellow]  
[Yellow Box with Title and  
Icon] [] [\faIcon{bolt}]
```

Green Box with Title and Icon



```
\begin{coloredblockicon}[green]  
[Green Box with Title and  
Icon] [] [\faIcon{bolt}] [r]
```

Boxes

Boxes with Icon and without Title

```
\begin{coloredblockicon}[Color] [Optional: Title] [Optional: Title Size]  
[Optional: Icon] [Optional: Side of icon (l,r)] [Optional: Alignment  
(t,c,b)] [Optional: Height cm] [Optional: Width Iconblock cm]
```



```
\begin{coloredblockicon}[blue]
```



```
\begin{coloredblockicon}[yellow]
```



```
\begin{coloredblockicon}[red]
```



```
\begin{coloredblockicon}[iee]
```



```
\begin{coloredblockicon}[turquoise]
```

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Source: Photo by [Estée Janssens](#) on [Unsplash](#)

Typeface

Font and Styling



Highlighting

- Use **bold text** to emphasize key points
- For a subtler emphasis, you can use *italics*
- Avoid using underlines for emphasis, as underlined text is commonly interpreted as a hyperlink and may lead to confusion



Color

- Make the most of the **default colors** available (IEE, blue, yellow, green, red and grey)
- To **color text**, use `\textcolor{color}{Text}`
- To draw attention, use **yellow** for **moderate emphasis** and **red** for **strong emphasis**

Typeface

Available Font Sizes

Tiny 3pt
Tiny 4pt

myFootnotesize 10pt

tiny 12.44pt

scriptsize 16.58679pt

footnotesize 20.73358pt

small 22.70316pt

normalsize 24.88pt

large 29.85593pt

Large 35.82726pt

LARGE 42.99257pt

huge 51.60126pt

Huge 61.90161pt

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Overlay

Reveal your content step-by-step



- Enhance your presentation by **revealing content step by step to guide audience attention.**
- **No need to duplicate slides — overlays handle it, and the slide number stays the same.**

■ Pause Command

- Insert \pause at the point where you want the next item to appear.
- Everything **before** \pause is shown on the current slide.
- Everything **after** \pause is shown only on the next reveal step.
- You can use **multiple** \pause commands in one frame to reveal items one at a time.

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⌚ Transparent or Invisible

- Unrevealed content can either be **transparent** or **invisible** until it is revealed.
- You control this using
 - `\setbeamercovered{transparent}` or
 - `\setbeamercovered{invisible}`.
- **Change the setting in the preamble to apply globally, or use them inside a frame to apply only to specific content.**

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Plots

Visualize your Numbers



Set **axis line style to black** to add a black **border** around the plot area



Include **axis labels** with descriptions and **units** and include thousand separator



Add a **black border** around the **sections** of the bar chart



Include a **legend** to explain the chart's data categories

★ Optional Improvements

- Add grey grid lines to the background
- Include caption in italics at the bottom, complete with figure numbering

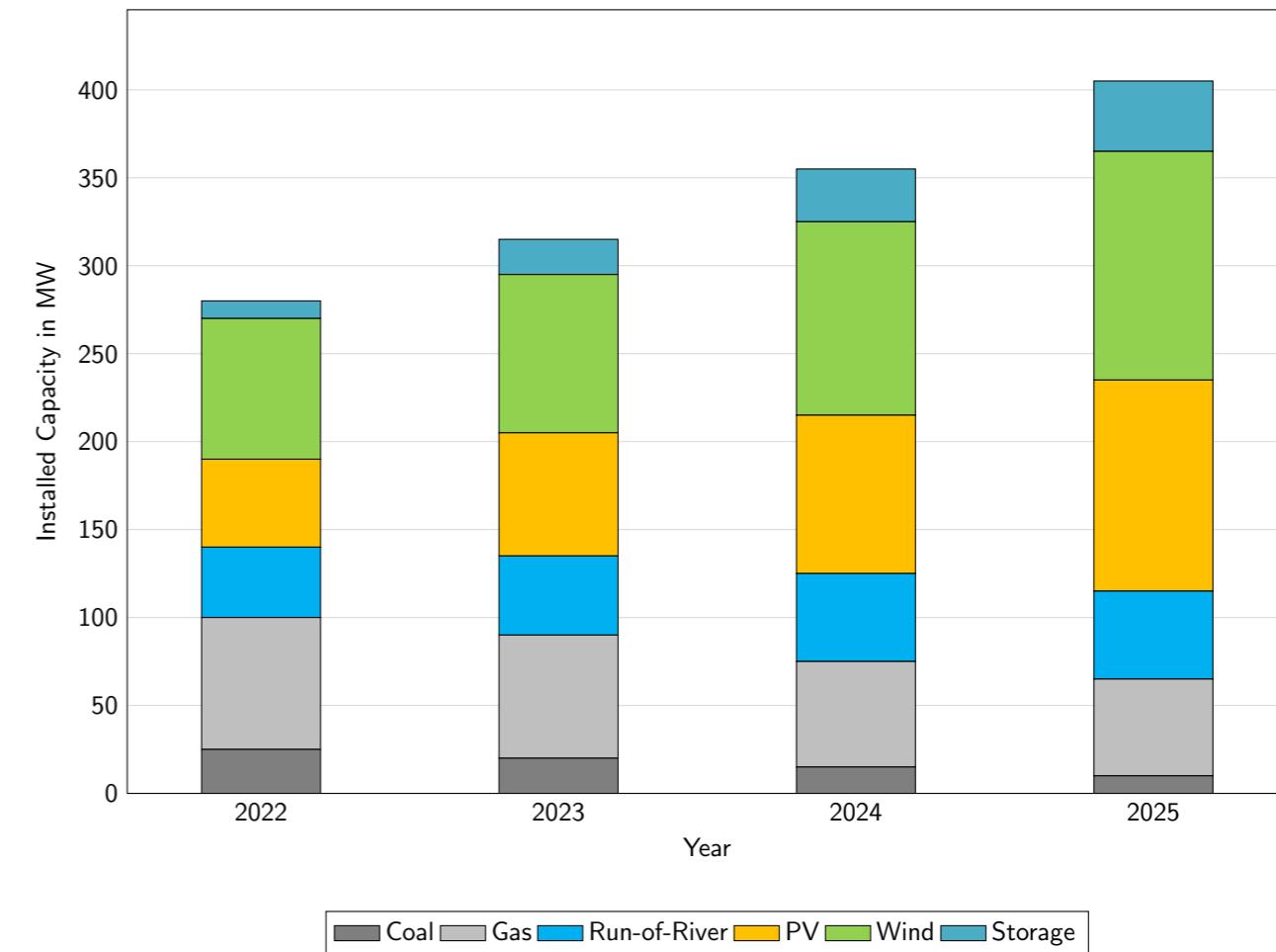


Figure 1: Installed capacity per power plant type in Wakanda from 2022-2025.

Source: Energy Report, Statistics Wakanda, 2023

Plots

Visualize your Numbers



Set **axis line style to black** to add a black **border** around the plot area



Include **axis labels** with descriptions and **units** and include thousand separator



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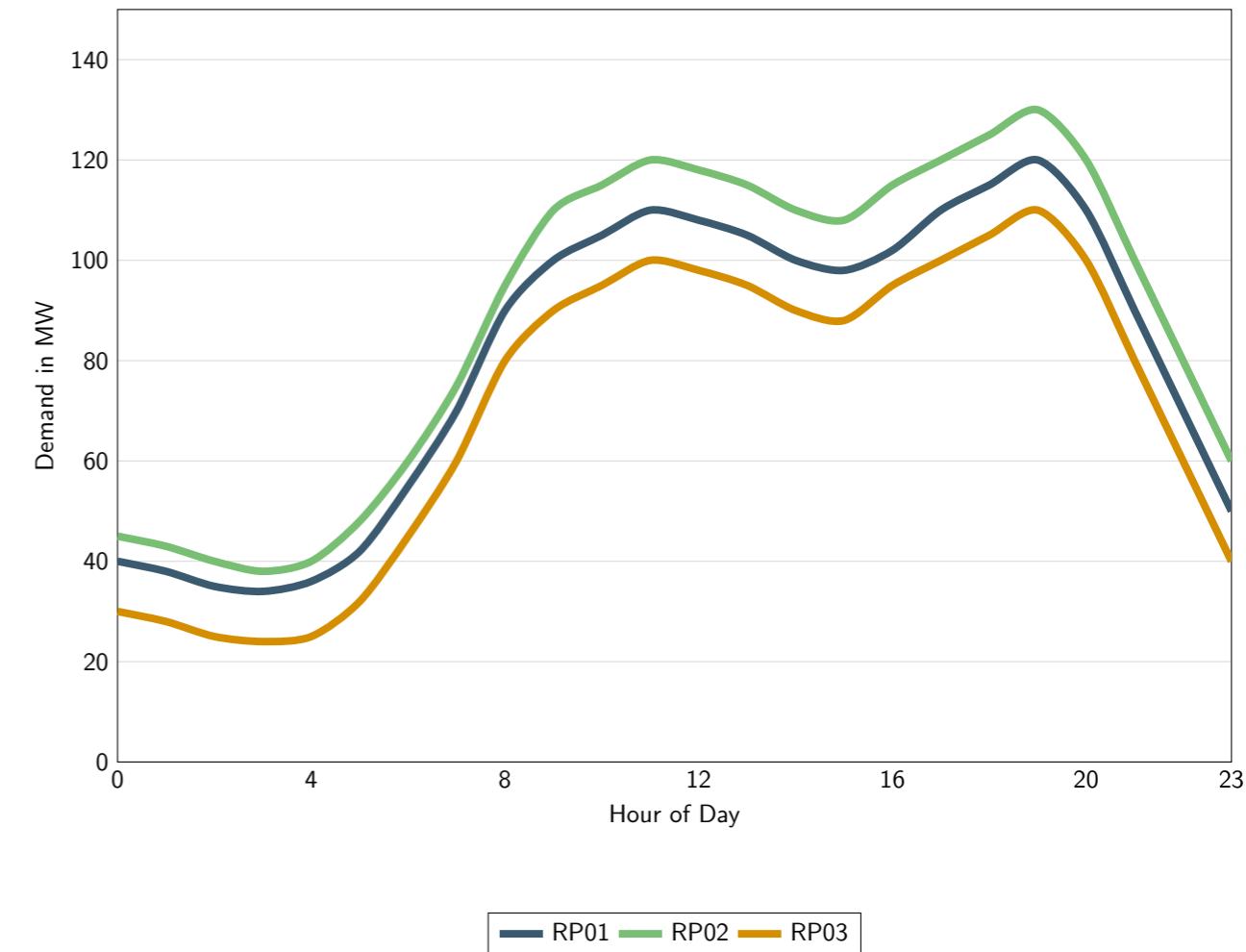


Figure 2: Demand per representative periode in Wakanda.

Source: Energy Report, Statistics Wakanda, 2023

Plots

Visualize your Numbers



Set **axis line style** to **black** to add a **black border** around the plot area



Include **axis labels** with descriptions and **units** and include thousand separator



Add a **black border** around the **sections** of the bar chart



Include a **legend** to explain the chart's data categories

★ Optional Improvements

- Add grey grid lines to the background
- Include caption in italics at the bottom, complete with figure numbering

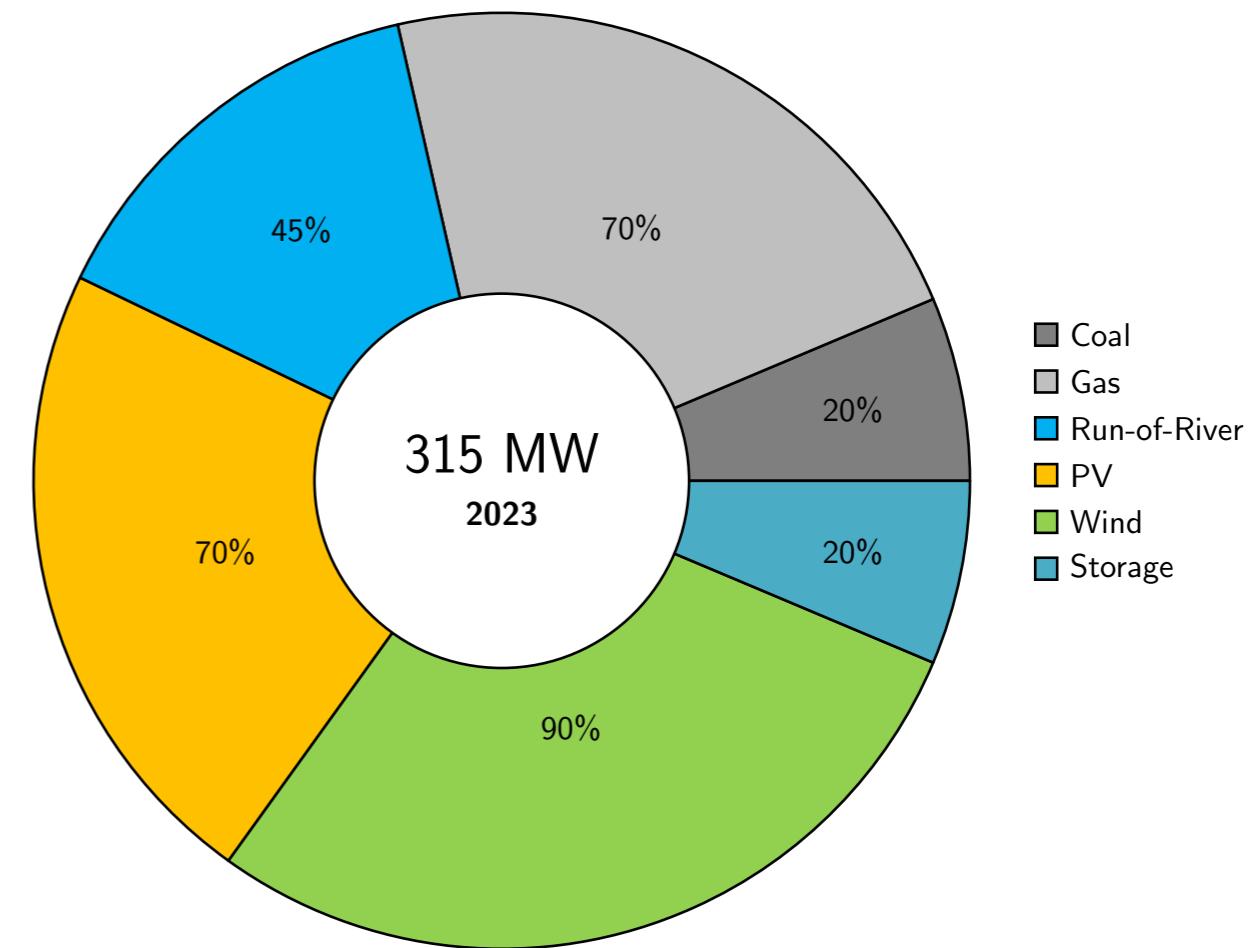


Figure 3: Shares of installed capacity per power plant type in Wakanda 2023.

Source: Energy Report, Statistics Wakanda, 2023

Plots

Colors for Power Plants

Power Plant Type	German Name	LaTeX Name	R	G	B	Hex	Color
Oil	Öl	\oilColor	16	47	64	102F40	<div style="background-color: #102F40; width: 1em; height: 1em;"></div>
Coal	Kohle	\coalColor	127	127	127	7F7F7F	<div style="background-color: #7F7F7F; width: 1em; height: 1em;"></div>
Gas	Gas	\gasColor	191	191	191	BFBFBF	<div style="background-color: #BFBFBF; width: 1em; height: 1em;"></div>
Other non-RES	Sonstige nicht-EE	\otherNonResColor	221	110	56	DD6E38	<div style="background-color: #DD6E38; width: 1em; height: 1em;"></div>
Nuclear	Nuklear	\nuclearColor	236	96	95	EC605F	<div style="background-color: #EC605F; width: 1em; height: 1em;"></div>
Biomass	Biomasse	\biomassColor	198	70	59	C6463B	<div style="background-color: #C6463B; width: 1em; height: 1em;"></div>
Run-of-River	Laufwasserkraft	\rorColor	0	176	240	00B0F0	<div style="background-color: #00B0F0; width: 1em; height: 1em;"></div>
Solar/PV	Solar/PV	\pvColor	255	192	0	FFC000	<div style="background-color: #FFC000; width: 1em; height: 1em;"></div>
Wind-onshore	Wind-onshore	\windColor	146	208	80	92D050	<div style="background-color: #92D050; width: 1em; height: 1em;"></div>
Wind-offshore	Wind-offshore	\windOffColor	30	143	79	1E8F4F	<div style="background-color: #1E8F4F; width: 1em; height: 1em;"></div>
Other RES	Sonstige EE	\otherResColor	185	207	222	B9CFDE	<div style="background-color: #B9CFDE; width: 1em; height: 1em;"></div>
Storage Hydro	Wasserspeicher	\storageHydroColor	75	172	198	4BACC6	<div style="background-color: #4BACC6; width: 1em; height: 1em;"></div>
Pumped Storage	Pumpspeicher	\pumpedStorageColor	59	90	112	3B5A70	<div style="background-color: #3B5A70; width: 1em; height: 1em;"></div>
BESS	Batteriespeicher	\bessColor	112	48	160	7030A0	<div style="background-color: #7030A0; width: 1em; height: 1em;"></div>
Other Storages	Sonstige Speicher	\otherStorageColor	76	133	123	4C857B	<div style="background-color: #4C857B; width: 1em; height: 1em;"></div>

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Source: Photo by Estée Janssens on Unsplash

Tables

Clear and Well-Designed Tables

Table Design

- **Bold headers for clarity and emphasis**
- **Black vertical lines for header and bottom only (1.5 pt)**
- **Grey vertical lines (1 pt) for the rest**
- **Avoid horizontal lines (unless necessary)**
- **Use gray!20 as background for odd rows**

Data Readability

- **Align numbers by decimal separator for better readability**
- **Show only meaningful decimals – no clutter!**
- **Use consistent units and place them in the header when possible**
- **Highlight the numbers you want to emphasize**

Power Plant Type	2022	2023	2024	2025
Coal	25.3	20.6	15.9	10.5
Gas	75.3	70.5	60.2	55.6
Run-of-River	40.3	45.0	50.0	50.0
PV	50.5	70.5	90.7	120.0
Wind	80.0	90.2	110.3	130.4
Storage Hydro	10.7	20.0	30.7	40.2

Table 1: Installed capacity per power plant type in Wakanda from 2022–2025 in MW.

Source: Energy Report, Statistics Wakanda, 2023

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Additional Tips

Improve your Design

Icons

- Incorporate **icons** to enhance **visual clarity** and aid quick **comprehension**
- The recommended option in **LATEX** is to use icons from the **fontawesome package**. You can find all **available icons** in the **docs**. Add an attribution on the closing slide.
- When using **third-party icons**:
 - Ensure the icons follow a **consistent design style**
 - Verify that you have the appropriate **usage rights** for the icons

Pictures

- Always **credit the source** of your pictures. Use the function `\addsource{}`.
- Ensure all images are **crisp and sharp** for **optimal quality**

Faded Image

Add a Nice Visual Touch

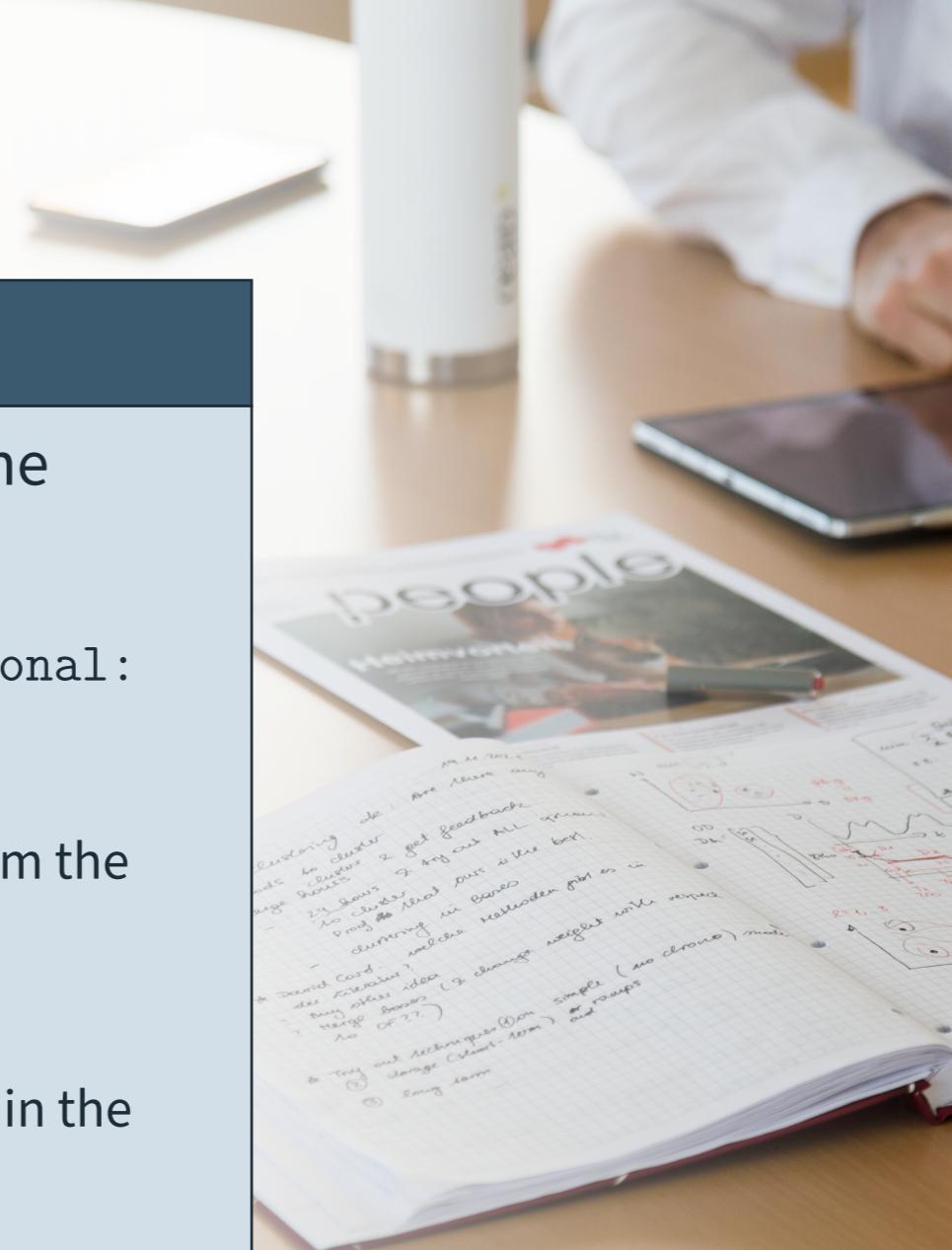


Faded Image

- To add a faded image as a background to your slide, use the following command:

```
\insertfadedpicture{inset from right}{image path}{Optional:  
caption text}
```

- **Inset from right:** Defines how far the image should be shifted in from the right edge. (Ensure the image is large enough.)
- **Image path:** Specifies the file path to the image.
- **Caption text:** Provides the text (e.g., image source) to be displayed in the bottom-right corner.
- This must be included at the beginning of your frame.



Source: Institute of Electricity Economics and Energy Innovation/TU Graz

Lists

Different Styles of Lists

There are **different styles** of lists that you can choose from.

`\begin{itemize}:`

- Item level 1
 - Item level 2
 - Item level 3

`\begin{tugitemize} (tighter spacing):`

- Item level 1
 - Item level 2
 - Item level 3

`\begin{enumerate}:`

1. Item level 1
 - a. Item level 2
 - i. Item level 3

`\begin{tugenumerate} (tighter spacing):`

1. Item level 1
 - a. Item level 2
 - i. Item level 3

Lists

Different Styles of Lists

There are **different styles** of lists that you can choose from.

`\begin{romanenumerate}:`

I Item level 1

i Item level 2

ii Item level 3

`\begin{tugromanenumerate} (tighter spacing):`

I Item level 1

i Item level 2

ii. Item level 3

`\begin{boxenumerate}:`

1 Item level 1

a Item level 2

ii Item level 3

`\begin{boxromanenumerate}:`

I Item level 1

i Item level 2

ii Item level 3

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Source: Photo by [Estée Janssens](#) on [Unsplash](#)

References

Cite the Sources you use

”In the middle of every difficulty lies opportunity.“

A. Einstein [1]

\textcite{}

If you want to include the authors, use \textcite{}.

In their study, **Gaugl et al.** [2] demonstrate that rising CO₂ prices result in higher electricity prices in Austria.

\cite{}

A simple reference is accomplished with \cite{}.

The LEGO model is an energy system optimization model developed at the Institute of Electricity Economics and Energy Innovation. [3]

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Source: Photo by [Estée Janssens](#) on [Unsplash](#)

Design Inspirations

Spark your Creativity

Methodology

NTC Model



Objective Function:
Minimize total system costs

$$\min \sum_{g,h} c_g^{op} \cdot p_g^h + \sum_g x_g \cdot (c_g^{Inv,MW} + c_g^{Inv,MWh} \cdot E2P_g)$$



Constraint 1:
Balance equation

$$\sum_g p_{gz(g,z),h} - \sum_g p_{cs(g,z),h} - \sum_{z \neq y} exp_{z,y,h} + \sum_{z \neq y} imp_{z,y,h} = dem_{z,h} \quad \forall z, y, h$$



Constraint 2:
NTC Limits

$$exp_{z,y,h} \leq NTC_{z,y} \cdot bn_{z,y,h} \quad \forall z, y, h$$



Constraint 3:
Flow Direction

$$imp_{z,y,h} \leq NTC_{y,z} \cdot (1 - bn_{z,y,h}) \quad \forall z, y, h$$



Constraint 4:
Export/Import

$$exp_{z,y,h} = imp_{y,z,h} \quad \forall z, y, h$$



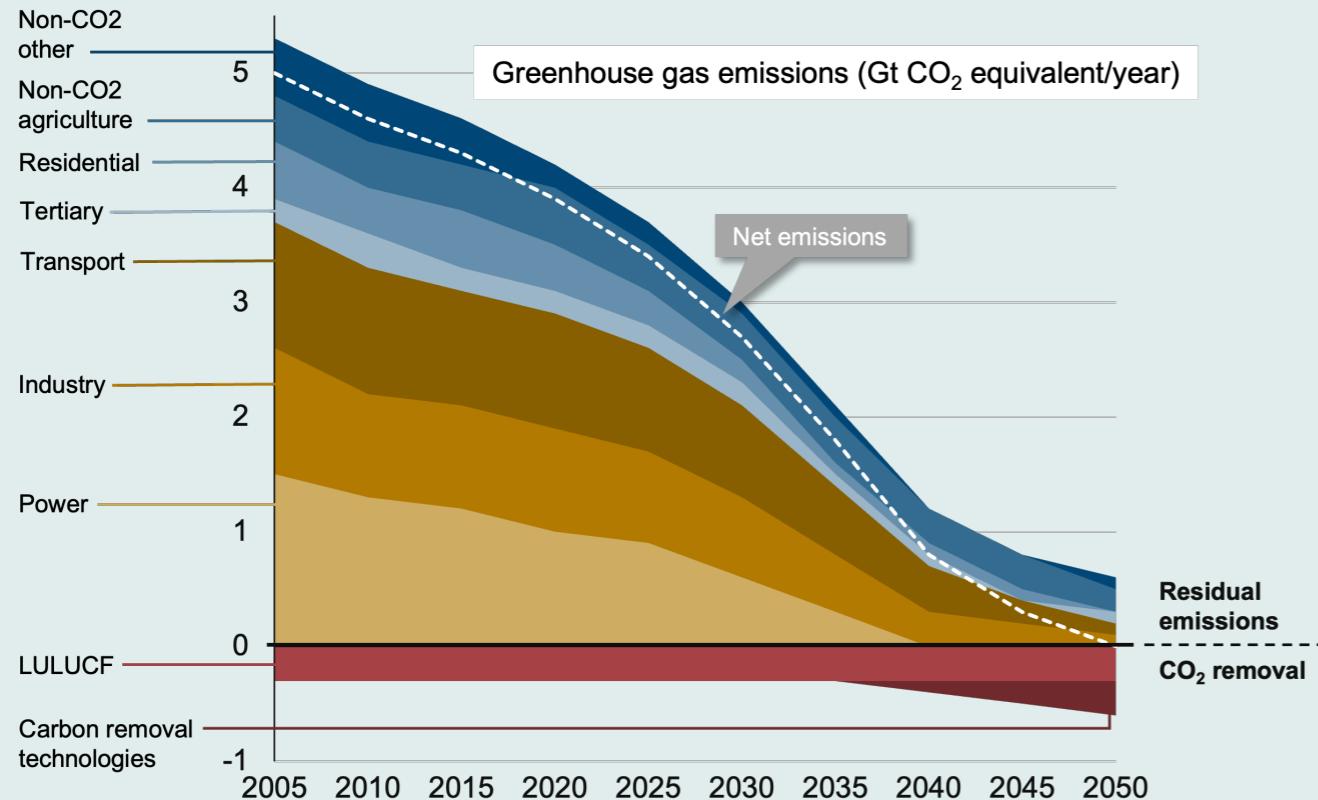
Constraint 5:
Generator Limits

$$\underline{p}_g \leq p_{g,h} \leq \overline{p}_g \quad \forall g, h$$

Decarbonization

Energy Sectors

Illustrative emissions pathways to achieve a net-zero target in the EU



The European Commission wants to achieve **climate neutrality until 2050**



Affected sectors:

- Electric power sector
- Transport and mobility
- Heat
- Gas (hydrogen), etc.



Large-scale investments in (energy) infrastructure required

Simulation/optimization models serve as decision support tool.

Examined Main Scenarios

Analysis of Flexibility Requirements

Scenario LOW ENERGY

STORYLINE: Austria continues to face a **challenging economic situation**, with **slowed investments** and **subdued economic growth**:

- **Investments in renewable energy remain low**, and **electricity demand is lower** than projected in the ÖNIP scenario.

Scenario BASE

STORYLINE: Austria pursues a **highly ambitious path to decarbonization** and achieves the goal of decarbonization by 2040:

- Ambitious renewable energy expansion **aligned with the ÖNIP** (Austrian National Energy and Climate Plan).

Scenario HIGH ENERGY

STORYLINE: Investments in **renewable energy exceed expectations**, accompanied by a **rapid pace of electrification**:

- This leads to **increased investments in renewables** and **a rising electricity demand**.

Through the in-depth analysis of the BASE scenario and the comparison with the extreme scenarios, the research questions are answered.

Grading

Attendance mandatory¹

Participation

- **Preparatory tasks**
Short tasks before class like watching a video, reading a text and answering some questions in TeachCenter
- **Exercises during class**

50 Point

Homework 1

- **Exercise**
Work you have to do at home.
- **Report**
Comment your code and write a small report

25 Point

Homework 2

- **Exercise**
Work you have to do at home.
- **Report**
Comment your code and write a small report

25 Point

In each part more than 50% of the points are required for a positive grade

Grading Scale

<50 Points: 5
50 – 62 Points: 4

63 – 75 Points: 3
76 – 88 Points: 2

89 – 100 Points: 1

¹ If more than two lessons are missed without an adequate excuse, you can no longer successfully complete the course.

Classification

Definition

Classification is a machine learning technique used to predict group membership for data instances.

Training Data

- Given a collection of **records** (**training set**), each record contains a set of **attributes**, with one attribute being the **class**.
- Each sample is characterized by a **tuple** (X, y) , where:
 - **X**: **attribute set** (**predictor**, **independent variable**, **input**)
 - **y**: **class label** (**response**, **dependent variable**, **output**)

Task

- Learn a **model** that maps each **attribute set X** to one of the predefined **class labels y**.
- Find a **model** for the **class attribute** as a **function** of the values of other attributes.

Goal

- Assign previously **unseen records** to a **class** as **accurately** as possible.
- Use a **test set** to determine the **accuracy** of the model.
- Typically, the **dataset** is divided into **training** and **test sets**:
 - **Training set**: Used to build the model
 - **Test set**: Used to validate the model

Classification

Examples

Sentiment Analysis

- **Task:** Determine the sentiment of a text (e.g., reviews, social media posts).
- **Attributes:** Text data (words, phrases).
- **Class Labels:** "Pos," "Neg," or "Neutr"

Disease Diagnosis

- **Task:** Diagnose whether a patient has a particular disease.
- **Attributes:** Medical history, test results, symptoms.
- **Class Labels:** "Disease" / "No Disease"

Activity Recognition

- **Task:** Determine the activity being performed based on sensor data.
- **Attributes:** Sensor readings (e.g., from a smartphone or wearable device).
- **Class Labels:** "Biking," "Running,"

Image Recognition

- **Task:** Identify objects or people in images.
- **Attributes:** Pixel values, image features, etc.
- **Class Labels:** "Cat," "Dog," etc.

Language Detection

- **Task:** Identify the language of a given text.
- **Attributes:** Text data (words, characters).
- **Class Labels:** "English," "Spanish," etc.

E-Mail Spam Detection

- **Task:** Classify as "spam" or "not spam."
- **Attributes:** Email content, sender, attachments etc.
- **Class Labels:** "Spam" or "Not Spam"

Pipeline Gas Transmission

Framework for Piecewise Linearization

General gas flow equation

$$f_{k,l} |f_{k,l}| = R_l^G (p_{k,m}^2 - p_{k,n}^2) \quad \forall k, l(m, n)$$

Linepack

$$lp_{k,l} = LP_l \frac{p_{k,m} + p_{k,n}}{2} \quad \forall k, l(m, n)$$

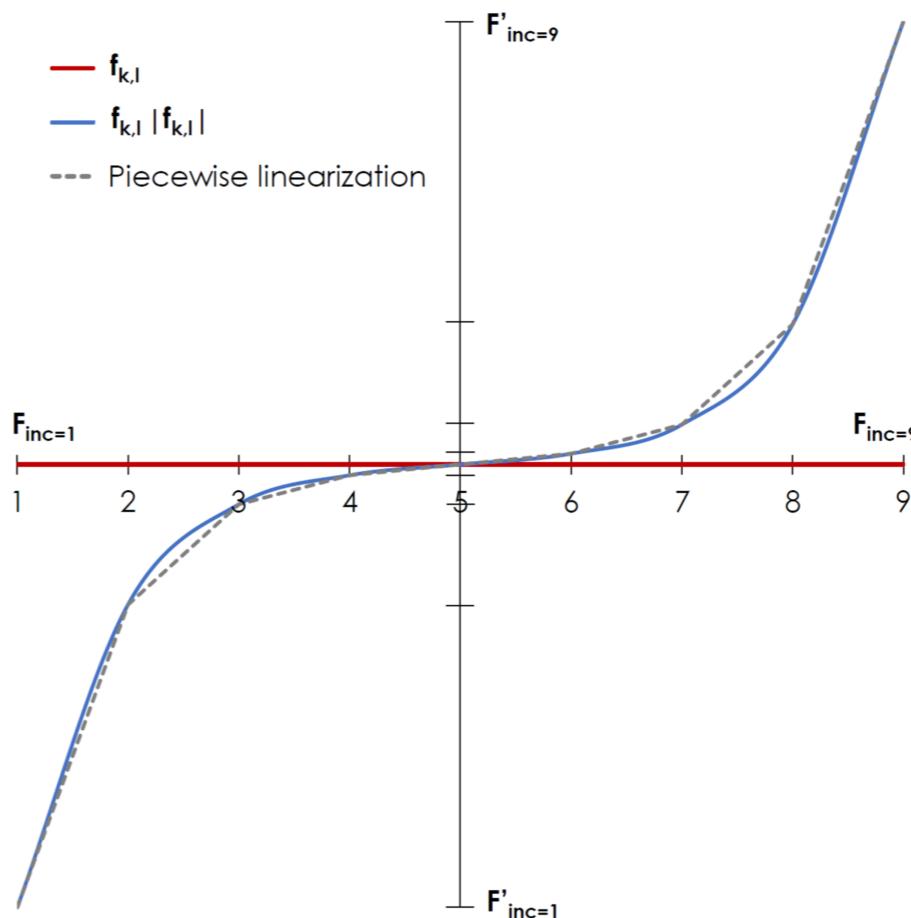
Average gas flow

$$f_{k,l} = LP_l \frac{f_{k,l}^{in} + f_{k,l}^{out}}{2} \quad \forall k, l(m, n)$$

Inventory constraint

$$lp_{k,l} = lp_{k-1,l} + f_{k,l}^{in} - f_{k,l}^{out} \quad \forall k, l(m, n)$$

**INC & SOS2 linearizations are tight & compact.
Their union is not!**



Indizes

k	Time step
m, n	Gas nodes
$l(m, n)$	Pipeline connecting m, n

Variables

$f_{k,l}$	Average gas flow
$p_{k,m}$	Nodal gas pressure
$f_{k,l}^{in}, f_{k,l}^{out}$	In and outflowing gas
$lp_{k,l}$	Linepack

Parameter

R_l^G	Pipeline characteristics
LP_l	Linepack characteristics

Thank You!

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